



Request for Proposal #16-17

Engineering and Construction Services for Hampshire Road Pump Station

Bid Posted: 07/14/2017

Pre-Bid Meeting: 07/26/2017 @ 10:00 a.m.
Government Office Bldg.
125 N. Division St., Room 306
Salisbury, MD 21801

Last Day for Questions: 08/04/2017 @ 12:00 p.m.

Proposal Opening: 08/14/2017 @ 2:30 p.m.
Government Office Bldg.
125 N. Division St., Room 104
Salisbury, MD 21801

Procurement Department
125 N. Division St., Room 104 Salisbury, MD 21801
PH: 410-548-3190 FX: 410-548-3192
Salisbury, MD 21801
www.salisbury.md

ADVERTISEMENT

CITY OF SALISBURY

RFP 16-17

Engineering Construction Services for Hampshire Road Pump Station

The City of Salisbury is seeking proposals from qualified and experienced vendors to provide engineering construction services including inspection for the implementation of the City's Hampshire Road Pump Station Improvements Project. The construction contract work will include installation of a new wet well, valve vault, force main, two new pumps, stationary generator, bypass pumping connection, new controls, paving and sitework.

Proposal documents in a CD-ROM format may be obtained from the Office of the Director of Procurement, Government Office Building, 125 N. Division Street, Room 104, Salisbury, Maryland 21801, phone number 410-548-3190 during normal business hours, upon payment of \$10.00 to the City of Salisbury, Maryland 21801, Finance Department in Room 103 of the same building. The proposal documents for RFP 16-17 will be posted via our website, www.ci.salisbury.md, Information Center, Bids & RFPs. Vendors are responsible for checking this website for addenda prior to submitting their bids. The City of Salisbury is not responsible for the content of any bid package received through any third party bid service. It is the sole responsibility of the Vendor to ensure the completeness and accuracy of the documents received.

A Pre-Proposal Meeting will be held on Wednesday, July 26th, 2017 at 10:00 A.M. (local time) in Room 306 of the Government Office building, address listed above.

Questions are due no later than Friday, August 4th, 2017 at 12:00 p.m. (local time), at the above location. No further questions will be accepted after this date. All questions will be written and can be faxed, mailed, hand delivered, or emailed to Michael Lowe, Senior Buyer-Procurement Department, 125 N. Division Street, Room 104, Salisbury, MD 21801, by fax at 410-548-3192, or via email at mlowe@salisbury.md.

Sealed Proposal Documents are due in the Office of the Director of Procurement, address above, Room 104, on Monday, August 14th, 2017 at 2:30 p.m. (local time), at which time and place they will be publicly opened and only the names of vendors read aloud. No late Completed Proposal Documents ("CPD") will be accepted; late CPD's will be returned unopened.

Jennifer L. Miller
Director of Procurement
City of Salisbury, Maryland

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SECTION I: INTRODUCTION

1. PURPOSE

A. The City of Salisbury is seeking proposals from qualified and experienced vendors to provide engineering construction services including inspection for the implementation of the City's Hampshire Road Pump Station Improvements Project. The Construction contract work will include installation of a new wet well, valve vault, force main, two new pumps, stationary generator, bypass pumping connection, new controls, paving and sitework.

2. CLARIFICATION OF TERMS

A. Professional firms or individuals that submit a bid for award of a contract ("Contract") are referred to as vendors ("Vendors") in this document. The Vendor that is awarded the Contract is herein referred to as the ("Successful Vendor").

3. QUESTIONS AND INQUIRIES

A. Questions regarding the Proposal Documents or procedures should be referred to Michael Lowe, Senior Buyer-Procurement Department, 125 N. Division Street, Room 104, Salisbury Maryland 21801, during normal business hours, or by fax at 410-548-3192, or by email at mlowe@salisbury.md.

B. Copies of the Proposal Documents are available in the Office of the Assistant Director of Internal Services-Procurement Division, 125 North Division Street, Room 104, Salisbury, Maryland 21801 or by calling (410) 548-3190 during normal business hours, or via our web site, www.ci.salisbury.md ; Information Center; BIDS & RFPs.

4. FILLING OUT PROPOSAL DOCUMENTS

A. Use only forms supplied by the City of Salisbury ("City").

B. Submit one unbound original and three (3) bound copies of completed Proposal Documents.

C. Proposals should be tab-sequenced as follows: (1) Cover letter, (2) Scope of Services/Project Understanding/ Project Approach/ Time Schedule, (3) Qualifications/ Standard Form 330, (4) Form of Proposal and signed addenda.

D. All blanks on the Proposal Documents will need to be filled in electronically or manually in ink.

E. Where so indicated by the make up of the Proposal Documents, sums will be expressed in both words and figures, and in the case of a discrepancy between the two, the amount written in words will govern. In the event there is a discrepancy between the unit price and the extended totals, the unit prices will govern.

F. Any interlineation, alteration, or erasure will be initialed by the signer of the Proposal Documents.

G. Each copy of the Proposal Documents will be signed by the person(s) legally authorized to bind the Vendor to a contract, using the legal name of the signer. Proposal Documents submitted by an agent will have a current Power of Attorney attached certifying the agent's authority to bind the Vendor.

H. Vendor will supply all information and submittals required by the Proposal Documents to constitute a proper and responsible completed Proposal Document package.

I. Any ambiguity in the Proposal Documents as a result of omission, error, lack of clarity or non-compliance by the Vendor with specifications, instructions, and/or all conditions of bidding will be construed in the light most favorable to the City.

5. SUBMISSION OF PROPOSAL DOCUMENTS

A. All copies of the Proposal Documents and any other documents required to be submitted with the Proposal Documents will be enclosed in a sealed envelope. The envelope will be addressed to the Assistant Director of Internal Services–Procurement Division and will be identified with the project name and the Vendor’s name and address. If the Proposal Documents are sent by mail, the sealed envelope will be enclosed in a separate mailing envelope with the notation “SEALED PROPOSAL DOCUMENTS ENCLOSED” on the face thereof.

B. Proposal Documents will be deposited at the designated location prior to the time and date for receipt of Proposal Documents as indicated in the Advertisement or Request for Proposal, or any extension made by Addendum. Proposal Documents received after the time and date for receipt will be returned unopened.

C. Vendor will assume full responsibility for taking whatever measures necessary to ensure that the Proposal Documents reach the Office of the Assistant Director of Internal Services-Procurement Division prior to the local time and date specified for receipt of Proposal Documents. The City will NOT BE RESPONSIBLE for any Proposal Document delayed in the postal or other delivery service nor any late Proposal Document, amendment, or request for withdrawal of Proposal Document, received after the Proposal Document submission date.

D. Vendors, or their authorized agents, are expected to fully inform themselves as to the conditions, requirements, and specifications before submitting Proposal Documents; failure to do so will be at the Vendor’s own risk.

E. A fully executed Affidavit of Qualification to Bid will be attached to each Proposal Document.

F. ALL MINORITY BUSINESS ENTERPRISE VENDORS ARE ENCOURAGED TO PARTICIPATE.

G. All Vendor-submitted Proposal Documents will be valid for a minimum of ninety (90) days from the date of Proposal Document opening.

6. OPENING OF PROPOSAL DOCUMENTS

A. Proposal Documents received on time will be opened publicly and only the vendor’s names will be read aloud for the record.

B. The Contract will be awarded or all Proposal Documents will be rejected within ninety (90) days from the date of the Proposal Document opening.

7. ACCEPTANCE OR REJECTION OF PROPOSAL DOCUMENTS

A. Unless otherwise specified, the Contract will be awarded to the most RESPONSIBLE and RESPONSIVE Vendor complying with the provisions of the Proposal Documents, provided the proposal price is reasonable, does not exceed the funds available, and it is in the best interest of the City to accept it. The City reserves the right to reject the Proposal Documents of any Vendor who has previously failed to perform properly in any way or complete on time contracts of a similar nature; or a Proposal Document from a Vendor who, investigation shows, is not in a position to perform the Contract; or Proposal

Documents from any person, firm, or corporation which is in arrears or in default to the City for any debt or contract.

B. In determining a Vendor's RESPONSIBILITY, the City may consider the following qualifications, in addition to price:

1. Ability, capacity, and skill to provide the commodities or services required within the specified time, including future maintenance and service, and including current financial statement or other evidence of pecuniary resources and necessary facilities;
2. Character, integrity, reputation, experience, and efficiency;
3. Quality of past performance on previous or existing contracts, including a list of current and past contracts and other evidence of performance ability;
4. Previous and existing compliance with laws and ordinances relating to contracts with the City and to the Vendor's employment practices;
5. Evidence of adequate insurance to comply with Contract terms and conditions;
6. Statement of current work load and capacity;
7. Explanation of methods to be used in fulfilling the Contract;
8. The Vendor, if requested, will be prepared to supply evidence of its qualifications, listed above, and its capacity to perform the Services; such evidence to be supplied within a specified time and to the satisfaction of the City.

C. In determining a Vendor's RESPONSIVENESS, the City will consider whether the Proposal Documents conform in all material respects to the Request for Proposal. The City reserves the right to waive any irregularities that may be in its best interest to do so.

D. The City will have the right to reject any and all Proposal Documents, where applicable, to accept in whole or in part, to add or delete quantities, to waive any informalities or irregularities in the Proposal Document received, to reject a Proposal Document not accompanied by required Proposal Security or other data required by the Proposal Documents, and to accept or reject any Proposal Document which deviates from specifications when in the best interest of the City. Irrespective of any of the foregoing, the City will have the right to award the Contract in its own best interests.

8. NOTICE TO VENDORS

A. Before a Vendor submits the Proposal Documents it will need to become fully informed as to the extent and character of the Services required and are expected to completely familiarize themselves with the requirements of this Proposal Document's specifications. Failure to do so will not relieve the Vendor of the responsibility to fully perform in accordance therewith. No consideration will be granted for any alleged misunderstanding of the material to be furnished or the Services to be performed, it being understood that the submission of a Proposal Document is an agreement with all of the items and conditions referred to herein.

END OF SECTION

SECTION II: GENERAL INFORMATION

1. ECONOMY OF PROPOSAL

A. Proposal Documents will be prepared simply and economically, providing straightforward and concise description of the Vendor's capabilities to satisfy the requirements of the Proposal Documents. Emphasis should be on completeness and clarity of content. Elaborate brochures and other representations beyond that sufficient to present a complete and effective Proposal Document are neither required nor desired.

2. RESPONSIBILITIES OF THE VENDOR

A. The Vendor will be responsible for the professional quality and technical accuracy of their advice and other services furnished in the Proposal Documents. The Vendor will perform services with the degree of skill that is normally exercised by recognized professionals as the Standard of Care with respect to services of a similar nature.

B. Neither the City's review, approval or acceptance of, nor payment for, any of the services required under the Contract will be construed to operate as a waiver of any rights under the Contract or any cause of action arising out of the performance of the Contract, and the Vendor will be liable to the City in accordance with applicable law for all damages to the City caused by the Vendor's negligent performance of any of the services furnished under the Contract.

C. The rights of the City provided for under the Contract are in addition to any rights and remedies provided by law.

3. PROPRIETARY INFORMATION OR TRADE SECRETS

A. The Vendor may invoke proprietary information or trade secret protection for submission of any data/material by (1) identifying the data/material in a written description, (2) clearly marking the data/material as proprietary, and (3) providing a written statement detailing the reasons why protection is necessary. The City reserves the right to ask for additional clarification prior to establishing protection.

4. OWNERSHIP OF MATERIALS

A. Ownership of all material and documentation originated and prepared pursuant to the Proposal Documents will belong exclusively to the City and is subject to public inspection in accordance with the Public Information Act. Trade secrets or proprietary information submitted by a Vendor in connection with a procurement transaction will not be subject to disclosure under the Public Information Act. However, the Vendor must invoke the protections of this section and be in accordance with Section 3.A.

B. All data collected, or developed, during the course of the project will be delivered to the City of Salisbury prior to the completion of the project. This data will be delivered both in its native format and in any format to which it has been transformed.

1. Geospatial data is data or information that identifies the geographic location of features and boundaries of either natural or constructed features. Spatial data is usually stored as coordinates and topology, and is data that can be mapped.

2. Tabular data (GIS) is descriptive information, usually alphanumeric, that is stored in rows and columns in a data base and can be linked to spatial data.

3. All spatial and related tabular data that is collected or developed during the course of a project will be considered the property of the City of Salisbury. A listing of all spatial and related tabular data that is expected to be collected or produced during the course of the project will be included in the Successful Vendor's contract deliverables. If the scope of this data increases or decreases, it is the responsibility of the Vendor to notify and receive written confirmation from the City of Salisbury. This data will be delivered to the City of Salisbury prior to the final invoice of any project unless this requirement has been waived. This data will be delivered in both its native format and in any format to which it has been transformed. For example: if a survey is conducted of an area and that data is then used to construct a CAD drawing or a GIS layer, The original survey data will be delivered in COGO format, The CAD data will be delivered in .dwg files and the GIS layer will be delivered in either .shp files or a geodatabase format.

5. CONTRACT AWARD

A. A written award by the City to the Successful Vendor in the form of a Purchase Order or other contract document will result in a binding Contract without further action by either party. If the Successful Vendor fails or refuses to sign and deliver the Contract and the required insurance documentation, the City will have the right to award to the next responsible and responsive Vendor. Contract will be executed by the Successful Vendor within fifteen (15) working days of receipt of the Contract.

B. Proposal Documents and Contracts issued by the City will bind the Vendor to applicable conditions and requirements herein set forth, unless otherwise specified in the Proposal Documents, and are subject to all Federal, State, and Municipal laws, rules, regulations, and limitations.

C. City personal property taxes ("Taxes") must be on a current basis; if any such Taxes are delinquent, they must be paid before award of Contract. Failure to pay will result in the award of Contract to another Vendor.

D. The City reserves the right to engage in individual discussions and interviews with those Vendors deemed fully qualified, responsible, suitable, and professionally competent to provide the required services should the project size warrant it. Vendors will be encouraged to elaborate on their qualifications, performance data, and staff expertise. Proprietary information from competing Vendors will not be disclosed to the public or to competitors.

E. The City may award in whole or in part to multiple vendors.

6. AUDIT

A. The Successful Vendor agrees to retain all books, records, and other documents relative to the awarded Contract for five (5) years after final payment, or until audited. The City, its authorized agents, and/or State auditors will have full access to and the right to examine any of said materials during said period.

7. KEY PERSONNEL

A. The personnel named in the technical Proposal Document will remain responsible throughout the period of the awarded Contract. No replacement may be made without

submission of a resume of the proposed replacement with final approval being granted by the Assistant Director of Internal Services–Procurement Division.

8. NONPERFORMANCE

A. The City reserves the right to inspect all operations and to withhold payment for any Services not performed or not performed in accordance with the specifications in this Proposal Document. Errors, omissions, or mistakes in performance will be corrected at no cost to the City. Failure to do so will be cause for withholding of payment for that Service. In addition, if deficiencies are not corrected in a timely manner, the City may characterize the Successful Vendor as uncooperative, which may jeopardize future project order solicitations.

9. ASSIGNMENT

A. Successful Vendor will not assign, transfer or subject the Contract, or its rights, title interests or obligations therein without City's prior written approval.
B. Violation of the terms of this paragraph will constitute a breach of Contract. All rights, title, interest and obligations of the Successful Vendor will thereupon cease and terminate.

10. MODIFICATION OR WITHDRAWAL OF PROPOSAL

A. A Proposal Document may not be modified, withdrawn, or cancelled by the Vendor during the stipulated time period following the time and date designated for the receipt of Proposal Documents, and each Vendor so agrees in submitting Proposal Documents.

11. DEFAULT

A. The Contract may be cancelled or annulled by the City in whole or in part by written notice of default to the Successful Vendor upon non-performance, violation of Contract terms, delivery failure, bankruptcy or insolvency, any violation of state or local laws, or the making of an assignment for the benefit of creditors. An award may then be made to the next most highly rated Vendor, or when time is of the essence, similar commodities and/or service may be purchased on the open market. In either event, the defaulting Vendor (or his surety) will be liable to the City for cost to the City in excess of the defaulted Contract price.

12. COLLUSION/FINANCIAL BENEFIT

A. The Vendor certifies that its Proposal is made without any previous understanding, agreement, or connection with any person, firm, or corporation making a Proposal Document for the same project; without prior knowledge of competitive prices; and is in all respects fair, without outside control, collusion, fraud, or otherwise illegal action.
B. Upon signing the Proposal Document, Vendor certifies that no member of the governing body of the City, or members of his/her immediate family, including spouse, parents or children, or any other officer or employee of the City, or any member or employee of a Commission, Board, or Corporation controlled or appointed by the Mayor or Council, has received or has been promised, directly or indirectly, any financial benefit related to this Contract.

13. TAX EXEMPTION

A. The City is exempt from Federal Excise Taxes, Maryland Sales and Use Taxes, and Transportation Taxes. This exemption cannot be used by Vendors doing business with the City. Vendors are responsible for State Sales Tax of real property furnished and installed or constructed for the City.

14. EQUAL EMPLOYMENT OPPORTUNITY AND NON-DISCRIMINATION

A. All Vendors are subject to, and must comply with, the provisions of all applicable state and federal anti-discrimination laws. The City encourages equal employment opportunity to businesses owned and controlled by minorities and women.

B. The successful Vendor will not discriminate against any employee or applicant for employment or any member of the public because of race, color, creed, religion, national origin, sex, sexual preference, disability, marital status, age; or otherwise commit an unfair employment practice. Vendor further agrees that this nondiscriminatory agreement will be incorporated by the Vendor in all contracts entered into with suppliers of commodities and services, contractors and subcontractors, and all labor organizations furnishing skilled, unskilled, and craft union skilled labor, or who may perform any such labor or services in connection with this Contract.

15. INDEMNITY

A. The Successful Vendor agrees to indemnify, defend, and hold harmless the City and its officers, employees, and agents from any and all liability, loss, cost, damage, and expense (including reasonable attorney's fees and court costs) resulting from, arising out of, or incurred by reason of any claims, actions, or suits based upon or alleging bodily injury, including death, or property damage rising out of or resulting from the Vendor's operations under the Contract, whether such operations be by the Vendor or by any subcontractor or by anyone directly or indirectly employed by either the Vendor or subcontractor.

B. Vendor further agrees to furnish adequate protection against damage(s) as a result of the Vendor's and Vendor's subcontractors' negligence in providing the Services under this Contract.

16. STATUS OF VENDOR

A. The Vendor will be responsible to the City for acts and omissions of their employees, subcontractors, and their agents and employees, and other persons performing portions of the Services under the Contract or other arrangement with the Vendor.

B. It is understood that the relationship of Vendor to the City will be that of an "Independent Contractor." Nothing contained herein will be deemed or construed to (1) make the Vendor the agent, servant, or employee of the City, or (2) create any partnership, joint venture, or other association between the City and the Vendor.

17. APPLICABLE LAWS

A. Vendor will observe and comply with all applicable Federal, State, and local laws and regulations in the performance of the Contract. The Contract will be construed and interpreted in accordance with the laws of the State of Maryland and all questions of performance hereunder will be determined in accordance with such laws.

18. SUSPENSION OR TERMINATION FOR CONVENIENCE

- A. The City will have the right, at any time by written notice, for its convenience, to suspend the Services under the Contract for such time as may be determined by the City to be necessary or desirable up to ninety (90) days, unless a longer time is agreed upon in writing by both parties; and thereafter, to require resumption of the whole or any part of the Services without invalidating the provisions of the Contract.
- B. The City will have the right, at any time by written notice, for its convenience, to terminate the Services in whole or in part.
- C. Any notice issued pursuant to Sections 18.A and/or 18.B will state the extent and effective date of such notice. Except as otherwise directed, the Vendor will stop Services on the date of receipt of the Notice of Termination or other date specified in the notice; nor place further orders or subcontracts for materials, services, or facilities, except as necessary for the completion of such portion of the Services not terminated.
- D. The Vendor, within thirty (30) days of the Notice of Termination, will submit a final invoice reflecting Services actually furnished pursuant to the Contract to the satisfaction of the City and for which no previous invoice was submitted to the City.
- E. In the event of a termination, pursuant to Section 18.B, the City will pay the Vendor's expenses verified by final invoice as set forth in Section 18.D for the following:
 - 1. Completed and acceptable Services executed in accordance with the Contract prior to the effective date of termination, including fair and reasonable sums for overhead and profit for such Services;
 - 2. Expenses sustained prior to the effective date of termination in performing Services and furnishing labor, materials, or equipment as required by the Contract in connection with uncompleted Services, plus fair and reasonable sums for overhead and profit.
- F. The Vendor will not be paid on account of loss of anticipated profits or revenues or for Services not completed prior to the date of termination of the Contract.

19. CONTRACT CHANGES

- A. NO CLAIMS may be made by anyone that the scope of the project or that the Vendor's Services have been changed (requiring changes to the amount of compensation to the Vendor or other adjustments to the Contract) UNLESS such changes or adjustments have been made by an approved WRITTEN AMENDMENT (Change Order) to the Contract signed by the Assistant Director of Internal Services-Procurement Division (and the City Council, if required), prior to additional Services being initiated. Extra Services performed without prior, approved, written authority will be considered as unauthorized and at the expense of the Vendor. Payment will not be made by the City.
- B. NO ORAL conversations, agreements, discussions, or suggestions, which involve changes to the scope of the Contract, made by anyone including any City employee, will be honored or valid. No written agreements or changes to the scope of the Contract made by anyone other than the Assistant Director of Internal Services-Procurement Division (with City Council approval, if required) will be honored or valid.
- C. If any Change Order in the Services results in a reduction in the Services, the Vendor will neither have, nor assert any claim for, nor be entitled to any additional compensation for damages or for loss of anticipated profits on Services that are eliminated.

D. No inspection, or any failure to inspect, at any time or place, will relieve the Vendor from its obligation to perform all the Services strictly in accordance with the requirements of the specifications of the Contract. The City's Project Representatives (construction inspectors) are NOT authorized to revoke, alter, enlarge, relax, or release any requirement of these specifications, nor to approve or accept any portion of Services, nor to issue instruction contrary to the drawings and specifications of the Contract.

20. ADDENDUM

A. No oral statements of any person will modify or otherwise affect or interpret the meaning of the Contract specifications, or the terms, conditions, or other portions of the Contract. All modifications and every request for any interpretation must be addressed to the Assistant Director of Internal Services, Procurement Division, Government Office Building, 125 N. Division Street, Room 104, Salisbury, Maryland 21801, and to be given consideration, must be received at the above address at least seven (7) days prior to the date fixed for the opening of Proposal Documents.

B. Any and all interpretations, corrections, revisions, and amendments will be issued by the Department of Internal Services-Procurement Division to all holders of Proposal Documents in the form of written addenda. Vendors are cautioned that any oral statements made by any City employee that materially change any portion of the Proposal Documents will not be relied upon unless subsequently ratified by a formal written amendment to the Proposal Document.

C. All addenda will be issued so as to be received at least five (5) days prior to the time set for receipt of Proposal Documents, and will become part of the Contract and will be acknowledged in the Proposal Document form. Failure of any Vendor to receive any such addenda will not relieve said Vendor from any obligation under the Proposal Document as submitted.

D. Vendors are cautioned to refrain from including in their Proposal Document any substitutions which are not confirmed by written addenda. To find out whether the City intends to issue an amendment reflecting an oral statement made by any employee, contact Jennifer L. Miller, Assistant Director of Internal Services-Procurement Division, at 410-548-3190 during normal business hours.

E. The Assistant Director of Internal Services-Procurement Division, reserves the right to postpone the Proposal Document opening for any major changes occurring in the 5-day interim which would otherwise necessitate an Addendum.

21. DEBARMENT

A. By submitting the proposal, the vendor warrants and certifies that he is eligible to submit a proposal because he is not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in a transaction by any Federal, State, or local department agency.

22. INSURANCE REQUIREMENTS

A. Unless otherwise required by Special Conditions for the Proposal Documents, if a Contract is awarded, the Successful Vendor will be required to purchase and maintain during the life of the Contract the following types and amounts of insurance (at minimum).

1. Commercial General Liability: \$1,000,000 (One million dollars) per occurrence \$3,000,000 (Three million dollars) aggregate for bodily injury and property damage.
2. Professional Liability Coverage (errors and omissions): \$1,000,000 (one million dollars) per occurrence and \$3,000,000 (three million dollars) aggregate minimum.
3. Commercial Automobile: \$1,000,000 (one million dollars) combined single limit per accident for bodily injury and property damage. Including hired, non-ownership coverage and owned vehicle coverage if company owns a vehicle.
4. The Vendors will provide the City with certificates of insurance evidencing the coverage required above. Such certificates will provide that the City be given at least thirty (30) days prior written notice of cancellation of, intention to not renew, or material change in such coverage. Vendor must provide certificates of insurance before commencing Services in conjunction with the Contract.
 - a. ON ALL LIABILITY INSURANCE POLICIES, CITY, ITS EMPLOYEES, AND OFFICERS MUST BE NAMED AS ADDITIONAL INSURED, AND INSURANCE CERTIFICATES FURNISHED TO THE CITY WILL INDICATE SUCH COVERAGE.
 - b. THE PROVIDING OF ANY INSURANCE REQUIRED HEREIN DOES NOT RELIEVE THE VENDOR OF ANY OF THE RESPONSIBILITIES OR OBLIGATIONS ASSUMED BY THE VENDOR IN THE AWARDED CONTRACT, OR FOR WHICH THE VENDOR MAY BE LIABLE BY LAW OR OTHERWISE.
 - c. Failure to provide and continue in force such insurance as required above, will be deemed a material breach of the Contract, will cause the Vendor to be in DEFAULT, and will operate as an immediate termination thereof. The City reserves the right to require higher limits on any Contract. A 30-day notice in writing of cancellation or non-renewal will be furnished by certified mail to the Assistant Director of Internal Services—Procurement Division at the address listed in solicitation. The Vendor agrees to be responsible for, indemnify, defend, and hold harmless the City, its officers, agents, and employees from the payment of all sums of money by reason of any claim against them arising out of any and all occurrences resulting in bodily or mental injury or property damage that may happen in connection with and during the performance of the Contract including, but not limited to, claims under the Worker's Compensation Act.

END OF SECTION

SECTION III: SCOPE OF SERVICES

1. DEFINITION OF TERMS

A. The Terms “Vendors” and “Successful Vendor” as previously described in Section I: Introduction, shall be synonymous with the term “Engineer,” “Inspector,” as outlined in Item 3: Scope of Services, below. The “Owner” refers to the City of Salisbury. The “Contractor” refers to the contractor who has fully executed and signed the construction contract for this project with the Owner.

2. PROJECT DESCRIPTION

A. Construction Administration Services

1. The Engineer will act as the Owner’s representative for Construction Administration Services during the Construction Phase as provided in the Contract Documents.
2. The Engineer will coordinate Construction Administration Services with the Owner and the Contractor, where applicable.
3. The Construction Phase will commence with the execution of the Construction Contract and will terminate upon written recommendation by Engineer for final payment to Contractor.
4. The construction cost estimate for the total project is approximately \$1.5 million.

B. Inspection Services

1. Inspector is the Engineer’s full time representative at the site and will act as directed by and under the supervision of the Engineer.
2. Inspector’s dealings in matters pertaining to the Contractor’s work in progress shall in general be with the Owner, Engineer and Contractor.
3. Inspector’s dealings with Subcontractors shall only be through, or with the full knowledge and approval of, the Contractor.
4. Inspector serves as Engineer’s liaison with Contractor and will work principally through Contractor’s authorized representative to assist in providing information regarding the intent of the Contract Documents.
5. Inspector shall not authorize any deviation from the Contract Documents or substitution of materials or equipment (including “or-equal” items).
6. Inspector shall not advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of the Contractor.
7. The Inspector will be 40 hours/week and will coordinate schedule with the Contractor.
8. The General Contractor is not required to provide a field office for inspection staff.
9. The Vendor shall provide with the proposal a sample Daily Field Inspection Report.

3. SCOPE OF WORK

A. Construction Administration Services. The Engineer will:

1. Chair the pre-construction meeting and monthly progress meetings. Issue minutes. One progress meeting per month is required.
2. Receive, review, and determine the acceptability of any and all schedules that Contractor is required to submit to Engineer, including the Progress Schedule, Schedule of Submittals, and Schedule of Values.

3. Review Requests for Information (RFI) and forward to the Owner. Coordinate the response to the Contractor. Issue necessary clarifications and interpretations of the Contract Documents as appropriate to the orderly completion of Contractor's work. Track status of all RFIs.
4. Review Proposed Change Orders (PCO) and Work Change Directives (WCD). Forward technical PCOs, report Contractor work in progress issues, and offer recommendations to the Owner. Coordinate the response to the Contractor. Track status of all PCOs and WCDs.
5. Review monthly partial payment applications, including quantities. Work directly with the Contractor to modify the partial payment application, when needed. Provide a recommendation to the Owner by signing the payment applications prior to forwarding to the Owner.
6. Visit the site at regular intervals to be familiar with the progression of work. The Engineer shall determine the intervals appropriate to the various stages of construction to observe the progress of Contractor's work as an experienced and qualified design and construction phase services professional. Attend site meetings as necessary to answer RFIs.
7. Review submittals by the Contractor and take appropriate action in respect to shop drawings, samples, certifications, inspections, tests, system startup reports and other data which the Contractor is required to submit. Verify conformance with the information given in the Contract Documents and compatibility with the design concept of the Project. Maintain a log of submittals and track the status.
8. Receive and review all certificates of inspections, tests, and approvals required by the Contract Documents. Receive, review, and transmit to the Owner appropriate maintenance and operating instructions, the final O&M manual, Release of Liens, bonds and evidence of insurance required by the Contract Documents;
9. Perform a punch list inspection of the completed work and develop a punch list. After notice from Contractor that Contractor considers the work ready for its intended use, visit the site to determine if the project is substantially complete. Make recommendations to the Owner for dates of Substantial Completion and Final Acceptance. Conduct a final site visit to determine if the punch list has been completed and if the completed work of Contractor is acceptable. At the appropriate time, recommend, in writing, final payment to Contractor and Final Acceptance of the project.
10. Prepare as-built drawings based on red-line drawings prepared by the Contractor during construction. Submit as-built drawings to the Owner for approval and make revisions as necessary. The Owner will provide CAD based files for use to prepare as-built drawings. The final submittal will be on mylar and accompanied by an electronic copy in AutoCAD .dwg file format.
11. Immediately notify the Owner of any site accidents, emergencies or damage to property.

B. Inspection Services

1. Full-time inspection services during the contract duration.

2. Conduct on-site observations of the Contractor's work in progress to assist Engineer in determining if the work is proceeding in accordance with the Contract Documents.
3. Report to Engineer whenever Inspector believes that any part of Contractor's work in progress will not produce a completed Project that conforms generally to the Contract Documents or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents.
4. Attend meetings with Contractor, such as preconstruction meetings, progress meetings, and other project-related on-site meetings.
5. Report to Engineer when Requests for Information (RFI), clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.
6. Record date of receipt of samples and shop drawings, and record date of approved shop drawings.
7. Receive samples which are furnished at the site by Contractor, and notify Engineer of availability of samples for examination.
8. Advise Engineer and Contractor of the commencement of any portion of the work requiring a shop drawing or sample submittal for which Inspector believes that the submittal has not been approved by Engineer.
9. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel as required. Verify that Contractor maintains adequate records thereof.
10. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups. Furnish to Engineer and Owner copies of all inspection, test, and system start-up reports.
11. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the results of these inspections, and report to Engineer.
12. Maintain at the Site orderly files for correspondence, reports of job conferences, reproductions of original Contract Documents including all change orders, field orders, work change directives, addenda, additional Drawings issued subsequent to the execution of the Construction Contract, Engineer's clarifications and interpretations of the Contract Documents, progress reports, Shop Drawing and Sample submittals received from and delivered to Contractor, and other Project-related documents.
13. Prepare a daily field report or keep a diary or log book, recording Contractor's hours on the site, weather conditions, data relative to questions of change orders, field orders, work change directives, or changed conditions, Site visitors, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer. Maintain daily diary or log book for the duration of the project.
14. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, or damage to property.
15. Review applications for payment with Contractor including necessary modifications and forward with recommendations to Engineer, noting particularly the relationship

of the payment requested to the schedule of values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

16. During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to the Owner prior to final payment for that part of the Work.
17. In conjunction with the Engineer, assist in the determination of Substantial Completion and the preparation of punch lists of items to be completed or corrected by the Contractor.
18. Participate in a final visit to the Project in the company of Engineer, Owner, and Contractor, and prepare a final list of items to be completed and deficiencies to be remedied.
19. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning Final Acceptance.
20. The Daily Field Inspection Reports should be grouped and submitted weekly to the City of Salisbury and Engineer of Record. These reports should be scanned and submitted electronically.

4. ADDITIONAL INFORMATION

- A. The Notice to Proceed (NTP) is anticipated to be no sooner than August 2017.
- B. The Bid Opening date for the General Contractor is tentatively scheduled for September, 2017.
- C. Construction Administration and Inspection Services will be needed during the duration of the three hundred sixty (360) calendar day construction contract. The 360 days starts when the Notice to Proceed (NTP) is issued by the City.
- D. A full set of Construction Specifications and Drawings will be made available to the Successful Vendor upon award.

END OF SECTION

SECTION IV: EXPERIENCE, STAFFING AND OTHER REQUIREMENTS

1. EXPERIENCE

- A. Provide a current Standard Form 330 and any other additional information that will document the Vendor's qualifications and ability to provide the required services.
- B. Include five (5) recent examples of completed projects, similar in nature to this RFP. Include the name and telephone number of the client contact for each project. Examples should be of the same type of work as requested within this Proposal Document.
- C. For the Work listed above, provide information on keeping cost performance and scheduling performance within project budgets.

2. STAFFING

- A. Provide an organizational chart to clearly show interrelationship of the team, including any subcontractors and field personnel.
- B. Identify and provide a statement of qualifications and specific responsibilities for all project team members who will be assigned to this Work, including those responsible for "hands on" work, as well as those assigned for supervision and oversight responsibilities.
- C. Identify and provide a statement of qualifications for all members of the Vendor's quality control team.

3. OTHER REQUIREMENTS

- A. Provide the geographic location of the Vendor relative to the City's location. The Vendor should include the complete address of the office proposed to handle the Work.

END OF SECTION

SECTION V: EVALUATION AND SELECTION PROCESS

1. EVALUATION

A. Proposals will be evaluated using the following criteria:

<u>Weighting Factor</u>	<u>Criterion</u>
40%	Expertise, experience, and qualifications of the Vendor, its personnel and proposed subcontractors as related to the Scope of Services, and understanding of the Scope of Services.
25%	Experience working with municipal governments and municipal projects with emphasis on projects with the City and Wicomico County or similar type municipalities and performance on all projects within the last three years.
25%	Price and billable rates.
10%	Geographic location of the Vendor relative to the location of the City and the Vendor's ability to respond to routine everyday type requests.

A. Each Vendor will be rated for each criterion on a scale of zero to four as described below:

Unacceptable	0
Poor	1
Fair	2
Good	3
Superior	4

B. A Vendor's final grade will be the sum of each criterion's rating multiplied by the weighting factor listed above.

**THIS AND PRECEDING SECTIONS DO NOT NEED
TO BE RETURNED WITH SUBMITTAL.**

END OF SECTION

FORM OF PROPOSAL

Date _____

To Whom It May Concern:

We hereby submit our Proposal Documents for "Engineering Construction Services for Hampshire Road Pump Station" as indicated in the Proposal Documents.

Having carefully examined the Proposal Documents and having received clarification on all items of conflict or upon which any doubt arose, the undersigned hereby requests consideration of our Proposal for award of the referenced Contract. All lump sum fees quoted are on a not-to-exceed basis and includes all labor, materials, subcontractors, and expenses.

ITEM	TASKS	LUMP SUM FEE
101.	Construction Administration Services	\$
102.	Inspection Services	\$
Total Items 101 through 102		\$

Add Alternates:		
103.	Add Alternate: Inspection services during normal business hours	\$_____/Hr.
104.	Add Alternate: Inspection services outside of normal business hours	\$_____/Hr.

Items 101 through 102: _____
Written

Printed Name

Signature

Name of Company

Address

City, State, Zip

REFERENCES

List three (3) references for projects successfully completed in the last five (5) years. References should also include the local government point of contact in each community/project referenced as well as other key organizations which are familiar with this project.

Type of Project:	
Company Name:	
Address:	
City, State, Zip Code:	
Contact Person:	
Telephone Number:	
Dates of Service:	
Date of Project Completion:	
Local Gov't Contact for Project:	
Key Organization Contact:	
Type of Project:	
Company Name:	
Address:	
City, State, Zip Code:	
Contact Person:	
Telephone Number:	
Dates of Service:	
Date of Project Completion:	
Local Gov't Contact for Project:	
Key Organization Contact:	
Type of Project:	
Company Name:	
Address:	
City, State, Zip Code:	
Contact Person:	
Telephone Number:	
Date of Service:	
Date of Project Completion:	
Local Gov't Contact for Project:	
Key Organization Contact:	

Print Name

Signature

EXCEPTIONS AND ADDENDA

The undersigned hereby certifies that, except as listed below, or on separate sheets attached hereto, the enclosed Proposal Document covers all items as specified.

EXCEPTIONS:

(If none, write NONE) _____

THE VENDOR HEREBY ACKNOWLEDGES RECEIPT OF THE FOLLOWING ADDENDA.

Number/Date/Initials

Print Name

Signature

OWNERSHIP DISCLOSURE FORM

COMPANY NAME: _____

TYPE OF COMPANY (circle one):

ADDRESS: _____

*Sole Proprietorship

*Partnership

*Corporation

FEIN#: _____

*Limited Liability Corporation

INSTRUCTIONS: Provide below the names, offices held and any ownership interest of all officers of the firm. If additional space is necessary, provide on an attached sheet.

NAME	OFFICE HELD	OWNERSHIP INTEREST (Shares Owned or % of Partnership)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

INSTRUCTIONS: Provide below the names, offices held and ownership interest of all individuals not listed above, and any partnerships, corporations and any other owner having a 10% or greater interest in the firm named above. If a listed owner is a corporation or partnership, provide below the same information for the holders of 10% or more interest in that corporation or partnership. If additional space is necessary, provide that information on an attached sheet. **If there are no owners with 10% or more interest in your firm, enter "None" below.**

NAME	OFFICE HELD	OWNERSHIP INTEREST (Shares Owned or % of Partnership)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

OWNERSHIP DISCLOSURE FORM – cont’d

COMPLETE ALL QUESTIONS BELOW	YES	NO
1. Within the past five years, has another company or corporation had a 10% or greater interest in the firm identified above? (If yes, complete and attach a separate disclosure form reflecting previous ownership interests.)	_____	_____
2. Has any person or entity listed in this form or its attachments ever been arrested, charged, indicted or convicted in a criminal or disorderly persons matter within the State of Maryland, any other state or the U.S. Government? (If yes, attach a detailed explanation for each instance.)	_____	_____
3. Has any person or entity listed in this form or its attachments ever been suspended, debarred or otherwise declared ineligible by any agency of government from bidding or contracting to provide services, labor, material or supplies? (If yes, attach a detailed explanation for each instance.)	_____	_____
4. Are there now any criminal matters or debarment proceedings pending in which the firm and/or its officers and or managers are involved? (If yes, attach a detailed explanation for each instance.)	_____	_____
5. Has any federal, state or local license, permit or other similar authorization, necessary to perform the work applied for herein and held or applied for by any person or entity listed in this form, been suspended or revoked, or been the subject of any pending proceedings specifically seeking or litigating the issue of suspension or revocation? (If yes to any part of this question, attached a detailed explanation for each instance.)	_____	_____

CERTIFICATION: I, being duly authorized, hereby represent and state that the information supplied above, including all attached pages, is complete and correct to the best of my knowledge. I acknowledge that the City of Salisbury is relying on the information contained herein and thereby acknowledge that I am under a continuing obligation from the date of this certification through the completion of any contracts with the City of Salisbury to notify the City in writing of any changes to the answers or information contained herein. I acknowledge that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I recognize that I am subject to criminal prosecution under the law and that it will also constitute a material breach of my agreement with the City of Salisbury and the City at its option, may declare any contract(s) resulting from this certification void and unenforceable.

PRINTED NAME: _____

SIGNATURE: _____

DATE: _____

WITNESS: _____

DATE: _____

AFFIX CORPORATE SEAL HERE

CONTRACTOR'S AFFIDAVIT OF QUALIFICATION TO BID

I HEREBY AFFIRM THAT:

I, _____ am the _____
(Printed Name) (Title)

and the duly authorized representative of the Vendor of
_____ whose address is
(Name of corporation)

and that I possess the legal authority to make this affidavit on behalf of myself and the Vendor for which I am acting.

Except as described in paragraph 3 below, neither I nor the above Vendor, nor to the best of my knowledge and of its officers, directors or partners, or any of its employees directly involved in obtaining contracts with the State or any county, bi-county or multi-county agency, or subdivision of the State have been convicted of, or have pleaded nolo-contendere to a charge of, or have during the course of an official investigation or other proceeding admitted in writing or under oath acts or omissions which constitute bribery, attempted bribery, or conspiracy to bribe under the provisions of Article 27 of the Annotated Code of Maryland or under the laws of any state or federal government (conduct prior to July 1, 1977 is not required to be reported).

(State "none" or, as appropriate, list any conviction, plea or admission described in paragraph 2 above, with the date, court, official or administrative body, the individuals involved and their position with the Vendor, and the sentence or disposition, if any.)

I acknowledge that this affidavit is to be furnished to the City, I acknowledge that, if the representations set forth in this affidavit are not true and correct, the City may terminate any Contract awarded and take any other appropriate action. I further acknowledge that I am executing this affidavit in compliance with section 16D of Article 78A of the Annotated Code of Maryland, which provides that certain persons who have been convicted of or have admitted to bribery, attempted bribery or conspiracy to bribe may be disqualified, either by operation of law or after a hearing, from entering into contracts with the State or any of its agencies or subdivisions.

I do solemnly declare and affirm under the penalties of perjury that the contents of this affidavit are true and correct.

Print Name

Signature

NON-COLLUSIVE AFFIDAVIT

_____ being first duly sworn,
deposes and says that:

1. He/she is the _____, (Owner, Partner, Officer, Representative or Agent) of _____, the Vendor that has submitted the attached Proposal Document;
2. He/she is fully informed respecting the preparation and contents of the attached Proposal Document and of all pertinent circumstances respecting such Proposal Documents;
3. Such Proposal Document is genuine and is not a collusive or sham Proposal Document;
4. Neither the said Vendor nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, have in any way colluded, conspired, connived or agreed, directly or indirectly, with any other Vendor, firm, or person to submit a collusive or sham Proposal Document in connection with the Services for which the attached Proposal Document has been submitted; or to refrain from bidding in connection with such Services; or have in any manner, directly or indirectly, sought by agreement or collusion, or communication, or conference with any Vendor, firm, or person to fix the price or prices in the attached Proposal Document or of any other Vendor, or to fix any overhead, profit, or cost elements on the Proposal Document price or the Proposal Document price of any other Vendor, or to secure through any collusion, conspiracy, connivance, or unlawful agreement any disadvantage against (Recipient), or any person interested in the Services;
5. The price or prices quoted in the attached Proposal Document are fair and proper and are not tainted by any collusion, conspiracy, connivance, or unlawful agreement on the part of the Vendor or any other of its agents, representatives, owners, employees or parties in interest, including this affiant.

Print Name

Signature

Title

Signed, sealed and delivered in the presence of:

Witness (Print Name)

Witness (Signature)

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Applications for Payment
- B. Payment for Tests and Inspections
- C. Products Stored on Project Site
- D. Measurement and Payment

1.02 APPLICATIONS FOR PAYMENT

- A. Review estimate with Inspector prior to submitting to the City for payment. Submit copies of Application for Payment monthly in accordance with the City standard invoicing procedures.
- B. Submit Application for Payment on form, which has been used for the Schedule of Values and approved by the Engineer.
- C. Include following Contractor's signed certification on Application for Payment:

The undersigned Contractor certifies that (1) all previous progress payments received from City of Salisbury on account of Work done under the Contract have been applied to discharge in full all obligations of Contractor incurred in connection with Work covered by prior Applications for Payment number 1 through __ inclusive; (2) title to all materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to City of Salisbury at time of payment free and clear of all liens, claims, security interests, and encumbrances (except such as covered by Bond acceptable to City indemnifying City of Salisbury against any such lien, claim, security interest, or encumbrance); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective, as that term is defined in the Contract Documents.

1.03 PAYMENT FOR TESTS AND INSPECTIONS

- A. Include the costs of shop tests and shop inspections in the price of the manufactured Products, and no separate or extra payment will be made for such tests and inspections.
- B. Contractor will appoint, employ, and pay for the services of an independent firm(s) to perform laboratory field-testing and inspections as required in the various Specification Sections. Testing and inspection services which will be performed by this independent firm(s) are specified below. Costs of all tests and inspections specified below shall be performed by and paid for by the Contractor as part of the Contract Price.
 - 1. Material source acceptability tests specified in appropriate sections.
 - 2. Soil tests for pipe trench backfill compaction (lab density/moisture and field quality control tests) as specified in Section 02221.

1.04 PRODUCTS STORED ON PROJECT SITE

- A. Payment will not be made for Products stored on the Project site but not yet incorporated in the Work.

1.05 CONTINGENT ITEMS

- A. Construction items identified as being Contingent are provided in the contract for use when and as directed by the Engineer. The quantities for these items shown on the plans and/or the Proposal are established for the purpose of obtaining a bid price. The quantities for these Contingent items may be increased or decreased without any adjustment to the contract unit price by the Engineer without negotiation. The Contractor will not be allowed to submit a claim against the City for any adjustment to the contract unit price bid, should the Contingent item(s) be increased, decreased, or eliminated entirely.
- B. Payment for any Contingent item(s) used will be made on the basis of the quantities as actually measured and as specified in the Specifications. Materials, Construction Requirements and Basis of Payment shall be specified elsewhere in the Plans, Specifications, Special Provisions or Addenda.

1.06 CONTINGENT QUANTITIES

- A. Construction item(s) whose quantities are listed in the Proposal are provided in the contract for use as directed by the Engineer. The quantities shown for these Construction item(s) are based upon the best information available at the time of bidding and were established for the purpose of obtaining a bid price. The Contingent

Quantities for these Construction items may be increased or decreased by the Engineer

without any adjustment to the contract unit price bid and will not be considered a basis of a claim by the Contractor against the City resulting from these quantity changes.

- B. Payment for any Contingent Quantities used will be made on the basis of quantities as actually measured and as specified in the Specifications. Materials, Construction Requirements and Basis for Payment shall be specified for the appropriate item(s) in the Specifications, Provisions, or Addenda.

1.07 MEASUREMENT AND PAYMENT

A. Bid Item No. 1 – Mobilization, demobilization, insurance, bonds

Method of Measurement and Basis for Payment:

Mobilization will not be measured but will be paid for on a lump sum basis.

When a Contractor has established the necessary facilities, an allowance of 50% of the lump sum price will be payable as part of the first monthly estimate. The remaining 50% will be prorated over the remaining duration of the Contract. The price bid shall include all labor, materials, equipment, tools and incidentals necessary to complete the work, including the movement of personnel and equipment to the project site; application, fee payment and acquisition for all necessary permits (i.e., sediment control plan for staging areas, temporary and permanent building permits, utility connections, etc.); construction stakeout; and the establishment of the Contractor's offices, buildings, and other facilities necessary to begin work on a substantial phase of the Contract. The cost of required insurance and bonds shall be included in this item.

Payment of the lump sum price bid will not be made more than once, regardless of the fact that the Contractor may have for any reason shut the work down on the Project, moved his equipment away from the Project site, and then back again. Total payment for this item shall not exceed 5% of the total contract price.

B. Bid Item No. 2 – Demolition of existing pump station

Method of Measurement and Basis for Payment:

Demolition will not be measured but will be paid for on a lump sum basis. Payment shall include all work described in Section 02100 of the Standard Specifications, such as tree and shrub removal, shrub removal and replanting for plants to be saved, tree and shrub repair, fence and guardrail removal and replacement, removal of stumps, roots, brush, rubbish, other vegetation, striping and removal of topsoil and grass mat, removal and fill of existing pump station.

C. Bid Item No. 3 – Maintenance of Traffic

Method of Measurement and Basis for Payment:

All temporary traffic signs required shall meet the requirements of MUTCD standards or an approved Traffic Control Plan (TCP) and will not be measured separately but included in the lump sum price for "Maintenance of Traffic." and will be full compensation for the manufacture, erection, relocation, maintenance, replacement due to normal wear, removal of all signs, and all labor, equipment and incidentals. The item "Maintenance of Traffic" will cover all traffic signs, barricades, cones required.

Any relocation, maintenance, replacement and/or removal due to normal wear and all labor, equipment and incidentals will be paid for under the item "Maintenance of Traffic." There will be no payment for any replacement of sign backing(s) or post(s).

The replacement of sign backing(s) and post(s) are incidental to the item "Maintenance of Traffic."

Temporary traffic signs and all associated hardware, fittings, posts, brackets and incidentals, when satisfactorily removed from the job site, shall become the property of the Contractor.

Maintenance of traffic will not be measured but will be paid for on a lump sum basis. If additional Contract pay items for maintenance of traffic are provided for in the proposal, the method of measurement will be in accordance with the pertinent specification.

All work incident to maintenance of traffic, inclusive of traffic managers and flaggers; furnishing, relocating, maintaining and removal of existing traffic signs, drums, cones, and other traffic devices; posting of "No Parking" signs; implementation of a Traffic Control Plan will be paid for at the Contract lump sum price for item "Maintenance of Traffic." This price shall include all materials, tools, labor and work of any kind to this item, except when otherwise specifically set up in the Proposal as a Contract pay item.

D. Bid Item No. 4 – Sediment and erosion control

Method of Measurement and Basis for Payment:

Erosion and sediment control measures will not be measured but will be paid for on a lump sum basis. Erosion and sediment control measures are considered to include

such items as stabilized construction entrances, straw bales, sediment traps, dikes, swale inlet protection, silt fence, dewatering basins, and temporary seeding and mulching.

E. Bid Item No. 5 – Furnish and install pump station

Method of Measurement and Basis for Payment:

This item shall be measured and paid for on a lump sum basis.

Payment shall include: furnishing and installing in place, complete, and functioning pump station that includes pumps, concrete pads and associated concrete work, valve vault, wet well, emergency connection vault, davit crane, paving, excavation, backfill, dewatering, shoring, testing, chain link fence, control panel, all electrical and telemetry, gravel surfacing, landscaping, pump around, site lighting, complete generator set including transfer switch, blowers, fan, grading, and all other work not mentioned to provide a complete pump station as shown on the plans and in the specifications.

F. Bid Item No. 6 - Furnish and install sewer manholes, all depths

Method of Measurement and Basis for Payment:

Furnishing and installing 4' diameter gravity sewer manholes will be measured per each complete in place, including installation of the frames and covers, piping and other items, as stipulated in the bid schedule and on the plans.

Payment will include excavation, backfill and bedding, providing new drop connections of the proper size and type required and concrete, frames and covers, dewatering, bypass pumping, abandonment of manholes and pipes, connection of sewer mains, sawcutting and removing pavement, vacuum testing, channeling, and restoration of disturbed areas.

G. Bid Item No. 7 – Furnish and install 8" gravity sewer main

Method of Measurement and Basis for Payment:

Furnishing and installing sewer pipe will be measured for payment by the linear foot of the various types and sizes provided, measured horizontally along the centerline of the pipe from center of structures. No deductions will be made for the lengths of fittings or connections. Measurement will be made for each size pipe regardless of the depth.

Payment will be made for the quantities measured at the unit price per linear foot for the various sizes in the Bid Schedule. Payment will include excavation, shoring, dewatering, pipe detection tape, dewatering, connection to existing manholes including drop connections, backfill and bedding as specified in Section 02221 for the main.

Should the Contractor desire for any reason to increase the trench width beyond the trench payment width as shown on the plans, no additional compensation will be granted to the Contractor.

Payment will also include:

- a. removal of existing pipe and disposal including existing concrete cradle and encasement
- b. restoration and restabilization of disturbed lawn areas with 4-inch topsoil, seed and mulch.
- c. removal and restoration of removed or destroyed shrubbery, mailboxes, signs, fences, guardrails, sheds or landscaping, street light poles and foundations, concrete sidewalks, concrete curbs, or any other surface feature or structure.
- d. testing
- e. bypass pumping
- f. stoppers or plugs
- g. maintenance of existing utilities or removal and replacement of existing utilities unless a specific pay item is included in the bid schedule.
- h. site security fencing or other measures
- i. replacement of various appurtenant connections and devices required for watertight construction
- j. concrete anchors and erosion checks
- k. compaction and tamping and associated compaction tests by independent firm
- l. temporary stockpiling, drying and placement of excavated material as backfill
- m. stockpiling of stripped topsoil and replacement of four (4) inches of topsoil or furnishing borrow topsoil
- n. pipe detection tape
- o. connection to manholes including Kor-N-Seal, modification of inverts and installing drop connections.
- p. cutting and removal from the site of existing trees within the 10 foot easement area, or within 5 feet of either side of the sewer main
- q. installation of new drop connections to manholes
- r. videotaping and photographs
- s. sawcutting and removing existing bituminous pavement
- t. furnish and install all borrow backfill as specified on the plans
- u. replacement of pavement markings
- v. temporary seeding and mulch if permanent seeding is not completed within thirty (30) days.
- w. connection to existing pipe using approved coupling device
- x. excavation and backfill
- y. modification to existing manholes to modify internal channeling as a result of realigning pipes to manhole

- z. placing and removing cold patch temporarily over trench for accommodation of traffic.
- aa. construction stakeout.
- bb. Furnishing and placing 12 inch depth of graded aggregate base under the bituminous paving.

H. Bid Item No. 8 – Furnish and install 4” force main

Method of Measurement and Basis for Payment:

Furnishing and installing sewer force main will be measured for payment by the linear foot of the various types and size provided, measured horizontally along the centerline of the pipe. No deductions will be made for the lengths of the fittings, connections or valves.

Payment will be made for the quantities measured for each size at the unit price per linear foot listed in the Bid Schedule.

Payment will include provision of fittings, valves, valve boxes, restrained joints, reducers, concrete anchors, removal and restoration of disturbed surface features such as topsoil, seeding, temporary pavement, curb, sidewalk, signs, fences, mailboxes, shrubs, clearing and grubbing.

Payment will include excavation, bedding and backfill, as specified in Section 02221 and implementation of all requirements.

Non-Payment Items for Sewer Force Main

The following items will not be measured for payment, but the cost thereof will be considered as incidental to the contract.

1. Removal of existing pipe and backfill.
2. Restoration and restabilization of disturbed areas such as lawns, curbs, sidewalks.
3. Mechanical Joint Restraints.
4. Harnessing and blocking.
5. Pipe and trench backfill testing.
6. Dewatering of excavation.
7. Restrained and/or mechanical joints.
8. Replacement of various appurtenant connections and devices required for watertight installations.
9. Removal and salvage of existing City facilities and delivery to appropriate locations.
10. Sawcutting and removal of existing pavement, curb, and/or sidewalk.
11. Furnishing and placing 12 inch depth of graded aggregate base under the bituminous paving.

12. Furnishing and placement of warning tape.
13. Restriping of any pavement markings disturbed by the trenching or other construction activities.

H. Bid Item No. 9 – Furnish and install pavement patch for trench repair, 3 inch base

Method of Measurement and Basis for Payment:

This item will be measured and paid for at the contract unit price per square yard in accordance with bid form. The payment will be full compensation for furnishing, hauling and placing all materials including anti-stripping additive, tack coat, asphalt, setting of lines and grades where specified and for all labor, equipment, tools and incidentals necessary to complete the work. Payment will also include: preparation of subgrade; disposal of removed pavement; saw cutting of existing pavement; removal and replacement of driveways at utility trenches; temporary cold patch and permanent hot mix asphalt pavement; graded aggregate for temporary accommodation of traffic; replacement and restoration of pavement outside the limits of payment set forth herein which have been disturbed and damaged by the Contractor's operations

I. Bid Item No. 10 – Remove existing pavement on Hampshire Road for Road Replacement

Method of Measurement and Basis for Payment:

This item shall include all labor, equipment, materials to remove and properly dispose of existing paving, aggregate and soils within the limit of road reconstruction on Hampshire Road. This item shall be measured for payment on a per square yard basis. Payment shall also include all preparation work necessary for new paving such as compaction of existing subgrade.

J. Bid Item No. 11 and 12 – Hot mix asphalt for new pavement

Method of Measurement and Basis for Payment:

Superpave Base Course and Superpave Surface Course will be measured and paid for at the contract unit price per ton in accordance with bid form and as shown on the plans. The payment will be full compensation for furnishing, hauling and placing all materials including anti-stripping additive, tack coat, pot hole and small repairs, setting of lines and grades where specified and for all labor, equipment, tools and incidentals necessary to complete the work. Payment will also include: preparation of subgrade; disposal of removed pavement; saw cutting of existing pavement; temporary pavement; graded aggregate for temporary accommodation of traffic; replacement and restoration of pavement outside the limits of payment set forth herein which have been disturbed and damaged by the Contractor's operations.

H. Bid Item No. 13 – Mill 2” depth of existing pavement on Northgate Drive

Method of Measurement and Basis for Payment:

This item shall be measured for payment on a per square basis for 2 inch depth of pavement removed. Payment shall include all labor, equipment, materials to remove the existing paving by milling.

I. Bid Item No. 14 - Furnish and install aggregate base, 8 inch depth on Hampshire Rd

Method of Measurement and Basis for Payment:

This item shall be measured and paid for on a square yard basis.

Payment shall include placing compacted aggregate, 8 inch depth for the new pavement in Hampshire Road where specified on the plans. All work associated with this bid item shall be included in the unit price which includes delivery, placement, compaction, and all other work not mentioned.

J. Bid Item No. 15 – Contingent, unsuitable material removal and refill

Method of Measurement and Basis for Payment:

Unsuitable material shall be removed to the limits directed by the City or Engineer shall be measured by the cubic yard of excavated material removed. Those portions of excavation not backfilled but utilized as trench excavation shall not be measured for payment as unsuitable but the cost thereof shall be included in unit price for pipe installation. The pay item shall also be used for payment for refill of miscellaneous unclassified excavation directed by the Engineer that is beyond the depth ranges shown on the plans or for removal of unsuitable material and backfill with AASHTO #57 stone.

Payment will be made for the quantities measured at the fixed unit prices per cubic yard listed in the Bid Schedule.

K. Bid Item No. 16 – Contingent, concrete, Class 2

Method of Measurement and Basis for Payment:

Measurement for contingent cast-in-place concrete will be made of the amount of concrete of each Mix Number furnished and installed in accordance with the dimensions as directed by the Engineer. Any concrete shown on the drawings shall be included in other appropriate bid items and not included in this contingent item.

Payment will be made per cubic yard for cast-in-place concrete which is installed at the direction of the Engineer in addition to the amounts required in the Contract Documents. No payment will be made for cast-in-place concrete installed for the Contractor's convenience or beyond the limits ordered by the Engineer.

L. Bid Item No. 17 – Contingent, test pits

Method of Measurement and Basis for Payment:

Test pits in the numbers, at the locations, and to the limits directed by the Engineer shall be measured by the cubic yard of excavated material removed. Those portions of test pits not backfilled but utilized as trench excavation shall not be measured for payment as test pits but the cost thereof shall be included in unit price for pipe installation.

Payment will be made for the quantities measured at the fixed unit prices per cubic yard listed in the Bid Schedule.

Payment will also include backfill with the materials as shown on the Contract Documents.

M. Bid Item No. 18 – Allowance – SCADA Program

Method of Measurement and Basis for Payment:

This item shall include furnishing all materials and labor to install the system associated with the SCADA system by the City's SCADA Contractor.

PART 2 - PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION

SECTION 01100

MOBILIZATION

PART 1 - GENERAL

1.01 Description

Mobilization shall include, but not necessarily limited to, the performance of preparatory construction operations, including the movement of personnel and equipment to the project site; application, fee payment and acquisition for all necessary permits (i.e., sediment control plan for staging areas, temporary and permanent building and plumbing permits, utility connections, etc.); and the establishment of the Contractor's offices, buildings, and other facilities necessary to begin work on the Contract. The cost of required insurance and bonds shall be included in this item. Mobilization shall be considered incidental to the pay items provided.

1.02 Submittals

The Contractor shall furnish proof of carriage of insurance as specified elsewhere in these specifications.

PART 2 - MATERIALS

NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION

- 3.01 All work performed in providing the facilities and services shall be done in a safe and workmanlike manner.

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Preconstruction conference.
- B. Progress meetings.

1.02 PRECONSTRUCTION CONFERENCE

- A. Engineer will schedule a conference to be held prior to Contractor's commencement of the Work.
- B. Attendance
 - 1. Owner's representatives
 - 2. Engineer
 - 3. Contractor (attendance required)
 - 4. Major Subcontractors
 - 5. Governmental agency representatives, utility representatives, and other parties who may have control of, or may be affected by, the Work.
 - 6. Resident Project Representative
- C. Agenda Items (as applicable to the Project)
 - 1. Designation of Contractor's supervisory personnel and phone numbers to be used in event of an emergency during non-working hours.
 - 2. List of major Subcontractors and suppliers
 - 3. List of proposed Products
 - 4. Schedule of Shop Drawing submissions
 - 5. Schedule of Values
 - 6. Construction progress schedule and work sequencing
 - 7. Utility relocations
 - 8. Procedures for submittals; Field Orders and Change Orders; and applications for Payment
 - 9. Control points
 - 10. Record documents
 - 11. Project coordination
 - 12. Site security
 - 13. Temporary utilities
 - 14. Field offices
 - 15. Housekeeping

16. Safety and first-aid procedures
17. Environmental requirements

D. Engineer will preside at conference and prepare minutes for distribution to participants.

1.03 PROGRESS MEETINGS

A. Engineer will schedule progress meetings throughout the construction period at intervals of one month.

B. Attendance

1. Owner's representative.
2. Contractor's Project Superintendent (attendance required) and other Contractor(s) representatives.
3. Major Subcontractors and suppliers.
4. Engineer.
5. Resident Project Representative.
6. Others as appropriate for agenda topics for each meeting.

C. Agenda

1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems which impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to Work.

D. Engineer will conduct meeting and prepare minutes for distribution to participants.

PART 2 - PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Submittal procedures.
- B. Action on submittals.
- C. Shop Drawings.
- D. Product data.
- E. Samples.
- F. Manufacturers' instructions.
- G. Manufacturers' certificates.
- H. Construction progress schedules.

1.02 SUBMITTAL PROCEDURES

- A. Transmit each submittal with Engineer accepted form.
- B. Number each submittal. Number shall consist of the following parts, each separated by a dash:
 - 1. Contract number.
 - 2. Five-digit Specification Section number.
 - 3. Two-digit sequence number starting for each Specification Section with 01 and continuing with 02, 03, etc., for subsequent submittals with the same Specification Section number.
 - 4. Use the fourth part of the number only for resubmittals. For the first resubmittal of a previous submittal, add -R1 to the previous number. For the second resubmittal, change to -R2, and so on.

As an example of the numbering process for Contract Number 1, the third submittal under Section 03300 would be numbered 1-03300-03 and the second resubmittal of this same submittal would be numbered 1-03300-03-R2.

- C. Identify Project, Contractor, Subcontractor, or supplier. Identify pertinent Drawing sheet and detail number(s), and Specification Section number, as appropriate.
- D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents. Stamp shall have the following format:

Approved for Contract Requirements

The Contractor's signature below indicates that this Submittal has been checked with the Drawings, Specifications, and site conditions and found to meet all requirements of same including dimensions, and that the Contractor's guarantee fully applies to the Product(s) covered.

RE: Project

Submittal Number

Drawing Sheet Number _____ Detail Number

Deviations from Contract Documents? No ___ Yes
(letter attached)

By

Signature (Contractor)

Contractor's Name

- E. Schedule submittals to expedite the Project, and deliver to Engineer at business address. Coordinate submission of related items.
- F. Submit letter which specifically identifies deviations from Contract Documents. Identify Product or system limitations which may be detrimental to successful performance of the completed Work.

- G. Where deviations from Contract Documents will affect the Work of another Contractor, the Contractor making the submittal shall attach a letter from the other Contractor(s) stating that the deviation will either:
 - 1. Have no effect on the other Contractor's Work; or
 - 2. Have an effect on the other Contractor's Work and that the Contractor making the submittal has agreed to pay all extra costs associated with the deviation.
- H. Provide space for Contractor and Engineer review stamps.
- I. Revise and resubmit submittals as required. Identify all changes made since previous submittal.
- J. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.03 ACTION ON SUBMITTALS

- A. Engineer's Action: Where action and return is required or requested, Engineer will review each submittal, mark with the action taken, and where possible return within two weeks of receipt. Where submittal must be held for coordination, Contractor will be so advised by Engineer.
- B. Submittals returned with "APPROVED" action indicate that the information submitted was found to be in conformance with the design concept and in compliance with the requirements of the Contract Documents. The Contractor remains responsible for work-related errors, deviations, and discrepancies in the submittal, but may proceed with performance of the work covered by the submittal.
- C. Submittals returned with "APPROVED AS NOTED" action indicate that the information submitted was found to be in conformance with the design concept and in compliance with the requirements of the Contract Documents, provided the noted clarifications or corrections are incorporated in the Work and in the Record Documents. The Contractor remains responsible for work-related errors, deviations, and discrepancies in the submittal, but may proceed with performance of the work covered by the submittal. Resubmission of information is not required.
- D. Submittals returned with "RETURNED FOR CORRECTION" action indicate that: (1) information submitted is at least partially not in conformance with the design concept, (2) information submitted is at least partially not in compliance with the requirements of

the Contract Documents, (3) submittal is incomplete and does not include all items required by the individual Specification Sections, or (4) certifications or computations required by the individual Specification Sections have not been included with the Shop Drawings and Product data. Engineer will note the deficiencies or corrections required,

and return the submittal to the Contractor. Performance of the work covered by the submittal shall not proceed until corrected information is submitted and approved.

- E. Submittals returned with "NOT AS SPECIFIED" action indicate that the Engineer interprets the information submitted to be not in conformance with the design concept or not in compliance with the Contract Documents. This action may also indicate non-compliance with the Contractor's responsibility to review information and submit notification of deviations and discrepancies for the Engineer's review. Performance of the work shall not proceed until new information is submitted and approved.
- F. Review Action does not establish submitted information as a Contract Document, a Change Order, or authorization to deviate from the Contract Documents.
- G. For all re-submittals except the first, Engineer and Engineer's consultants will record manhours required for review of the re-submittal. At the discretion of the Engineer, Contractor may be charged for review of such repeat re-submittals at Engineer's (and Engineer's consultant's) current hourly rates. Charges for repeat re-submittals will be subtracted from Contractor's next progress payment.

1.04 SHOP DRAWINGS

- A. Submit the number of opaque reproductions which Contractor requires, plus three copies which will be retained by Engineer.
- B. After review, distribute in accordance with Article on "Submittal Procedures" above and provide copies for Record Documents described in Section 01700 - Contract Closeout.

1.05 PRODUCT DATA

- A. Submit the number of copies which the Contractor requires, plus three copies which will be retained by the Engineer.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.
- C. After review, distribute in accordance with Article on "Submittal Procedures" above and provide copies for Record Documents described in Section 01700 - Contract Closeout.

1.06 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- B. Submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Engineer's or Owner's selection.
- C. Include identification on each sample, with full Project information.

1.07 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual Specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product data.
- B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.08 MANUFACTURER'S CERTIFICATES

- A. When specified in individual Specification Sections, submit manufacturers' certificate to Engineer for review, in quantities specified for Product data.
- B. Indicate Product conforms to or exceeds specified requirements. Submit supporting computations, reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer.
- D. When required by individual Specification Sections, include computations signed and sealed (or stamped) by a registered Professional Engineer.
- E. When Supplementary Conditions specify certain regulatory restrictions concerning origin of Products (for example, that any steel used on the Project must be a Product of the United States), submit a certificate from Products manufacturer that Products supplied to the Contractor are in conformity with the regulatory requirements.

1.09 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit four copies of progress schedule for Owner and Engineer review. Revise and resubmit as required. Progress schedule shall include a breakdown of individual work tasks and be in the form of a Gantt chart.
- B. Submit revised schedules with each Application for Payment, identifying changes since previous version.
- C. Indicate submittal dates required for Shop Drawings, Product data, samples, and Product delivery dates, including those furnished by Owner and under Allowances.
- D. Do not include extensions to the Contract Time in revised progress schedules until such extensions have been approved by Owner in accordance with Article 12 of the General Conditions.
- E. Failure to submit an initial or revised progress schedule, acceptable to the Engineer, before or with each Application for Payment will be considered a substantial violation of the Contract Document provisions. In accordance with Paragraph 14.7 of the General Conditions, the Engineer may recommend that the Owner withhold payment of all or part of the amount shown in an Application for Payment until an acceptable progress schedule is submitted.
- F. Time unit used on progress schedule: Week.

PART 2 - PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION

SECTION 01400
QUALITY CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Quality assurance and control of installation.
- B. References.

1.02 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce workmanship of specified quality.
- F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.03 REFERENCES

- A. Conform to reference standards cited in Specifications.
- B. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

- D. Any measurement or payment provisions included in a reference standard are not applicable to this Project.

PART 2 - PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION

SECTION 01410

MAINTENANCE OF TRAFFIC

PART 1 - GENERAL

A. Description

1. This work pertains to the maintenance of traffic, both vehicular and pedestrian, on any facility affected by the work of the Contract.
2. All work shall be in accordance with the latest issue of the Maryland Manual on Uniform Traffic Control Devices, the Contract Documents, and as directed by the Engineer. Unless specifically included in the Proposal as a bid item, maintenance of traffic shall include furnishing traffic managers and flaggers; relocating, maintaining, and removing existing traffic signs and other traffic control devices; and implementation of a Traffic Control Plan (TCP). This item is considered incidental to the pay items provided.

B. Quality Assurance

The Engineer will inspect all materials furnished by the Contractor for maintenance of traffic to ensure compliance with the Contract Documents. However, the inspection, or the lack thereof, by the Engineer shall in no way relieve the Contractor of his responsibility to provide for the maintenance of traffic in accordance with the Contract Documents.

C. Submittals

The Contractor shall submit a Traffic Control Plan (TCP) for all work within any obstruction of and/or crossing of any public right-of-way or any private drive, access road, parking lot, or sidewalk.

PART 2 - MATERIALS

A. Detailed Material Requirements

All materials, whether temporary or permanent, shall meet the requirements of the Maryland Manual on Uniform Traffic Control Devices and the Contract Documents.

PART 3 - EXECUTION

- A. The Contractor shall provide for the safe and expeditious movement of all traffic through the project in accordance with the TCP, the Contract Documents, and as directed by the Engineer.

Equipment which is in use and requires temporary storage within the limits of the project and materials stored or stockpiled on the project site shall be placed in a location which shall not be hazardous to the traveling public and as approved by the Engineer.

All vehicles and all construction equipment entering or leaving the Project site and/or work area must follow the traffic flow pattern as established by the Traffic Control Plan.

All construction operations shall be performed in the normal direction of traffic flow unless written permission is obtained from the Engineer prior to the commencement of such work. Work performed and equipment moving against the normal traffic flow pattern is strictly prohibited unless a written exception is granted by the Engineer.

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Regulatory requirements.
- B. Temporary sanitary facilities.
- C. Barriers.
- D. Water control.
- E. Dust control.
- F. Protection of installed work.
- G. Security.
- H. Progress cleaning.
- I. Safety equipment.
- J. Removal of utilities, facilities.
- K. Progress Photographs

1.02 REGULATORY REQUIREMENTS

- A. Comply with applicable laws and regulations of authorities having jurisdiction, including but not limited to building codes, health and safety regulations, utility company regulations, and environmental protection regulations.
- B. Provide electrical equipment which is UL listed.

1.03 TEMPORARY SANITARY FACILITIES

- A. Provide self-contained single-occupant toilet units of the chemical, aerated-circulation. Units shall be properly vented and fully enclosed with a shell of glass fiber-reinforced

polyester or similar non-absorbent material.
1.04 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide protection for plant life designated to remain. Replace damaged plant life.
- C. Protect vehicular traffic, stored Products, site and structures from damage.

1.05 WATER CONTROL

- A. At all times during the construction of Work on this Project maintain the flow of storm water and naturally occurring water in existing channels affected by the Work.
- B. Contractor assumes risk from flood damages to the work in progress or to work completed. Make repairs and replacements to the satisfaction of the Engineer.
- C. Contractor assumes responsibility for damages to property caused by flooding due to blocking or restriction of storm water passages, natural waterways, and wastewater facilities.
- D. See other water control requirements under Section 01560 -- "Sediment and Erosion Control".

1.06 DUST CONTROL

- A. Maintain all work areas, both on and off the Project site, free from dust.
- B. Use sprinkling of water and/or, if approved by the Engineer or Resident Project Representative, chemical or light bituminous treatment to control dust.
- C. Where sprinkling is used, repeat at intervals as required to keep all parts of the disturbed area at least damp at all times.
- D. Perform dust control whenever a dust nuisance or hazard occurs and whenever directed by the Engineer or Resident Project Representative.

1.07 PROTECTION OF INSTALLED WORK

- A. Protect installed Work and provide special protection where specified in individual Specification Sections.

- B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.
- C. Provide protective covering at wall openings.
- D. Prohibit traffic from landscaped areas.

1.08 SECURITY

- A. Provide security and facilities to protect Work from unauthorized entry, vandalism, or theft.

1.09 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove waste materials, debris, and rubbish from site weekly and dispose off-site.
- C. Remove mud and construction debris on a daily basis from paved surfaces used by the Contractor.
- D. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- E. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

1.10 SAFETY EQUIPMENT

- A. First Aid Supplies: Comply with governing regulations.

1.11 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary above grade or buried utilities, equipment, facilities, and materials prior to Final Application for Payment inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.12 CONSTRUCTION SITE DOCUMENTATION

- A. Prior to commencing with construction, Contractor shall generate video tapes of pre-construction conditions at the Project area and submit one (1) set to Engineer.
- a. Information shown shall include but not be limited to streets, driveways, sidewalks, curbs, ditches, fencing, railing, visible utilities, retaining structures, and adjacent building structures.
 - b. The purpose of video taping is to document existing conditions and to provide a fair measure of required restoration.
 - c. Care should be taken to record all existing conditions which exhibit deterioration, imperfections; structural failures or situations that would be considered substandard.
 - d. The taping shall be performed by a firm or individual proficient in audio-visual work. The tapes shall be high quality, color and in the VHS format.
 - e. Temporary lighting shall be provided as necessary to properly tape areas where natural lighting is insufficient (indoors, shadows, etc.)
 - f. The tapes shall include an audio soundtrack to provide the following information:
 1. Detailed description of location being viewed referenced to Contract Drawings (i.e. station number, building designation, pipeline route, etc.).
 2. Direction (N, S, E, W, looking up, looking down, etc.) of camera's view.
 3. Date, time, temperature, environmental conditions at time of taping.
 - g. Any areas not readily visible by taping methods shall be described in detail. Unless otherwise approved by Engineer, taping shall not be performed during inclement weather or when the ground is covered partially or totally with snow, ice, leaves, etc.
 - h. The original tapes shall be submitted to the Engineer accompanied by a detailed log of the contents of each tape. The log shall include location descriptions with corresponding tape counter numbers to facilitate the quick location of information contained on the tapes.
 - i. The tapes will be maintained by the Engineer during construction and may be viewed at any time by the Contractor upon request. Upon final acceptance, the tapes will become the permanent property of the Owner.
- B. Cost associated with video taping, photographing, and leak detection shall be considered incidental to the pay items provided.

PART 2 - PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION

SECTION 01560

SEDIMENT AND EROSION CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Work required by regulations to prevent soil erosion and control sedimentation during Work on the Project.

1.02 SEDIMENT AND EROSION CONTROL PLAN

- A. The requirements of the Sediment and Erosion Control Plan are given in the following Articles of this Section. Construction details for various Sediment and Erosion Control measures are shown on the Drawings.

1.03 REGULATORY REQUIREMENTS

- A. The sediment and erosion control measures are subject to inspection by State, County, and local regulatory agencies. The Contractor shall be fully responsible for constructing and maintaining the sediment and erosion control measures to the extent that they are, at all times, acceptable to the regulatory agencies. The Contractor shall be liable for payment of any fines or legal costs that the Owner may incur as a result of the Contractor's failure to properly construct and maintain the sediment and erosion control measures. The Contractor's field representative shall possess a valid green card.
- B. The objective of the "Sediment and Erosion Control Plan" is the protection of private property. To assist any damaged property owners in redress of grievances, the following stipulations are made:
 - 1. Any silt, sediment, or mud leaving the construction site will be construed as damage to neighboring property and evidence of negligence on the part of the Contractor.
 - 2. Any damages claimed by neighboring property owners will be rectified and restitution made by the Contractor.
- C. Comply with the *2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control*, published jointly by the Water Resources Administration, Soil Conservation Service and State Soil Conservation Committee.
- D. Comply with any local laws, codes, and regulations concerning the construction and maintenance of sediment and erosion control measures.

1.04 CONSTRUCTION SEQUENCE

- A. Install all sediment and erosion control measures prior to start of trenching operations.
- B. Conduct construction operations in accordance with the sequence shown on the approved S.E.C. plan.

1.05 GENERAL SEDIMENT AND EROSION CONTROL METHODS/PROCEDURES

- A. In all cases, the smallest practical area of land surface shall be disturbed.
- B. Stripped topsoil shall be placed up slope from proposed construction areas where possible. Stockpiles shall be stabilized if to remain in place longer than 14 days. Topsoil shall be kept separate from all other materials.
- C. Utility excavations shall be open only long enough to properly install and inspect all underground facilities in accordance with applicable Specification Sections.
- D. Excavated material shall be placed up slope from the excavation whenever possible. Runoff from spoil piles shall be directed through a sediment filter structure and discharged in a non-erosive manner. Stockpiles of excavated material shall be stabilized if to remain in place longer than 14 days.
- E. Dewatering equipment discharge shall be directed onto a stabilized surface so that erosion does not occur. Discharges shall be directed through a sediment filter structure or sedimentation basin and discharged in a non-erosive manner.
- F. Backfilled excavations shall be restored to original type of cover and grade in accordance with Specifications. Temporary stabilization is required for any and all erodible/soluble areas and materials to be exposed for a period of time exceeding 20 days.
- G. Areas to be seeded or sodded shall be finish graded with six inches of topsoil unless otherwise specified. Positive drainage shall be maintained away from all structures. No isolated low spots shall be created.
- H. All sediment shall be prevented from entering any storm drain, ditch, or water course through use of a sediment filter structure.
- I. Construction access from unpaved areas to paved areas or streets (public or private) shall be via a stabilized construction entrance. The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto the paved surface.

Sediment spilled, dropped, or tracked onto paved surface shall be removed immediately.

1.06 SPECIFIC SEDIMENT AND EROSION CONTROL PROCEDURES

A. Clearing/Grubbing

1. Upstream diversion facilities shall be constructed and operational prior to removal of vegetation from Project areas. This system shall divert surface runoff away from the construction area.
2. A temporary diversion and collection system shall be provided at the downstream limits of all areas to be stripped. This facility shall be in place and functional prior to stripping operations. This system shall collect sediment-carrying water from the construction area and convey it to temporary or permanent sediment traps for non-erosive discharge onto stabilized areas.
3. Temporary and permanent sediment traps and discharge structures shall be located such that all surface water leaving the construction area passes through them.

B. Rough Grading Excavation

1. Upstream diversion facilities shall be re-established and relocated as required to maintain function during excavation operations.
2. Temporary and permanent diversion and collection system shall be modified or installed at the downstream limits of all areas to be excavated. All discharge from such facilities shall be via either temporary or permanent sediment traps and discharge structures.
3. Temporary and permanent sediment traps and discharge structures shall be modified or installed at all points of discharge of sediment-carrying water.

C. Stockpiles: Soil stockpile areas to remain in place for periods of time greater than 20 days shall be stabilized with temporary seeding.

D. Dewatering Operations: Dewatering operations, when required, shall discharge through sediment traps onto non-erodible surfaces. Existing sediment trap structures may be utilized or additional structures may be required.

E. Dewatering Basins

1. Construct dewatering basin(s) to intercept any water, including that from dewatering operations, where required to remove sediment by providing detention volume and settling time.
2. Remove sediment from basin whenever approximately one-third of basin volume is filled with sediment.

F. Silt Fence Sediment Barrier

1. Silt fence sediment barrier shall be used to filter sediment from runoff.
2. Sediment barriers shall be inspected after each rain and repaired as required to

- maintain proper function.
- 3. Remove sediment behind barrier whenever sediment deposit reaches depth of approximately six inches.
- G. Straw Bale Sediment Barrier
 - 1. Straw bales shall be used only as short-term control measures.
 - 2. Bales shall be securely staked across areas of concentrated flow.
 - 3. Bales shall be inspected regularly and replaced as necessary.
- H. Stabilized Construction Entrance
 - 1. Install stabilized construction entrance at each point where construction traffic leaves Project site and enters any paved or public roads.
 - 2. Stabilized construction entrances shall be used to reduce tracking of mud onto paved roads.
 - 3. Any sediment or mud which flows or is tracked onto any paved or public roads shall be removed daily.
 - 4. The stabilized construction entrance shall be removed when permanent pavement structure will be constructed.
- I. Temporary Stabilization of Construction Roads (including those which will become permanent roads), Temporary Parking Areas, and Construction Staging Areas
 - 1. Stabilize all areas which will be used for storage and by construction vehicles to minimize dusting, to prevent accumulation of water, and to prevent erosion.
 - 2. Where temporary stabilization methods have been used on roads which will become a permanent feature of the finished Project, remove all temporary stabilization materials which have been contaminated with mud or are otherwise unsuitable as permanent surfaces or as base/subbase for bituminous or cement concrete paving materials.
- J. Channel Diversions
 - 1. When required, construct fabric-based channel diversions to route flow around sections of existing channels.
- K. Temporary Cover -- The following methods shall be used to provide temporary ground cover and stabilization of erodible surfaces:
 - 1. Seeding
 - a. The seed shall be 100% (by weight) annual rye, and shall be applied at the rate of 10 pounds per 1,000 square feet.
 - b. Temporary seeding on slopes in excess of 5:1 shall be mulched. All temporary seeding between June 1 and September 15 shall be mulched. Temporary seeding shall be watered as required to develop cover.
 - c. Mulch shall be straw, shall be clean and free from noxious weeds, and shall be applied at the rate of 100 pounds (2-3 bales) per 1,000 square feet.
 - 2. Black Polyethylene Sheeting: 3 mil black polyethylene sheeting may be used to

stabilize erodible/soluble material stockpiles. Sheets shall be overlapped so as to shed and not contain water. Sheets shall be anchored with tires or approved equal at six feet O.C. along seams and edges and ten feet O.C. throughout.

3. Plywood Sheeting: Plywood sheeting may be used to protect existing vegetation under short duration storage/stockpile areas. Use of this protection method shall be limited to maximum four days. Contractor shall be responsible for restoring or replacing vegetation damaged under sheeting.

1.07 RESTORATION

- A. After completion of construction, remove all temporary erosion and sedimentation control devices. Restore areas in which these devices were located to the original condition or to the condition called for by the Contract Documents.

PART 2 - PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Transportation and handling.
- B. Storage and protection.

1.02 TRANSPORTATION AND HANDLING

- A. Transport and handle Products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to assure that Products comply with requirements, quantities are correct, and Products are undamaged.
- C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.03 STORAGE AND PROTECTION

- A. Store and protect Products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive Products in weather-tight, climate controlled enclosures.
- B. For exterior storage of fabricated Products, place on sloped supports, above ground.
- C. Provide off-site storage and protection when site does not permit on-site storage or protection.
- D. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- E. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- F. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

- G. Arrange storage of Products to permit access for inspection. Periodically inspect to assure Products are undamaged and are maintained under specified conditions.

PART 2 - PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION

SECTION 01650

EQUIPMENT, SYSTEMS, AND FACILITY START-UP

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Start-up and testing of equipment and systems.
- B. Demonstration and instructions.

1.02 START-UP AND TESTING OF EQUIPMENT AND SYSTEMS

- A. General:
 - 1. Costs of start-up and testing are considered part of the Contractor's Bid price(s) and no extra compensation will be granted for this phase of Work.
 - 2. Submit a start-up and testing plan to Engineer for approval at least 14 days prior to the initiation of this phase of the work. Include:
 - a. Source of water to be used.
 - b. Proposed dates and time periods for starting and testing each system or equipment item.
 - c. Names of manufacturers' representatives which will be present during this phase of the Work and the time periods during which they will be on the Project site.
 - d. Dates and time periods proposed for "Demonstration and Instructions" for each system and equipment item.
 - e. Method proposed for disposal of water used during start-up and testing.
 - f. Plans for coordinating with other Contract Document requirements, including:
 - 1) Pipe system testing.
 - 2) Disinfection of potable water systems.
 - 3) HVAC testing, adjusting, and balancing.
 - 4) Electrical system testing.
 - 3. Notify Engineer at least seven days prior to the start-up of each system and equipment item.
 - 4. Do not permit water used in start-up and testing operations to flow to the distribution system. Provide Engineer-approved means for recirculating testing water through the pump station or discharging back to the raw water source.
 - 5. Coordinate start-up and testing of various systems and equipment items.
 - 6. Execute equipment and system start-up and testing under supervision of responsible manufacturer's representatives and in accordance with manufacturers' instructions.

7. Manufacturer's authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up and testing.
 8. Requirements for electrical system testing are specified in Section 16010.
-
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.
 - C. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
 - D. Verify that instrumentation, control, alarm, annunciation, and automatic shutdown systems are operating properly.
 - E. Verify wiring and support components for equipment are complete and secure.
 - F. Check water containment structures, piping, and equipment for leaks.
 - G. Verify that equipment items are operating without excess vibration.
 - H. Verify that all valves will open and close without binding.
 - I. Simulate power failure to verify that standby systems function properly and that re-activation of utility power source will not result in damage to or malfunction of equipment and control systems.
 - J. See individual Specification Sections for start-up and testing requirements for specific equipment items.
 - K. Obtain approval from Engineer for method of disposing of water used during start-up and testing.
 - L. Correct any deficiencies prior to initiating actual pump station operation and requesting closeout inspection.
 - M. Submit a written report certifying that all systems and equipment items are functioning correctly and ready for long-term operation.
 - N. Contractor shall be responsible for all costs associated with retesting systems or equipment, including but not limited to engineering, administrative, construction observation and manufacturer's representation.

1.03 DEMONSTRATION AND INSTRUCTIONS

- A. During start-up and testing operations, demonstrate operation and maintenance of equipment to Owner's personnel.
- B. Qualified manufacturers' representatives shall participate in demonstration and instructions to Owner's personnel.
- C. Utilize Operation and Maintenance manuals as basis for instruction. Review contents of manuals with Owner's personnel in detail to explain all aspects of operation and maintenance.
- D. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at scheduled times, at equipment location.
- E. Prepare and insert additional data in Operations and Maintenance manual when need for additional data becomes apparent during instruction.
- F. After successful start-up and training submit a completed "Equipment Manufacturer's Certification of Installation, Testing and Inspection" form attached to the end of this Section.

PART 2 - PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION

**EQUIPMENT MANUFACTURER'S CERTIFICATE OF INSTALLATION,
TESTING AND INSTRUCTION**

Owner - _____
(fill in)

Project - _____
(fill in description)

Contract No. _____
(fill in)

M&E No. _____
(fill in)

EQUIPMENT SPECIFICATION SECTION _____

EQUIPMENT DESCRIPTION _____

I, _____ Authorized representative of
(Print Name)

(Print Manufacturer's Name)

hereby CERTIFY that _____
(Print equipment name and model with serial No.)

installed for the subject project (has) (have) been installed in a satisfactory manner, (has) (have) been satisfactorily tested, (is) (are) ready for operation, and that Owner assigned operating personnel have been suitably instructed in the operation, lubrication, and care of the unit(s) on

Date: _____ Time: _____

CERTIFIED BY: _____ DATE: _____
(Signature of Manufacturer's Representative)

10518.00
CITY OF SALISBURY – HAMPSHIRE ROAD SEWAGE LIFT STATION

01650-5

ARRO

OWNER'S ACKNOWLEDGMENT OF MANUFACTURER'S INSTRUCTIONS

(I) (We) the undersigned, authorized representatives of (insert Owner's name) and/or its Plant Operating Personnel have received classroom and hands-on instruction on the operation, lubrication, and maintenance of the subject equipment and (am) (are) prepared to assume normal operational responsibility for the equipment:

(Insert name and title) Date: _____

_____ Date: _____

_____ Date: _____

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Closeout procedures.
- B. Final cleaning.
- C. Project record documents.
- D. Warranties.
- E. Spare parts and maintenance materials.

1.02 CLOSEOUT PROCEDURES

- A. Sequence of closeout procedures is as follows:
 - 1. Contractor submits written request for closeout inspection to Engineer.
 - 2. Owner, Engineer, and Contractor conduct closeout inspection.
 - 3. Engineer prepares "punchlist" of items to be completed and submits to Contractor.
 - 4. Contractor completes items on punchlist and requests re-inspection.
 - 5. Engineer and Contractor conduct re-inspection.
 - 6. If, on the basis of re-inspection, Engineer believes Project to be substantially complete, Engineer prepares a tentative certificate of Substantial Completion and submits to Owner for approval. Tentative certificate fixes the date of Substantial Completion and includes a list of items to be completed and time limit for their completion. List of items to be completed will include deficiencies in cleaning and in submittal of spare parts, extra materials, Operation and Maintenance manuals, inspection certificates from regulatory agencies, Record Documents, warranties, and other items required by the Contract Documents.
 - 7. When Owner accepts the tentative certificate, Engineer issues to the Contractor a Certificate of Substantial Completion as described in the General Conditions.
 - 8. When Contractor completes items on the final punchlist, as issued with the Certificate of Substantial Completion, he requests final inspection.
 - 9. Owner, Engineer, and Contractor conduct final inspection.
 - 10. If Owner and Engineer agree that all items have been completed, Contractor will submit Final Application for Payment.

11. Contractor submits Final Application for Payment, including all documents required by the General Conditions and any other portion of the Contract Documents, to the Engineer. Final Applications for Payment shall identify total adjusted Contract Price, previous payments, and amount remaining due.
12. When Engineer approves Final Application for Payment, he submits to Owner with recommendation for payment.
13. Owner makes final payment to Contractor, deducting the amount of liquidated damages and the amount of any unresolved claims which have been filed against the Owner in connection with the Work.

1.03 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Sweep and remove stains and foreign deposits from paved areas.
- C. Rake landscaped areas.
- D. Remove waste and surplus materials, rubbish, and construction facilities from the site. Do not burn waste materials, bury debris or excess materials on Owner's property, or discharge volatile or other hazardous materials into drainage systems. Remove waste materials from the Project site and dispose of in a lawful manner.

1.04 PROJECT RECORD DOCUMENTS

- A. Maintain on site, one set of the following record documents; record actual revisions to the Work:
 1. Drawings.
 2. Specifications.
 3. Addenda.
 4. Change Orders and other Modifications to the Contract.
 5. Reviewed Shop Drawings, Product data, and samples.
- B. Store Record Documents separate from documents used for construction.
- C. Record information concurrent with construction progress.
- D. Specifications: Legibly mark and record at each Product Section description of actual Products installed, including the following:
 1. Manufacturer's name and Product model and number.
 2. Product substitutions or alternates utilized.
 3. Changes made by Addenda and Modifications.

- E. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to plan datum and base lines.
 - 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 3. Field changes of dimension and detail.
 - 4. Details not on original Drawings.
- F. Delete Engineer title block and seal (by crossing out) from Record Drawings.
- G. Include the following Contractor's signed statement on each Record Drawing sheet:

These Record Drawings have been prepared by

_____ (Name of Contractor)

and accurately reflect as-built conditions. Responsibility for accuracy of the Record Drawings rests with the Contractor.

- H. Submit documents to Engineer with request for closeout inspection. (See Paragraph 1.02A1 of this Section.)

1.05 WARRANTIES

- A. Provide duplicate notarized copies.
- B. Assemble documents from Subcontractors, suppliers, and manufacturers.
- C. Provide Table of Contents and assemble in three D side ring binder with durable plastic cover.
- D. Submit prior to final Application for Payment.
- E. Date of warranty shall be no earlier than the date of Substantial Completion.
- F. For items of Work delayed beyond date of Substantial Completion, provide updated warranty within ten days after acceptance of such work, listing date of acceptance as start of warranty period.
- G. For warranties with coverage period exceeding one year, make provisions for direct assignment of warranty to Owner one year after date of Substantial Completion.

- H. Final Application for Payment will positively not be approved by Engineer without approved warranty certificates.

1.06 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide Products, spare parts, maintenance, and extra materials in quantities specified in individual Specification Sections.
- B. Deliver to Project site and place in location as directed; obtain receipt prior to Final Application for Payment.

PART 2 - PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION

SECTION 02010

SUBSURFACE EXPLORATION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Subsurface Information: A geotechnical engineering report has been prepared for this project. The report is for informational purposes only and should not be considered part of the contract. The opinions expressed in this report are those of the geotechnical engineer and represent his interpretation of the subsoil conditions, tests, and the results of analyses which he has conducted. The Contractor hereby distinctly agrees that neither the Owner nor the Engineer is responsible for the correctness or sufficiency of the information given. This report may be examined by bidders at the office of the Engineer or copies may be procured from the Engineer at a nominal charge.
- B. Test Boring Logs: The following logs presenting physical data on subsurface conditions are for the information of the Owner only, and in no event is this information to be considered as part of the Contract. It is expressly understood that the Owner or the Engineer will not be responsible for any interpretation or conclusions drawn therefrom by the Contractor.
- C. Digging Test Pits:
 - 1. In locations where required by the Engineer, or indicated on the Drawings, dig test pits to determine the location and elevation of existing subsurface utility pipelines, cables or structures. Dig such test pits in the presence of an authorized representative of the owner of the subsurface utility pipelines, cables or structures. The Contractor is further advised that no excavation, pipe laying or other work is permitted at above referenced locations without the presence or approval of an authorized representative of the owner of the subsurface utility.
 - 2. In locations where new sewers are to be connected to existing sewers, the Contractor will not be permitted to proceed with new construction until he has dug test pits and determined the exact location and elevation of the existing sewers. Dig such test pits only at the locations agreed to by the Engineer.
 - 3. Digging test pits in locations required by the Engineer or indicated on the Drawings will be classified as "Contingent, Test Pit."
 - 4. Payment for this additional work will be made at the applicable unit prices bid under the Schedule of Unit Prices for Additions, Deductions or Deletions in Contract Quantities.

- D. Test pits or other miscellaneous excavation dug to obtain information on subsurface conditions or underground obstructions without written requirement of the Engineer will be at the Contractor's expense.

PART 2 - PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION

SECTION 02052

DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Site Conditions.
- B. Materials.
- C. Examination.
- D. Performance.

1.02 RELATED SECTIONS

- A. Subsurface Exploration: Section 02010.
- B. Site Grading: Section 02210.
- C. Demolition work, as specified herein, is not intended to be performed as a wrecking operation but as preparatory work relative to the performance of the various construction operations of the Project specified in other Sections of these Specifications.

1.03 SITE CONDITIONS

- A. Exterior Dust Control: To prevent unnecessary spread of dust during Performance of exterior demolition work, thoroughly moisten surfaces and debris as required to prevent dust being a nuisance to the public, neighbors and concurrent performance of other work on the site. Water for use in dust control shall be obtained from Contractor's own source.
- B. Interior Dust Control: To prevent spread of dust during performance of the interior demolition work, Contractor shall erect and maintain a dust tight temporary enclosure surrounding the areas of demolition. Fabricate such temporary enclosure from impervious materials such as plywood or sheet polyethylene supported on rough carpentry framing.

- C. Protection: Exercise care during demolition work to confine demolition operations to the areas indicated on the Drawings. The physical means and methods used for protection are at the Contractor's option. However, the Contractor shall be responsible for replacement and restitution work of whatever nature at no expense to the Owner.
 - 1. When public safety is endangered during the progress of the demolition work, provide adequate protective measures to protect the public, and pedestrian and vehicular traffic on streets and walkways adjacent to the Project Site.
- D. Explosives and Blasting: Not permitted in performance of demolition work.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials needed or required for temporary protection in the form of barricades, fences, enclosures, etc., may be pre-used construction materials of sound condition and reasonably clean. However, the condition of same materials shall meet or exceed the requirements of governing agencies or approving bodies as may be involved with the work.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to performance of the actual work, carefully inspect the entire site and locate those objects and structures designated to be demolished and removed.
- B. Prior to performance of the actual work, carefully inspect the structure and verify with the Engineer the objects being removed and objects to be preserved.
- C. Locate existing exposed and buried active utilities and determine the requirement for their protection, or their disposition with respect to the demolition work.

3.02 PERFORMANCE

- A. General: The means and methods of performing demolition (and removal) operations is the sole responsibility of the Contractor. However, equipment used, and methods of demolition (and removal) will be subject to approval of the Engineer.
- B. Debris Removal: Dispose of demolition debris off-site in a lawful manner.

- C. Abandoned Equipment and Machinery: Existing equipment and machinery in or on the structures, not claimed as salvage by the Owner, shall become the property of the Contractor and may not be disposed of on the Site but removed and disposed of in a lawful manner, off Site.
- D. Salvage: The Owner shall have the right to claim as salvage any items and materials removed under the work of this Section. Should such right of salvage be exercised by the Owner, move and neatly store removed items on the site in a location agreeable to the Owner, in a manner approved by the Engineer.
- E. When removing concrete slabs, saw cut such slabs at the limits of removal to assure a smooth, uniform joint with new concrete installation.
- F. When removing masonry, remove to the next full size unit so proper toothing-in of new work may be done.
- G. Perform removal of masonry and concrete debris, keeping such debris dampened during removal and until outside building.

END OF SECTION

SECTION 02055

REMOVAL AND ABANDONMENT OF EXISTING FACILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Related sections.
- B. Site Conditions.
- C. References.
- D. Materials
- E. Inspection
- F. Performance

1.02 RELATED SECTIONS

- A. Trenching, Backfilling and Compacting: Section 02221.
- B. Cast-In-Place Concrete: Section 03300.
- C. Grout: Section 03600.

1.03 SITE CONDITIONS

- A. Dust Control: To prevent unnecessary spread of dust during performance of demolition work, thoroughly moisten surfaces and debris as required to prevent dust being a nuisance to the public, neighbors and concurrent performance of other work on the site. Water for use in dust control shall be obtained from Contractor's own source.
- B. Protection: Exercise care during demolition and removal work to confine demolition operations to the facilities as indicated on the Drawings. The physical means and methods used for protection are at the Contractor's option. However, the Contractor will be completely responsible for replacement and restitution work of whatever nature at no expense to the Owner.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C33; Concrete Aggregates, Spec. for.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials needed or required for temporary protection in the form of barricades, fences, enclosures, etc., may be "used" construction materials of sound condition and reasonably clean.
- B. Equipment, machinery and apparatus (motorized or otherwise) used to perform the demolition and removal work may be used as chosen at the Contractor's discretion, but which will perform the work within the limits of the Contract requirements.
- C. Sand: ASTM C33.
- D. Lean Concrete: 2000 psi compressive strength at 28 days with minimum cement content per cubic yard in accordance with current ready-mix plant standard practice.
 - 1. Reduced Aggregate: Aggregate with particle size not less than 1/8-inch or more than 1/2-inch in any dimension and a maximum of 5% of particles passing a #8 sieve.
- E. Grout: Non-shrink as specified in Section 03600.
- F. Concrete: 2500 psi per requirements of Cast-In-Place Concrete, Section 03300.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Prior to performance of the actual Work, carefully inspect the entire site and locate those facilities designated to be demolished and removed or abandoned.
- B. Do not begin work of this section without approval to do so by the Engineer.
- C. Locate existing exposed and buried active utilities and determine the requirements for their protection.

3.02 PERFORMANCE

- A. General: The means and methods of performing demolition operations are the sole responsibility of the Contractor.
- B. Excavation and Backfilling: Per requirements of Trenching, Backfilling, and Compacting, Section 02221.
 - 1. Should the Contractor, in demolishing or removing existing facilities, excavate below the subgrade for new facilities, he will be required to backfill the area excavated below the subgrade with Aggregate Backfill or with concrete as required by the Engineer at his own expense and at no additional cost to the Owner.
- C. Debris Removal: Dispose of demolition debris off Site in a lawfully approved landfill area.
- E. Salvage:
 - 1. Carefully remove existing (equipment) and (manhole frames and covers). The following equipment at the existing pump station will be salvaged and transported to the City of Salisbury:
 - a. Pumps
 - b. Controllers, including enclosures
 - c. Valves, fittings, and appurtenances
 - d. Telemetry, including antennae
 - e. Ventilation equipment
 - 2. If the Engineer directs the Contractor to use the frames and covers to construct new facilities, thoroughly clean by wire brushing and paint with one coat of an approved asphalt base paint.
 - 3. The existing items shall remain the property of the City. The Contractor shall at no additional cost to the Owner, transport them to and store them at the City Public Works Department.
- F. Plugging Existing Facilities:
 - 1. Provide watertight seals using 2500 psi concrete. For large openings use manhole brick and waterproof mortar.
 - 2. Plug openings in manholes that are to be abandoned or filled using non-shrink grout as specified in Section 03600.
 - 3. Plug the ends of pipe sewers that are to be abandoned or filled.
- G. Filling Manholes to be Abandoned:
 - 1. Remove cone or tapered section of manhole.
 - 2. Fill with Aggregate Backfill placed in layers not to exceed 12-inches in depth after compaction.
 - a. Perform compaction with vibratory type compactor.
 - b. Puddling or jetting compacting methods are not permitted.

END OF SECTION

SECTION 02100

CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Related sections.
- B. Site conditions
- C. Materials
- D. Inspection
- E. Performance

1.02 RELATED SECTIONS

- A. Earthwork: Section 02200.
- B. Soil and Select Materials: Section 02240.

1.03 SITE CONDITIONS

- A. Environmental Requirements: Exercise the necessary means and methods to control dust on the site during performance of the work.
- B. Burning: Perform on-site and off-site burning only if permitted by governing local laws and regulations.
- C. Protection:
 - 1. Preserve all objects, including trees and shrubs designated to remain (if any). The means and methods used for protection are at the Contractor's option.
 - 2. Use required protective measures during the felling of trees and debris removal to provide for the safety of employees and others.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Fill Material: Common Earth Backfill as specified in Section 02240.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Prior to performance of the actual work, carefully inspect the entire site and locate objects and the plant life designated to be preserved.

3.02 PERFORMANCE

- A. Where Excavation work is to be performed, clear and grub the area within 5 feet of each side of the center of pipe to the depths as follows:
 - 1. Sewer Mains and Force Mains: 12 inches.
 - 2. Electrical cable/conduit: 8 inches.
- B. Stump Removal:
 - 1. Remove stumps and roots completely in areas of Excavation and Embankment.
 - 2. In all other areas as specified previously and not included in Excavation and Embankment area, remove stumps and roots, matted roots and similar subsurface debris to the depths as previously specified.
 - 3. Stumps over 4 inches in diameter left in place in areas other than Excavations and Embankments areas shall be treated with herbicide to prevent regrowth.
 - 4. Backfill stump holes with fill material as previously specified.
- C. Disposal: Burnable debris may be disposed of by controlled, supervised burning; local laws and regulations permitting.
 - 1. Contractor option to dispose of burnable debris along with non-burnable debris off-site in a lawful manner.
 - 2. Dispose of debris from clearing and grubbing in a site having current approval for conducting solid waste disposal.
 - 3. Remove clearing and grubbing debris accumulations daily.

4. Should the Contractor elect to continue work beyond normal working hours, clearing and grubbing debris shall not be allowed to accumulate for more than 48 hours.

END OF SECTION

SECTION 02151

SHORING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Shoring, sheeting and bracing necessary to protect excavations against loss of ground, caving or slipping.

1.02 RELATED SECTIONS

- A. Earthwork: Section 02200.

1.03 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
 - 1. Shoring materials and installation work shall conform to Federal, State and local laws, rules, regulations and requirements.
 - 2. Provide material for sheet piling, sheeting bracing and shoring and drive or set in place in accordance with Federal, State and local laws for excavations and construction and as may be required to protect the workers and the public, or to maintain the trench pay-line widths specified in Section 02200.

1.04 SITE CONDITIONS

- A. Responsibility for Condition of Excavation:
 - 1. The failure or refusal of the Engineer to suggest the use of bracing or sheeting, or a better quality, grade, or section, or larger sizes of steel or timber, or to suggest sheeting, bracing, struts, or shoring to be left in place, shall not in any way or to any extent relieve the Contractor of any responsibility concerning the condition of excavation or of any of his obligations under the Contract, nor impose any liability on the Engineer or the Owner; nor shall any delay, whether caused by any action or want of action on the part of the Contractor, or by any act of the Engineer, Owner, or their agents, or employees, resulting in the keeping of any excavation open longer than would otherwise have been necessary, relieve the Contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of his obligations under the Contract relating to injury to persons or property, nor entitle him to any claims for extra compensation.

- B. The Engineer reserves the right to order sheeting and bracing left in place for the protection of the finished work or adjacent property. Sheeting and bracing which have

been ordered left in place by the Engineer must be removed for a distance of three feet below the established or existing grade, whichever is lower. Trench bracing, except that which must be left in place, may be removed when the backfilling has reached the respective levels of such bracing.

- C. Before starting work, check and verify governing dimensions and elevations.
- D. Protect existing active sewer, water, gas, electricity and other utility services and structures.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Provide suitable shoring and bracing materials which will support loads imposed.
- B. Wood Materials: Use wood sheeting, sheet piling, bracing and shoring which is in good serviceable condition and timbers of sound condition.
 - 1. If wood is part of shoring system near existing structures, use pressure preservative treated materials or remove before placement of backfill.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Drive or set sheeting, sheet piling, braces or shores in place and arrange such that they may be withdrawn as the excavations are backfilled, without damage to piping and structures, and without damage to or settlement of adjacent structures and pavements.
- B. Engineer reserves the right to order sheeting driven to the full depth of the excavation or to such additional depths as may be required for the protection of the work.
- C. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
- D. Wherever shoring is required, locate the system to clear permanent construction and to permit forming and finishing of concrete surfaces. Provide shoring system adequately anchored and braced to resist earth and hydrostatic pressures.
- E. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to Engineer.

- F. Maintain bracing until structural elements are rebraced by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.
- G. Install internal bracing, if required, to prevent spreading or distortion to braced frames.
- H. Remove sheeting, shoring and bracing in stages to avoid disturbance to underlying soils and damage to structures, pavements, facilities, and utilities.
- I. Repair or replace, as acceptable to Engineer, adjacent work damaged or displaced through installation or removal of shoring and bracing work.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Trench excavation for underground piping.
- B. Bedding and backfilling.
- C. Surface restoration.

1.02 RELATED SECTIONS

- A. Soil and Select Materials: Section 02240.
- B. Paving and Surfacing: Section 02500.
- C. Division 3 - Concrete.

1.03 DESCRIPTION

- A. Definitions:
 - 1. Unclassified Excavation: Removal of materials of any kind in the excavation, including rock excavation.
 - 2. Miscellaneous Unclassified Excavation: Unclassified excavation required by the Engineer and not included in other items for payment.
 - 3. Subgrade: Trench bottom prepared as specified to receive pipe bedding, concrete cradle or concrete encasement or the bottom of excavations prepared to receive pipe line structures.

1.04 PROJECT CONDITIONS

- A. Classification of Excavated Materials: Under this contract, all excavation shall be unclassified; that is, the removal of all material of any nature, kind, type or origin will be considered the same and shall be included in the unit pricing as indicated in the Proposal.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Common Earth Backfill: As specified in Section 02240.
- B. Select Material Bedding, Haunching, and Backfill: As specified in Section 02240.
- C. Classification of Backfill and Bedding Materials:
 - 1. Pipe Bedding: Type B or C Select Material, as specified in Section 02240 at locations as shown on the Drawings.
 - 2. Pipe Initial Backfill: Type B or C Select Material, as specified in Section 02240 at locations as shown on the Drawings.
 - 3. Backfill Material To Restoration Depth: Type B or C Select Materials as specified in Section 02240.
- D. Underground Warning Tape:
 - 1. Printed polyethylene tape, 3 inches minimum width, color coded, 1 inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types.
 - 2. Non-magnetic.
 - 3. Provide for:
 - a. Sanitary Sewer and Force Main Line.
 - b. Electrical cable and conduit.

PART 3 - EXECUTION

3.01 TRENCH PREPARATION AND EXCAVATION

- A. Perform sheeting and shoring in accordance with requirements of Shoring: Section 02151.
- B. Perform soil erosion control work in accordance with requirements of the local Soil Conservation District.
- C. General: Excavation of every description and of whatever substances encountered shall be performed to the lines and grades indicated on the Drawings and specified herein, or as directed by the Engineer.
 - 1. Excavation shall be made by open cut, unless written permission to tunnel or bore is given by the Engineer or is specifically outlined in the specifications or shown on the Drawings.
 - 2. Trenches may be excavated and backfilled either by machinery or by hand as the Contractor may elect, provided, however, the Contractor shall use hand excavation

where necessary to protect existing structures, utilities, or private or public properties and provided, further, that backfilling shall be done by hand to the extent hereinafter specified.

3. The Contractor shall have no claim for extra compensation due to the fact that hand excavation, instead of machine excavation, may be made necessary from any cause whatever.

D. Stripping, Storing and Restoring Surface Items: The Contractor shall remove all paving, sub-paving, curbing, gutters, brick, paving block, granite curbing, flagging or other similar materials, and grub and clear the surface over the area to be excavated. He shall properly store and preserve such materials that may be required for future use in restoring the surface. The Contractor shall be responsible for any loss or damage to said materials because of careless removal or neglectful or wasteful storage, disposal, or use of the materials.

1. All materials which may be removed, including rock, earth and sand taken from the excavation, shall be stored, if practical, in the roadway or such other suitable place and in such manner as the Engineer shall approve.
2. If more materials are removed from any trench than can be backfilled over the completed pipe or stored in the street, leaving space for traffic, the excess materials shall be removed and stored at a suitable site provided by the Contractor.
3. The Contractor shall, at his own expense, bring back as much of the approved materials so removed as may be required to properly refill the trench.
4. When directed by the Engineer, the Contractor shall furnish such other suitable materials as may be necessary to properly refill the trench at no additional cost to the Owner.
5. The Contractor shall restore all shrubbery, fences, sheds, poles or other property and surface structures, removed or disturbed as a part of the work, to a condition equal to that before the work began, furnishing all labor and materials incidental thereto, without any additional cost to the Owner.
6. The Engineer may mark certain trees, shrubs, or other items that are not to be disturbed or damaged. In the event such items are disturbed or damaged, they shall be replaced or compensated for at the Contractor's expense.

E. Width of Trench: Pipe trenches shall be sufficiently true in alignment to permit the pipe to be laid in the approximate center of the trench. The trench shall be wide enough to provide a free working space on each side of the pipe; however, the trench width shall be as shown on the plans.

1. At manholes, valve pits, and other structures, the pay-line shall be measured as 1-foot outside the wall for excavation and 18-inches outside the wall for restoration.
2. Where sheeting and shoring are used, the maximum allowable width of trench as shown on the plans shall be measured between the closest interior faces of the

sheeting or shoring as placed. Whenever, for any reason, the maximum trench width is exceeded below the top of the pipe, the Contractor may be ordered by the Engineer to cradle or encase the pipe in concrete at the Contractor's expense in order to insure the structural integrity of the pipe.

3. If the maximum width of trench specified above cannot be maintained, the Contractor shall install temporary sheeting at his own cost and expense.
4. Where lines are to be constructed on rights-of-way or easements in open areas, the maximum width of trench at the top specified hereinbefore may be exceeded only if the construction is kept entirely within the limits of the right-of-way or easements and can be carried on without damage to adjoining property. The angle of slope shall be the angle at which the trench bank will stand without sliding and in no case shall the angle of slope be steeper than one-half horizontal to one vertical.
5. In locations other than rights-of-way or easements, the Engineer may, as warranted by working conditions, waive the requirements that the maximum width of trench at the top shall not exceed the dimensions specified hereinbefore.
6. If the maximum width requirement at the top is waived by the Engineer, the Contractor will not be entitled to additional compensation beyond the specified trench widths.
7. Where the Engineer specifically requires the contractor in writing to excavate beyond the maximum allowable trench width, the Contractor will be entitled to and will be reimbursed for the quantity of material excavated beyond the specified trench widths in accordance with the applicable unit price bid under the Schedule of Unit Prices for Contingent Items in Contract Quantities.

F. Length of Trench:

1. No trench shall be opened more than 100 feet in advance of the pipe lines laid.
2. The Contractor shall limit all trench openings to a distance commensurate with all rules of safety.
3. If the work is stopped either totally or partially, the Contractor shall refill the trench and temporarily repave over the same at his expense and the trench shall not be opened until he is ready to proceed with the construction of the pipeline.

G. Pumping and Draining: The Contractor shall remove by pumping, draining, or otherwise, any water which may accumulate in the trenches and other excavations and shall build all dams and do all other work necessary to keep the trenches or other excavation as free from water as possible.

1. Where it is impractical to completely drain the trench, special pipe or jointing materials may be authorized at no additional expense to the Owner.
2. While the pipelines are being laid, the Contractor shall have sufficient pumping machinery ready for immediate use.
3. All surface waters shall be prevented from entering the open ditches or excavations by proper grading of the surface in the vicinity of the excavation.

- H. Accommodations of Drainage: The Contractor shall keep gutters, sewers, drains and ditches open at all times so that the flow of storm or other waters shall not be obstructed. If the material excavated from the trenches must temporarily extend over gutters or other waterways, it shall be the duty of the Contractor to plank or bridge over the gutters, without extra compensation, so that the flow of water is not impeded.
- I. Protection of Utilities, Property and Structures: The existence and location of underground utilities as indicated on the plans is presented merely to serve as a notification that such utilities do exist in the general proximity of the work. Any utilities not shown, or not located as shown, shall not be cause of the Contractor to deny responsibility for their protection and/or repair during construction.
1. The Contractor shall notify all utility companies in advance of construction to include requesting the utilities to be field located and cooperate with agents of these companies during the progress of the work. Procedures for emergency action and repairs to utilities shall be established with the utility company prior to commencement of the work. During the course of his work, if the Contractor damages any of the aforementioned utilities, he shall immediately follow the procedure of emergency action and repair as established at his own expense.
 2. Whenever the Contractor, during the progress of the excavation, shall uncover service pipes or lines, which because of injury or age are in poor condition, he shall immediately notify the proper authority in order that steps may be taken for replacement or repair. Locations of repairs, and the procedures of repairs that have been made shall be recorded by the Contractor.
 3. The Contractor shall, at his own expense, sustain in their places, and protect from direct or indirect injury, all pipes, conduits, tracks, walls, buildings, and other structures or property in the vicinity of his work, whether above or below the ground, or that may appear in the trench. He shall at all times have a sufficient quantity of timber and plank, chains, ropes, etc., on the ground and shall use them as necessary for sheeting his excavations and for sustaining or supporting any structures that are uncovered, undermined, endangered, threatened, or weakened, whether such structures are or are not shown on the drawings.
 4. Pipes and underground conduits exposed as a result of the Contractor's operations shall be adequately supported along their entire exposed length by pressure treated timber or planking, installed in such manner that the anchorage of the supporting members will not be disturbed or weakened during the backfilling operation. Backfill of selected material shall be carefully rammed and tamped under and around the supports and all supports shall be left in place as a guard against breakage of the supported structure due to trench settlement. No additional payment will be due the Contractor for material left in place nor for the labor of installing and maintaining supports.
 5. The Contractor will not be paid for maintaining existing utilities and storm sewers in place that extend across the trench for the new sewer main or laterals, even if the

3.02 PIPE BEDDING AND TRENCH BACKFILL

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additional work shall be in accordance with the General Conditions of the Contract.

4. Excavation in Fill: When the pipe is laid in fill, the compacted embankment shall be brought to a height of at least 9-inches above the proposed crown of the pipe before the trench is excavated.

C. Backfilling Methods:

1. General: Backfilling shall not be done in freezing weather except by permission of the Engineer, and it shall not be done with frozen material. Do not backfill when the material already in the trench is frozen.
 - a. Where Select Material is not indicated on the Drawings or specified herein, and in the opinion of the Engineer should be used in any part of the work, the Contractor shall furnish and backfill with Select Material as directed.
 - b. Payment will be made in accordance with the unit price bid under the Schedule of Unit Prices for Contingent Items. Miscellaneous excavation and backfill are contingent items.
 - c. No extra compensation will be made for Select Material backfill required for the pipe bedding, or due to excavation made beyond the limits specified, or where used as special bedding at the discretion of the Contractor.

- D. Pipe Bedding Beneath and Haunching to Centerline of Pipe: All trenches shall be backfilled by hand, from the bottom of the trench to the centerline of the pipe with Select Material placed in layers of 3 inches (uncompacted thickness) and compacted by tamping. Bedding and haunching material shall be deposited in the trench for its full width on each side of the pipe and fittings simultaneously.

- E. Initial Backfill Over Pipe: From the centerline of the pipe and fittings to a depth of one (1) foot above the top of the pipe, the trench shall be backfilled with Select Material by hand or by approved mechanical methods. The Contractor shall use special care in placing this portion of the backfill so as to avoid damaging or moving the pipe. The backfill shall be placed in 6-inch layers (uncompacted thickness) and compacted by tamping.

- F. Backfill Material to Restoration Depth: From one (1) foot above the top of the pipe to restoration depth, the trench shall be backfilled with material as required for initial backfill. Backfill in this section of the trench shall be consolidated by tamping in eight (8) inch layers or other approved mechanical methods unless otherwise specified. Any consolidation method utilizing water, such as jetting or puddling shall not be permitted. Consolidation shall proceed from the center of the trench to the sides to prevent arching. No extra payment will be made for backfill whether native material or borrow select backfill is used.

- G. Underground Warning Tape: For the purposes of early warning and identification of buried pipes during future trenching or other excavation, provide continuous identification tapes in trenches. Install in accordance with printed recommendations of the tape manufacturer, and as modified herein. Bury tape at a depth of 2 feet above crown of pipe.
1. Provide in trenches for utilities indicated in Part 2 of this Specification Section.
- H. Compacting: During the course of backfilling and compacting work, the Engineer may, at any location or depth of trench, make tests to determine whether the Contractor's compaction operations are sufficient to meet specified requirements. Compact trench backfill as follows:
1. Use mechanical tampers to compact backfill materials in trench refill operations to produce a density of backfill at the bottom of each layer of not less than 95 percent of maximum density obtained at optimum moisture content as determined by AASHTO T 99. Perform field determinations of density, when requested by the Engineer, in accordance with AASHTO T 191.
- I. Inspection and Testing: Perform earthwork under continuous inspection by the Engineer or his representative. Do not place fill material unless the Engineer or his representative is on the site. The Contractor, using the services of a qualified materials testing firm approved by the City, shall make field density tests of the compaction of each layer of fill in accordance with one of the following: ASTM D1556; ASTM D2167; ASTM D2922; or ASTM D2937. One test per 100 linear foot trench and additional tests as directed by the Engineer; one test per 1000 square feet for general grading and additional tests as directed by the Engineer for general grading. Contractor shall be required to test under supervision of Engineer at the expense of the Contractor. Allow time for the Engineer to examine the testing reports from the materials testing firm upon completion of each layer of fill in a designated area. The Contractor shall provide equipment to cut smooth surfaced spot locations designated by the Engineer on which to perform the test. When the tests indicated that density or moisture content does not meet requirements specified herein, the particular layer or portion thereof, as determined by the Engineer, shall be reworked by rolling or by scarifying, wetting or drying and recompacting until the required density has been obtained. The Contractor will be required to submit documentation (compaction test reports) as work progresses to assure compliance with the requirements of the Specifications. Upon completion of all trench backfill and embankment fills, a final compaction test report and certification by an approved materials testing firm shall be provided for review and approval by the City and RPR. All approvals shall be through City of Salisbury prior to commencing construction of curbs/roadways, etc. Compaction test reports shall include date taken, location (MH-MH/station), moisture content, optimum moisture, dry density, maximum density, percent compaction. Additionally, the locations of tests are to be plotted on the profile view of the approved drawings at the depth and station they were taken.

Compaction tests, at a minimum, shall be performed beneath the new wet well, valve vault, all new manholes, hoist foundation and along the trench for the new force main.

3.03 RESTORATION AND CLEAN-UP OF SURFACE

- A. Replacement of Structures by Contractor: The Contractor shall restore (unless otherwise stipulated) all sidewalks, curbs, gutters, shrubbery, fences, poles, sod or other property and surface structures removed or disturbed as a part of the work to a condition equal to that before the work began, furnishing all labor and materials incidental thereto.
- B. Clean-Up and Maintenance of Surfaces:
 - 1. General: During construction, the surfaces of all areas including, but not limited to, roads, streets, and driveways shall be maintained on a daily basis to produce a safe, desirable, and convenient condition. Streets shall be swept and flushed after backfilling, and recleaned as dust, mud, stones and debris caused by the work, or related to the work again accumulates. Failure of the Contractor to perform this work shall be cause for the Engineer to order the work by others, and backcharge all costs to the Contractor.
 - a. All surplus materials furnished by the Contractor and temporary structures shall be removed from the site by the Contractor.
 - b. All dirt, rubbish and excess earth from the excavation shall be disposed of by the Contractor in a manner and place acceptable to all governing agencies.
 - c. The construction site shall be left clean at the end of each working day to the satisfaction of the Engineer.
 - 2. Repair or Correction of Unsatisfactory Conditions: All unsatisfactory conditions resulting from the work shall be corrected.
 - a. Any subnormal or dangerous condition caused by the work, on any surface, shall be repaired or corrected within two hours of observance or notification of its existence. If repairs or corrections are not made within this period, the Owner shall cause to have the work completed with the resulting cost subtracted from the Contractor's next monthly payment request. Any such costs shall be deemed a reduction in the total amount due the Contractor under the contract and no subsequent reimbursement shall be made to the Contractor by the Owner for these costs.

END OF SECTION

SECTION 02210

SITE GRADING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Products.
- B. Compaction.
- C. Tolerances.

1.02 RELATED SECTIONS

- A. Finish Grading: Section 02260.
- B. Paving and Surfacing: Section 02500.

1.03 SYSTEM DESCRIPTION

- A. Definitions:
 - 1. Rock Excavation: Consolidated hard mineral material mass exceeding one-half cubic yard in volume which, in the opinion of the Engineer, cannot be excavated except by drilling and blasting or drilling and wedging. Structure foundations of concrete or of masonry or stone laid in cement-mortar will also be classified as rock if the volume requiring removal at any single location exceeds one-half cubic yard.
 - 2. Items involved in the excavation such as sidewalks, curbs and street or roadway paving of whatever material shall not be classified as rock excavation.
 - 3. Earth Excavation: Materials of any kind in the excavation which, in the opinion of the Engineer, cannot be classified as rock excavation.
 - 4. Unclassified Excavation: Removal of materials of any kind in the excavation, including rock excavation.
 - 5. Subgrade: Prepared earth surfaces on or over which additional materials will be placed or work is to be performed.

1.04 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T99, Moisture-Density Relations of Soils, Using a 5.5-lb. Rammer and a 12-in. Drop.
 - 2. AASHTO T191, Standard Method of Test for Density of Soil In-Place by the Sand Cone Method.
- B. American Society for Testing and Materials: ASTM D2167, Density of Soil in Place by the Rubber-Balloon Method.
- C. The "MDT Sections" noted herein refer to sections contained in the Maryland Department of Transportation, State Highway Administration, Standard Specifications for Construction & Materials, as supplemented. The references pertain only to materials, construction equipment, methods and labor. The measurement and payment provisions do not apply to work to be performed under this Contract.
 - 1. MDT Section 901 Aggregates.

1.05 SUBMITTALS

- A. Test Reports: Compaction density test reports based on method of density determination as specified in referenced standards and methods as approved by the Engineer.

1.06 SITE CONDITIONS

- A. Classification of Excavated Materials: No consideration will be given to the nature of materials, which may include rock, encountered in site grading operations. Therefore, as unclassified excavation, no additional payment will be made for difficulties occurring in excavating and handling of materials.
- B. Environmental Requirements:
 - 1. Do not perform grading when soil or weather conditions are unsuitable. Unsuitable conditions include moisture saturated or frozen in place soil and precipitation of any kind present on the soil or occurring during the Work.
 - 2. Exercise the necessary means and methods to control dust on the site as well as in the off site work areas where excavation and grading are required.
 - 3. Do not leave the site in a dusting condition following the work of this Section. If necessary, employ a watering schedule to control the dust.
 - 4. Do not use frozen material in performing the work or place materials on frozen surfaces.
 - 5. When it is necessary to haul soft or wet soil material over roadways, use suitably tight vehicles to prevent spillage. Clear away spillage of materials on roadways caused by hauling at no expense to the Owner.

6. Plan work so as to provide adequate protection during storms with provisions available at all times for preventing flood damage.
- C. Protection: Assume all risks attending the presence or proximity of overhead or underground public utility and private lines, pipes, conduits and support work for same, also existing structures and property of whatever nature, in or over excavations or adjacent to such excavations. Complete responsibility for replacement and restitution work of whatever nature to the above, as damaged or destroyed by work of this Contract, rests solely with the Contractor and at no expense to the Owner.
1. Outside Rights-of-way: Take necessary precautions to protect trees, shrubs, lawns and such other landscaping from damage. Restitution work for damages rests solely with the Contractor and at no expense to the Owner.
 2. Temporary Protective Construction: Erect and maintain without expense to the Owner, substantial barricades to exclude pedestrians or vehicles.
- D. Accommodation of Traffic: Do not obstruct streets, roads and highways, unless the Municipality or Governing Agency authorizes in writing the complete closing of the street, road or highway. Employ such measures, at no expense to the Owner, as may be necessary to keep the street, road or highway open and safe for traffic. Maintain a straight and continuous passageway on sidewalks and over crosswalks, at least three feet wide and free from obstructions. DO NOT OBSTRUCT FIRE HYDRANTS.
- E. Explosives and Blasting: Not permitted in performance of site grading work.
- F. Borrow Excavation: When the required quantity of earth fill material exceeds the quantity of suitable on site fill material, provide borrow excavation. If borrow excavation is needed, notify the Engineer sufficiently in advance to permit the Engineer to verify such need and to view the proposed borrow pit to determine the material suitability. Borrow excavation will be subject to the Engineer's approval whose written consent shall be obtained prior to its use.
- G. Excess Materials: No right of property in materials is granted the Contractor of excess on site materials prior to completion of Site Work. This provision does not relieve the Contractor of his responsibility to remove and dispose of surplus excavated materials. Unsuitable material such as sod, stumps and spongy soil as well as excess rock shall become the property of the Contractor and shall be disposed of legally off-site.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Backfill: On-site excavated soil or soil-rock mixed materials free of topsoil, vegetation, lumber, metal, and refuse; and free of rock or similar hard objects larger than six inches in any dimension. Rock to soil ratio shall not exceed one part rock to three parts soil.

- B. Coarse Aggregate Material: Use AASHTO No. 57 conforming to MDT Section 901.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Salvaged Topsoil: Within the areas indicated for grading, strip turf and topsoil to the depth of suitable topsoil material and stock pile for subsequent topsoiling operations.
 - 1. Topsoiling: Performed as work of Section 02260.
- B. Stockpiling: Place topsoil storage piles within the limits of the project, on well drained land and at locations not interfering with the Prosecution of Work.

3.02 PERFORMANCE

- A. Erosion Control: Implement erosion control measures during performance of work of this Section.
- B. Overlot Grading: Perform rough grading over the site within the areas to be graded as indicated on the Drawings.
 - 1. Topsoiled Areas: Not more than 0.15 ft. above or below indicated grade less specified topsoil depths.
 - 2. Vehicle Traffic Areas: Not more than 0.10 ft. above or below indicated grade less specified or indicated depths of paving and aggregate base.
- C. Removing Obstructions:
 - 1. Where rock is encountered at proposed subgrade elevations, remove such for a depth of six inches below proposed subgrade.
 - 2. At excavation bottom, cut rock to form level surface for pipe or foundation bedding.
- E. Roadway Excavation: Excavate or otherwise remove and satisfactorily dispose of materials located within the limits indicated on the Drawings for roadways.
 - 1. Excavate to roadway subgrade depths required, and cut drainage channels and waterways as detailed.
 - 2. Excavate subgrade material determined unsatisfactory in the opinion of the Engineer. Refill such areas to required elevation with Backfill.
- F. Roadway grading: Shape subgrade of roadways, intersections, approaches, entrances and adjoining pedestrian walkways to no more than 0.10 foot above or below the elevations indicated on the Drawings.

- G. Compaction: Compact finished subgrades to the minimum final density percentages specified herein which are based on the maximum dry weight density of subgrade materials at their optimum moisture content.
 - 1. Overlot Grading: Not less than 90%.
 - 2. Roadway Subgrade: Not less than 95%.
- H. Corrections: Correct roadway subgrade irregularities exceeding previously specified limits to the Engineer's satisfaction either by removing or adding material as required, followed by rolling until satisfactorily compacted.
- I. Roadway Base Course and Surface Construction: As per requirements of Section 02500.

3.03 FIELD QUALITY CONTROL

- A. Surface Tolerance: Check finished subgrade for smoothness and elevation in accordance with the following:
 - 1. Use string lines for controlling the finished elevation of roadway subgrade. Maintain such lines until surface irregularities have been satisfactorily corrected.
- B. Field Moisture-Density Tests: When deemed necessary by the Engineer the Contractor will be required to conduct a minimum of two field moisture-density determinations on Site Grading work at locations designated by the Engineer.
 - 1. The moisture content at which the maximum density of the Backfill is obtained with a given compactive effort, AASHTO T99, shall be considered the optimum moisture content.
 - 2. Determine compaction density of roadway in accordance with AASHTO T191.

END OF SECTION

SECTION 02220

STRUCTURAL EXCAVATION, BACKFILL, AND COMPACTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Structural excavation for below grade tankage.

1.02 RELATED SECTIONS

- A. Soil Erosion and Sedimentation Control: Section 01560.
- B. Subsurface Exploration: Section 02010.
- C. Clearing and Grubbing: Section 02100.
- D. Shoring: Section 02151.
- E. Site Grading: Section 02210.
- F. Cast-In-Place Concrete: Section 03300.

1.03 DESCRIPTION

- A. Rock Excavation: Consolidated hard mineral material mass exceeding one-half cubic yard in volume which, in the opinion of the Engineer, cannot be excavated except by drilling and blasting or drilling and wedging. Structure foundations of concrete or of masonry or stone laid in cement-mortar will also be classified as rock if the volume requiring removal at any single location exceeds one-half cubic yard. No soft or disintegrated rock that can be removed with a pick, nor any material which can be broken down by sledge hammers, nor any ledge or single boulder less than one-half cubic yard in volume, nor loose, shaken, or previously blasted rock, nor broken stone in rock filling or elsewhere, nor rock exterior to the line of measurement as hereinafter specified, will be allowed as rock.
 - 1. Items involved in the excavation such as sidewalks, curbs and street or roadway paving of whatever material shall not be classified as rock excavation.
- B. Earth Excavation: Materials of any kind in the excavation which, in the opinion of the Engineer, cannot be classified as rock excavation.

- C. Earth Excavation Below Subgrade: Same as Earth Excavation except such excavation is performed below elevations given as subgrade.
- D. Unclassified Excavation: Removal of materials of any kind in the excavation, including rock excavation.
- E. Unclassified Excavation Below Subgrade: Same as unclassified excavation except such excavation is performed below elevations given as subgrade.
- F. Miscellaneous Unclassified Excavation: Unclassified excavation required by the Engineer and not included in other items for payment.
- G. Subgrade: The areas upon which rest the planned bottoms of footings, foundations or slabs.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM D422, Particle-Size Analysis of Soils, Method for.
 - 2. ASTM D423, Liquid Limit of Soils, Test for.
 - 3. ASTM D424, Plastic Limit and Plasticity Index of Soils, Test for.
 - 4. ASTM D698, Moisture-Density Relations Of Soils Using 5.5/lb. (2.5 kg) Rammer and 12-in. (304.8-mm) Drop.
 - 5. ASTM D1556, Density of Soil in Place by the Sand-Cone Method.
 - 6. ASTM D2167, Density of Soil in Place by the Rubber-Balloon Method.
 - 7. ASTM D2922, Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 8. ASTM D3017, Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 9. ASTM D4318, Liquid Limit, Plastic Limit, and plasticity Index of Soils, Test Method for.
- B. Testing Agency: As approved by the Engineer with the following required qualifications.
 - 1. Laboratory and field testing must be performed under the general supervision of a Registered Professional Engineer.
 - 2. The independent testing agency must have experience in quality control of earthwork structural fills.

1.05 SUBMITTALS

- A. Testing Agency Approval: Submit experience qualifications of the proposed independent testing agency for approval.
- B. Samples: Submit samples of materials being proposed for use based on the following:
 - 1. Aggregates: Submit a 10 lb. sample of each type, packaged in containers or bags of suitable strength.

2. Selected Compacted Fill: Submit representative samples in quart size moisture-proof containers of suitable strength.
3. Backfill: Submit samples of materials proposed for backfill when requested by Engineer.

1.06 SITE CONDITIONS

- A. Classification of Excavated Materials: No consideration will be given to the nature of the materials encountered in structural excavating operations. Therefore as unclassified excavation no additional payment will be made for difficulties occurring in excavating and handling of materials
- B. Environmental Requirements:
 1. Do not perform excavating, backfilling or compacting when weather conditions or the condition of materials are such, in the opinion of the Engineer, that work cannot be performed satisfactorily.
 2. Do not use frozen materials as backfill nor wet materials containing moisture in excess of the amount necessary for satisfactory compaction.
 3. Prior to use, moisten dry backfill material not having sufficient moisture to obtain satisfactory placement or compaction.
 4. Accommodation of Drainage: Maintain sewers, drains and ditches free of debris for surface drainage. No damming or ponding of water in gutters or other waterways will be permitted. Do not direct flow of water across or over pavements except through approved pipes or properly constructed troughs. Provide pipes or troughs of such sizes and lengths as may be required. Control grading in the vicinity of excavations so the ground surface is properly pitched to prevent water running into excavated areas.
 5. Pumping: Keep excavations free from water. Build dams and other devices necessary for this purpose, including lowering the water table below excavation bottom by deep wells, well points and pumping. Provide and operate pumps of sufficient capacity for dewatering the excavations. Dispose of water removed from excavations in a manner that will not cause injury to the public health, to public or private property, to the work of other Trades or Contractors, to any portion of the work completed or in progress or produce impediment to the use of highways, roads, lanes and streets by the public. No additional payment will be made for pumping or other difficulties encountered due to water.
 6. Control groundwater and surface water during construction in order to maintain soil stability. Maintain the water table elevation sufficiently below the levels of excavations that slopes will remain stable and bottoms of excavations will not become loosened by flow of water. If the foundation material loses its strength due to improper dewatering techniques, overexcavate the material and replace it with Structural Foundation Backfill at the Contractor's expense.

- B. Dust Control: To prevent spread of dust during performance of work of this Section, thoroughly moisten excavation areas by sprinkling or other methods as approved by the Engineer.
- C. Explosives and Blasting: Not permitted in performance of structural excavation work.
- D. Removal of Rock by Means Other Than Blasting: Where removal of rock by means other than blasting is required, remove by the use of mechanical surface impact equipment, or by drilling and hydraulic rock splitting equipment, or by other methods.
- E. Responsibility For Condition Of Excavation: The Contractor shall solely be responsible for the condition and results of excavations made by him. Slides and cave-ins shall be removed without extra compensation at whatever time and under whatever circumstances they may occur.
 - 1. Subsurface conditions data as specified in Section 02010.
- F. Protection:
 - 1. The Contractor shall, at no expense to the Owner, sustain in their places, and protect from direct or indirect injury, all pipes, conduits, structures, or other property in the vicinity of the work, whether above or below ground, or that may appear in the excavation. Contractor shall at all times have a sufficient quantity of timber and plank, chains, ropes, and other materials and equipment, on site and shall use them as necessary for sheeting excavations and for sustaining, or supporting any structures that are uncovered, undermined, endangered, threatened, or weakened.
 - 2. Pipes and underground conduits exposed as a result of Contractor's operations shall be adequately supported along their entire exposed length by timber or planking, installed in such manner that the anchorage of the supporting members will not be disturbed or weakened during the backfilling operation. Backfill of selected material shall be carefully placed and tamped under and around the pipe, or conduit as the supports are removed.
 - 3. The Contractor shall take all risks attending the presence, or proximity of pipes, poles, power lines, wires, structures, or other property, of every kind and description, in or over the excavation, or in the vicinity of the work, whether above or below the surface of the ground; and shall be responsible for all damages and assume all expenses for direct, or indirect, injury, caused by the work, to any of them, or to any person, or property by reason of them or by reason of injury to them, whether such structures are, or are not indicated on the Drawings.
- G. Borrow Excavation: Where the required quantity of backfill exceeds the quantity of suitable material excavated within the limits of the project site and rights-of-way, obtain sufficient material to complete the backfill at no additional cost to the Owner. If borrow excavation is needed, notify the Engineer sufficiently in advance of borrow excavation requirements to permit the Engineer to verify the need for such borrow excavation and to

view the proposed borrow pit and determine the suitability of the material to be provided. Borrow excavation from outside sources must be suitable in all respects and will be subject to the approval of the Engineer, whose written consent must be obtained before its use will be permitted.

- H. Excess Materials: No right of property in materials is granted the Contractor of excavated materials prior to backfilling. This provision does not relieve the Contractor of his responsibility to remove and dispose of surplus excavated material.
- I. Change of Excavation Location:
 - 1. Should the Engineer require a change in location of excavation from that indicated on the Drawings due to the presence of an obstruction, or from other cause and such change is made before the excavation is begun, the Contractor shall not be entitled to extra compensation or to a claim for damages.
 - 2. Should the Engineer require a change in location of any excavation from that indicated on the Drawings due to the presence of an obstruction or from any other cause, and if such changed location increases or decreases the quantity of excavation, then an adjustment will be made in lump sum price bid under which the work was performed.
 - 3. If a change of excavation location is authorized by the Engineer upon the Contractor's request, the Contractor shall not be entitled to extra compensation, and if such change of excavation location involves the abandonment of excavation already made, the abandoned excavation and refill shall be at the Contractor's expense.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Backfill: On-site excavated soil or soil-rock mixed material free of topsoil, vegetation, lumber, metal and refuse; and free of rock or similar hard objects larger than six inches in any dimension, with the exception that highly plastic clays and silts will not be permitted. Rock to soil ratio shall not exceed one part rock to three parts soil.
- B. Aggregate Backfill: Select Granular Material (Graded Aggregate Base – GAB)
- C. Aggregate Base Course: AASHTO No. 57 Type C or better Coarse Aggregate.
- D. Structural Foundation Backfill:
 - 1. Concrete (2500 psi): Conforming to requirements of Section 03300.
 - 2. Aggregate Fill:
 - a. AASHTO No. 57 Coarse Aggregate.
 - b. Select Granular Material (GAB) Aggregate.

- c. Size No. 57 Coarse Aggregate.
- d. Size No. 57 Coarse Aggregate.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Perform sheeting and shoring in accordance with requirements of Section 02151.
- B. Perform soil erosion control work in accordance with requirements of Section 01560.

3.02 EXCAVATION

- A. General:
 - 1. Perform excavation using machinery, except that hand excavation may be required where necessary to protect existing structures, buried utilities or private or public properties. No additional compensation will be paid for hand excavation instead of machine excavation as may be necessary from any cause whatever.
 - 2. Perform excavation of every description and of whatever substances encountered to the lines and grades or depths indicated by the Drawings and as specified herein.
 - 3. Where work space is limited, remove excavated material from the limited area and replace the material after the structure has been installed. No additional compensation will be made for such removal and replacement.
 - 4. Extend excavation a sufficient distance from footings, and foundations to permit placing and removal of concrete formwork, installation of services, other construction and for inspection.
- B. Rock Excavation: Remove rock below subgrade that is shattered due to rock removal operations and in the opinion of the Engineer is unfit for foundations. Fill to subgrade with Structural Foundation Backfill those areas where shattered rock has been removed. Perform such backfilling to the satisfaction of the Engineer. No separate or additional payment will be made for such removal and backfill.
- C. Excavation Below Subgrade:
 - 1. Do not excavate below depths indicated on the Drawings or such depths as required by the Engineer.
 - 2. Excavation below depths indicated on the Drawings or as required by the Engineer, through the fault of the Contractor, shall be restored to the indicated or required depths with Structural Foundation Backfill at the expense of the Contractor. Structural Foundation Backfill material as selected by Engineer.
 - 3. If the foundation for any structure is required by the Engineer to be carried lower than plan subgrade elevation, the voids caused by this excavation shall be backfilled up to plan subgrade elevation with Structural Foundation Backfill.

- 2) Maintain material in a moist condition during hauling, placing and compacting.
 - 3) Spread material uniformly without segregation of coarse and fine material.
 - 4) Place material in 8-inch layers and compact to 100 percent of the maximum dry density based on ASTM D698, Method C, with replacement of oversize material.
 - 5) One field density determination is required for each layer of material placed.
2. Aggregate Base Course:
 - a. Provide beneath concrete slabs for structures as indicated on the Drawings.
 - b. Place directly on excavation bottoms and where required on complete structural fills.
 - c. Compact with a vibratory compactor to the satisfaction of the Engineer.

3.04 BACKFILLING

A. General:

1. Perform backfilling using machinery, except that hand backfilling may be required where necessary to prevent displacing walls, foundations or buried utilities or damage to such. No additional compensation will be paid where backfilling by hand is required.
2. After completion of footings and walls and the removal of forms and prior to backfilling, clean excavation free of trash and debris.
3. See Section 02221 for locations where different types of backfill are used and for surface finishing.
4. Do not place Backfill material prior to seven days after completion of structure walls.
5. Do not place Backfill material on wet or frozen areas.
6. Do not operate heavy equipment closer to walls than a distance equal to the height of Backfill material above the top of the structure footing.
7. Do not place Backfill material against exterior walls until supporting floors or slabs at top of walls are in place.
8. Perform compaction using power driven tampers or compactors suitable for material being placed.

B. Backfill: Place Backfill in loose, uniform horizontal layers not exceeding six inches in depth.

1. Maintain moisture content of Backfill at compaction within two percent of optimum moisture as determined by ASTM D698.
2. Compact Backfill to at least 95 percent of the maximum dry density based on ASTM D698.

- C. Aggregate Backfill: Place Aggregate Backfill in 4 inch layers and thoroughly compact each layer with a vibratory compactor to the satisfaction of the Engineer.
- D. Cleanup: Excess excavated material that cannot be used at the project site shall be removed and disposed of off the site in a legal manner at no additional expense to the Owner.

3.05 FIELD QUALITY CONTROL

- A. Testing: Performed by the independent testing agency as prior approved for laboratory testing.
 - 1. In-place field density tests conducted in accordance with ASTM D1556, ASTM D2167, or ASTM D2922. If methods of ASTM D2922 are used for density testing, the moisture content must be determined as stated in ASTM D3017.
 - 2. Perform at least one field moisture-density determination (test) for each layer of material placed.
 - 3. Test locations as directed by the Engineer.
 - 4. The Engineer may require additional tests whenever necessary to ensure that the specified density is being obtained.
- B. Corrective Measures: Whenever tests indicate that the field moisture or density does not meet specified requirements, take corrective action as approved by the Engineer.
 - 1. Corrective measures may include loosening the soil and wetting or drying it prior to recompaction, additional compaction, or removing and replacing the material.
 - 2. Retest material that did not meet the moisture and density requirements after corrective measures have been performed.
- C. Retesting: The Engineer may at any time require retesting of any material, whether in stockpiles or being placed, if it appears that the material differs from that which has previously been approved for use.

END OF SECTION

SECTION 02221

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Trench Excavation for Piped Utilities.
- B. Trench Excavation for Electrical Work.
- C. Bedding and Backfilling.
- D. Surface Restoration.

1.02 RELATED SECTIONS

- A. Soil Erosion and Sedimentation Control: Section 01560.
- B. Subsurface Explorations: Section 02010.
- C. Shoring: Section 02151.
- D. Paving and Surfacing: Section 02500.
- E. Gravity Wastewater Sewer: Section 02731.
- F. Force Mains: Section 02732.
- G. Division 3 - Concrete.

1.03 DESCRIPTION

- A. Definitions:
 - 1. Unclassified Excavation: Removal of materials of any kind in the excavation, including rock excavation.
 - 2. Rock Excavation: Removal of consolidated hard mineral material mass exceeding one-half cubic yard in volume which, cannot be excavated except by drilling and blasting or drilling and wedging. Structure foundations of concrete or of masonry or stone laid in cement-mortar is classified as rock if the volume requiring removal at any single location exceeds one-half cubic yard. No soft or disintegrated rock

which can be removed with a pick, or any material which can be broken down by sledge hammers, or any ledge or single boulder less than one-half cubic yard in volume, or loose, shaken, or previously blasted rock, or broken stone in rock filling or elsewhere, or rock exterior to the line of measurement as hereinafter specified, will be allowed as rock.

- a. Items involved in the excavation such as sidewalks, curbs and street or roadway paving of whatever material is not classified as rock excavation.
3. Earth Excavation: Removal of materials of any kind in the excavation which cannot be classified as rock excavation.
4. Miscellaneous Unclassified Excavation: Unclassified excavation required by the Engineer and not included in other items for payment.
5. Subgrade: Trench bottom prepared as specified to receive pipe bedding, concrete cradle or concrete encasement or the bottom of excavations prepared to receive pipe line structures.

1.04 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 1. AASHTO T99, Moisture-Density Relations of Soils, Using a 5.5-lb. Rammer and a 12-in. Drop.
 2. AASHTO T191, Standard Method of Test for Density of Soil In-Place by the sand cone method.
- B. The "MDT Sections" noted herein refer to sections contained in the Maryland Department of Transportation, State Highway Administration, Standard Specifications for Construction & Materials, as supplemented. The references pertain only to materials, construction equipment, methods and labor. The measurement and payment provisions do not apply to work to be performed under this Contract.
- C. Maryland Department of Transportation, State Highway Administration, Standard Specifications for Construction and Materials.
 1. MDT Section 901 Aggregates, 2001.

1.05 PROJECT CONDITIONS

- A. Classification of Excavated Materials: Under this contract, all excavation shall be unclassified; that is, the removal of all material of any nature, kind, type or origin will be considered the same and shall be included in the unit pricing as indicated in the Bid Form.
- B. Trench Work for Electrical:
 1. Exceptions to pipe line trench work requirements are as specified herein.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Backfill Material: On site ,or imported (borrowed), excavated material, free of cinders, ashes, refuse, vegetable, or organic material, boulders, rocks, stone, or other material which, in the opinion of the Engineer, is unsuitable. Backfill material shall conform to the requirements established under “Classification of Backfill Materials,” specified below. No additional payment will be made for imported materials.
- B. Aggregate Backfill and Bedding: Aggregate Backfill and Bedding requirements established under “Classification of Backfill and Bedding Materials,” specified below.
- C. Classification of Backfill and Bedding Materials:
 - 1. Pipe Bedding: (AASHTO No. 8) Coarse Aggregate.
 - 2. Initial Backfill and Backfill to 12 inches over pipe: AASHTO No. 8 Coarse Aggregate.
 - 3. Backfill Material To Restoration Depth: Excavated material approved by the Engineer and containing no stones larger than six (6) inches in maximum dimension. A maximum of 20% of the backfill volume may be stones so long as the stones are evenly distributed within the material.
- D. Lawn seed mixture shall be equivalent to the following:

Red Fescue	40%
Common Kentucky Bluegrass	40%
Annual Ryegrass	20%
- E. Underground Warning Tape:
 - 1. Provide for:
 - a. Sanitary sewers, green.
 - b. Storm drains, green.
 - c. Sewage force main, green.
 - d. Water line, blue.
 - e. Gas line, yellow.
 - f. Electrical conduit, red.
 - g. Telephone conduit, orange.

PART 3 - EXECUTION

3.01 TRENCH PREPARATION AND EXCAVATION

- A. Perform sheeting and shoring in accordance with requirements of Shoring: Section 02151.
- B. Perform soil erosion control work in accordance with requirements of Soil Erosion and Sedimentation Control: Section 01560.
- C. General: Excavation of every description and of whatever substances encountered shall be performed to the lines and grades indicated on the Drawings and specified herein, or as directed by the Engineer.
 - 1. Excavation shall be made by open cut, unless written permission to tunnel or bore is given by the Engineer or is specifically outlined in the specifications or shown on the Drawings.
 - 2. Trenches may be excavated and backfilled either by machinery or by hand as the Contractor may elect, provided, however, the Contractor shall use hand excavation where necessary to protect existing structures, utilities, or private or public properties and provided, further, that backfilling shall be done by hand to the extent hereinafter specified.
 - 2. The Contractor shall have no claim for extra compensation due to the fact that hand excavation, instead of machine excavation, may be made necessary from any cause whatever.
- D. Stripping, Storing and Restoring Surface Items: The Contractor shall remove all paving, sub-paving, curbing, gutters, brick, paving block, granite curbing, flagging or other similar materials, and grub and clear the surface over the area to be excavated. Properly store and preserve such materials that may be required for future use in restoring the surface. The Contractor shall be responsible for any loss or damage to said materials because of careless removal or neglectful or wasteful storage, disposal, or use of the materials.
 - 1. All materials which may be removed, including rock, earth and sand taken from the excavation, shall be stored, if practical, in the roadway or such other suitable place and in such manner as the Engineer shall approve.
 - 2. If more materials are removed from any trench than can be backfilled over the completed pipe or stored in the street, leaving space for traffic, the excess materials shall be removed and stored at a suitable site provided by the Contractor.
 - 3. The Contractor shall, at his own expense, bring back as much of the approved materials so removed as may be required to properly refill the trench.
 - 4. When directed by the Engineer, the Contractor shall furnish such other suitable materials as may be necessary to properly refill the trench at no additional cost to the Owner.
 - 5. The Contractor shall restore all shrubbery, fences, poles or other property and surface structures, removed or disturbed as a part of the work, to a condition equal to that before the work began, furnishing all labor and materials incidental thereto, without any additional cost to the Owner.

- F. Trench Width and Depth for Electrical Work:
1. Excavate trenches for both single and banked conduit runs to vertical lines not exceeding maximum trench pay-line widths specified previously for piping, to accommodate the conduit or conduits width.
 2. Excavate trenches for both single and banked conduit runs to elevations indicated, and where not indicated, to the depth required to provide a minimum of two feet of cover unless indicated otherwise on Drawings.
- G. Length of Trench:
1. No trench shall be opened more than 100 feet in advance of the pipe lines laid.
 2. The Contractor shall limit all trench openings to a distance commensurate with all rules of safety.
 3. If the work is stopped either totally or partially, the Contractor shall refill the trench and temporarily repave over the same at his expense and the trench shall not be opened until he is ready to proceed with the construction of the pipeline.
- H. Pumping and Draining: The Contractor shall remove by pumping, draining, or otherwise, any water which may accumulate in the trenches and other excavations and shall build all dams and do all other work necessary to keep the trenches or other excavation as free from water as possible.
1. Where it is impractical to completely drain the trench, special pipe or jointing materials may be authorized at no additional expense to the Owner.

2. While the pipelines are being laid, the Contractor shall have sufficient pumping machinery ready for immediate use.
 3. All surface waters shall be prevented from entering the open ditches or excavations by proper grading of the surface in the vicinity of the excavation.
- I. Accommodations of Drainage: The Contractor shall keep gutters, sewers, drains and ditches open at all times so that the flow of storm or other waters shall not be obstructed. If the material excavated from the trenches must temporarily extend over gutters or other waterways, it shall be the duty of the Contractor to plank or bridge over the gutters, without extra compensation, so that the flow of water is not impeded.
- J. Blasting and Explosives: Not permitted in performance of trenching work.
- K. Protection of Utilities, Property and Structures: The existence and location of underground utilities as indicated on the Drawings is presented merely to serve as a notification that such utilities do exist in the general proximity of the work. Any utilities not shown, or not located as shown, shall not be cause of the Contractor to deny responsibility for their protection and/or repair during construction.
1. Whenever the Contractor, during the progress of the excavation, shall uncover service pipes or lines, which because of injury or age are in poor condition, Contractor shall immediately notify the proper authority in order that steps may be taken for replacement or repair. Locations of repairs, and the procedures of repairs that have been made shall be recorded by the Contractor.
 2. The Contractor shall, at no expense to the Owner, sustain in their places and protect from direct or indirect injury, all pipes, conduits, tracks, walls, buildings and other structures or property in the vicinity of the work, whether above or below the ground, or that may be exposed in the trench. Contractor shall at all times have a sufficient quantity of timber, planks, chains, ropes, etc., and shall use them as necessary for sheeting excavations and for sustaining or supporting any structures that are uncovered, undermined, endangered, threatened, or weakened, whether such structures are or are not shown on the drawings.
 3. Pipes and underground conduits exposed as a result of the Contractor's operations shall be adequately supported along their entire exposed length by timber or planking, installed in such manner that the anchorage of the supporting members will not be disturbed or weakened during the backfilling operation. Backfill of selected material shall be carefully rammed and tamped under and around the supports and all supports shall be left in place as a guard against breakage of the supported structure due to trench settlement. No additional payment will be due the Contractor for material left in place nor for the labor of installing and maintaining supports.
 4. Where necessary, in order to keep one side of the street or roadway free from any obstruction or to keep the material piled alongside of the trench from falling on private property outside the right-of-way, a safe and suitable fence shall be placed alongside the trench.

5. The cost of all work related to utility protection and repair shall be included in the unit price per lineal feet of pipe installed, or in the lump sum price of the contract. No separate payment will be made for utility location or repairs.

3.02 PIPE BEDDING AND TRENCH BACKFILL

- A. Bedding: The trench shall be excavated to a depth of six (6) inches below the outside diameter of the pipe barrel, or deeper if so specified. The resultant subgrade shall be undisturbed, or compacted as approved by the Engineer if disturbed. The bedding shall then be prepared by placing a thoroughly compacted aggregate pipe bedding and initial backfill material, as specified hereinafter, in 4-inch (uncompacted thickness) layers to 12-inches above top of pipe. Bedding shall provide uniform and continuous bearing and support for the pipe at every point between bell holes.
- B. Special Bedding:
 1. Unstable Subgrade: Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable, or other organic material, or large pieces or fragments of inorganic material, which, in the opinion of the Engineer, should be removed, the Contractor shall excavate and remove such unsuitable material to the width and depth recommended by the Engineer.
 - a. Before pipe is laid, the subgrade shall be made by backfilling with aggregate material, as directed by the Engineer, in 3-inch (uncompacted thickness) layers thoroughly tamped and the bedding prepared as hereinbefore specified.
 - b. Aggregate Backfill when used at the direction of the Engineer to stabilize trench subgrade will be paid for in accordance with the unit price bid for Miscellaneous Aggregate Backfill at the trench pay-line width specified under the Schedule of Unit Prices for Quantity Adjustments, exclusive of the pipe bedding.
 - c. Additional excavation required to remove unstable material will be paid for in accordance with the applicable unit price bid for Miscellaneous Unclassified Excavation under Schedule of Unit Prices for Quantity Adjustments.
 2. Special Foundations: Where the bottom of the trench at the subgrade is found to consist of material which is unstable to such a degree that, in the opinion of the Engineer, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, the Contractor shall construct a foundation for the pipe in accordance with plans prepared by the Engineer. Compensation for such additional work shall be in accordance with the General Conditions of the Contract.
 4. Excavation in Fill: When the pipe is laid in fill, the compacted embankment shall be brought to a height of at least 9 inches above the proposed top of the pipe before the trench is excavated.
- C. Backfilling Methods:

1. General: Backfilling shall not be done in freezing weather except by permission of the Engineer, and it shall not be done with frozen material. Do not backfill when the material already in the trench is frozen.
 - a. Where aggregate backfill is not indicated on the Drawings or specified herein, and in the opinion of the Engineer should be used in any part of the work, the Contractor shall furnish and backfill with aggregate as directed.
 - b. Payment will be made in accordance with the unit price bid for Miscellaneous Aggregate Backfill.
 - c. No extra compensation will be made for aggregate backfill required for the pipe bedding, or due to excavation made beyond the limits specified, or where used as special bedding at the discretion of the Contractor.
- D. Pipe Bedding Beneath and to Centerline of Pipe: All trenches shall be backfilled, from the bottom of the trench to the centerline of the pipe with bedding material placed in layers of 4 inches (uncompacted thickness) and compacted by tamping or other approved mechanical methods. Bedding material shall be deposited in the trench for its full width on each side of the pipe and fittings simultaneously.
- E. Initial Backfill Over Pipe: From the centerline of the pipe and fittings to a depth of one (1) foot above the top of the pipe, the trench shall be backfilled by hand or by approved mechanical methods. The Contractor shall use special care in placing this portion of the backfill so as to avoid injuring or moving the pipe. The backfill shall be placed in 4-inch layers (uncompacted thickness) and compacted by tamping or other approved mechanical methods.
- F. Aggregate Backfill to Restoration Depth (Roadways, Driveways and Other Paved Areas): From one (1) foot above the top of the pipe to restoration depth, the trench shall be backfilled by hand or by approved mechanical methods. Backfill in this section of the trench shall be coarse aggregate material subject to limitations specified and consolidated by tamping in four (4) inch layers or other approved mechanical methods unless otherwise specified. Any consolidation method utilizing water such as jetting or puddling shall not be permitted. Consolidation shall proceed from the center of the trench to the sides to prevent arching.
- G. Backfill Material to Restoration Depth (Seeded Areas): From one (1) foot above the top of the pipe to restoration depth, the trench shall be backfilled by hand or by approved mechanical methods. Backfill in this section of the trench shall be excavated material subject to limitations specified and consolidated by tamping in eight (8) inch layers or other approved mechanical methods unless otherwise specified. Any consolidation method utilizing water, such as jetting or puddling shall not be permitted. Consolidation shall proceed from the center of the trench to the sides to prevent arching. No extra payment for excavated material backfill will be given the Contractor.
- H. Underground Warning Tape: For the purposes of early warning and identification of buried pipes during future trenching or other excavation, provide continuous

identification tapes in trenches. Install in accordance with printed recommendations of the tape manufacturer, and as modified herein. Bury tape at a depth of 12 inches below grade; in pavements measure 12 inches from subgrade of pavement.

1. Provide in trenches for utilities indicated in Part 2.

I. Backfilling Trenches for Electrical Work:

1. Perform trench backfilling for conduits by methods which will result in thorough compaction of backfill material without displacement of the conduit and minimum settlement of backfilled material. Settlement of backfill shall be considered evidence of improper workmanship or inclusion of unsuitable backfill materials, or both, and will require removing and recompacting settled material at no expense to the Owner.
2. Backfill conduits, not encased in concrete, to the level of planned subgrade using Excavated Backfill Material placed in layers not exceeding 6-inches in thickness after compaction.
3. Backfill concrete encased conduits using Excavated Backfill Material placed in layers not exceeding 6-inches in thickness after compaction.
 - a. In trenches under paved areas, use Aggregate Backfill of classification and methods of placement as that specified previously for piping.

J. Compacting: During the course of backfilling and compacting work, the Engineer may, at any location or depth of trench, make tests to determine whether the Contractor's compaction operations are sufficient to meet specified requirements. Compact trench backfill as follows:

1. Use mechanical tampers to compact backfill materials in trench refill operations to produce a density of backfill at the bottom of each layer of not less than 90 percent of maximum density obtained at optimum moisture content as determined by AASHTO T99. Perform field determinations of density, when requested by the Engineer, in accordance with AASHTO T191.

3.03 RESTORATION AND CLEAN-UP OF SURFACE

- A. Replacement or Restoration of Surface Items: The Contractor shall restore (unless otherwise stipulated) all sidewalks, curbs, gutters, shrubbery, fences, poles, sod or other property and surface structures removed or disturbed as a part of the work to a condition equal to that before the work began, furnishing all labor and materials incidental thereto.
- B. Clean-Up and Maintenance of Surfaces:
1. General: During construction, the surfaces of all areas including, but not limited to, roads, streets, and driveways shall be maintained on a daily basis to produce a safe, desirable, and convenient condition. Streets shall be swept and flushed after backfilling, and recleaned as dust, mud, stones and debris caused by the work, or related to the work again accumulates. Failure of the Contractor to perform this

work shall be cause for the Engineer to order the work by others, and backcharge all costs to the Contractor.

- a. All surplus materials furnished by the Contractor and temporary structures shall be removed from the site by the Contractor.
 - b. All dirt, rubbish and excess earth from the excavation shall be disposed of by the Contractor in a manner and place acceptable to all governing agencies.
 - c. The construction site shall be left clean at the end of each working day to the satisfaction of the Engineer.
2. Repair or Correction of Unsatisfactory Conditions: All unsatisfactory conditions resulting from the work shall be corrected.
- a. Any subnormal or dangerous condition caused by the work, on any surface, shall be repaired or corrected within two hours of observance or notification of its existence. If repairs or corrections are not made within this period, the Owner shall cause to have the work completed with the resulting cost subtracted from the Contractor's next monthly payment request. Any such costs shall be deemed a reduction in the total amount due the Contractor under the contract and no subsequent reimbursement shall be made to the Contractor by the Owner for these costs.

END OF SECTION

SECTION 02240

SOIL AND SELECT MATERIALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements for Soil and Select Materials specified in other Specification Sections.

1.02 RELATED SECTIONS

- A. Section 02100 – Clearing and Grubbing.
- B. Section 02200 - Earthwork.
- C. Section 02260 - Finish Grading.

1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. AASHTO M6 - Fine Aggregate for Portland Cement Concrete.
 - 2. AASHTO M43 - Standard Sizes of Coarse Aggregate for Highway Construction.
 - 3. AASHTO M283 - Coarse Aggregate for Highway and Airport Construction.
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D2487 - Classification of Soils for Engineering Purposes.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. Topsoil From On-Site Excavations
 - 1. Free of roots, rocks larger than one inch, subsoil, debris, and weeds.
 - 2. Ash or soil containing ash will not be accepted for use as topsoil.

- B. Imported Topsoil - If Topsoil from on-site excavations is not sufficient to cover all areas requiring Topsoil, provide imported material meeting the following requirements at no additional cost to the Owner:
 1. Friable loam.
 2. Free of subsoil, roots, grass, weeds, stone, and foreign matter.
 3. Acidity range (pH): 5.5 to 7.5.
 4. Organic Matter: Minimum of four percent, maximum of 25 percent.
- C. Suitable Subsoil From On-Site Excavations (for use as Common Fill)
 1. Excavated material which is free of lumps larger than six inches, rocks larger than three inches, debris, and ash.
 2. Classified as CL, ML, SC, SM, SP, SW, GC, GM, GP, or GW in accordance with ASTM D2487.
- D. Imported Common Fill: If Suitable Subsoil from on-site excavations is not sufficient to satisfy the total requirement for Common Fill on the Project, provide imported Common Fill material meeting the specifications for Suitable Subsoil in 2.01C above.
- E. Unsuitable Soil from On-Site Excavations
 1. Material which does not meet the requirements for Topsoil or Suitable Subsoil as specified in 2.01A and 2.01C above.
 2. Ash or any soil containing ash will be classified as Unsuitable Soil.
 3. Soil contaminated by petroleum products will be classified as Unsuitable Subsoil.
 4. Remove Unsuitable Soil materials from the Project site. Unsuitable Soils shall be removed from the Project site and disposed of at no additional cost to the Owner.
- F. Cost of Imported Soil Materials: If imported soils are required, obtain, haul, stockpile, and place such imported materials at no additional cost to the Owner.

2.02 SELECT MATERIALS

- A. Coarse Aggregates
 1. Type A (coarse stone)
 - a. Angular, crushed, washed, natural stone.
 - b. Free of shale, clay, friable material, and debris.
 - c. Graded in accordance with ASTM C136 within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
2½"	100
2"	90 - 100
1½"	35 - 70
1"	0 - 15
½"	0 - 5

- d. Meet grading requirements of AASHTO M43, Size No. 3.
- e. Meet quality requirements of AASHTO M283, Class A, unless otherwise specified or shown on the Drawings.

2. Type B (medium coarse stone)

- a. Angular, crushed, washed, natural stone.
- b. Free of shale, clay, friable material, and debris.
- c. Graded in accordance with ASTM C136 within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
1½"	100
1"	95 - 100
½"	25 - 60
#4	0 - 10
#8	0 - 5

- d. Meet grading requirements of AASHTO M43, Size No. 57.
- e. Meet quality requirements of AASHTO M283, Class A, unless otherwise specified or shown on the Drawings.

3. Type C (pea gravel)

- a. Angular, crushed, washed, natural stone.
- b. Free of shale, clay, friable material, and debris.
- c. Graded in accordance with ASTM C136 within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
¾"	100
1/2"	90 - 100
3/8"	40 - 70
#4	0 - 15
#8	0 - 5

- d. Meet grading requirements of AASHTO M43, Size No. 7.
- e. Meet quality requirements of AASHTO M283, Class A, unless otherwise specified or shown on the Drawings.

B. Compactable Aggregates (coarse aggregate with fines)

1. Type D

- a. Graded in accordance with ASTM C136 within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
2"	100
¾"	52 - 100
3/8"	36 - 70
#4	24 - 50
#16	10 - 30
#200	0 - 10

C. Sand

1. Type F (high quality, free draining sand)

- a. Graded in accordance with ASTM C136 within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8"	100
#4	95 - 100
#16	45 - 80
#50	10 - 30
#100	2 - 10
#200	0 - 3

- b. Meet the grading requirements of AASHTO M6, except as otherwise specified.
- c. Meet the quality requirements of AASHTO M6.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Place and compact Soil and Select Materials in accordance with the requirements given in "Related Sections" and the Drawings.

END OF SECTION

SECTION 02260
FINISH GRADING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Soil and Seed Materials.

1.02 RELATED SECTIONS

- A. Earthwork: Section 02200.
- B. Soil and Select Materials: Section 02240.

1.03 QUALITY ASSURANCE

- A. Source Quality Control:
 - 1. Packaged Products shall indicate the manufacturer's guaranteed analysis on each package and arrive on site as originally packaged and unopened.

1.04 REFERENCES

- A. American Society for Testing and Materials, ASTM C 602 Agricultural Liming Materials, Spec. for.

1.05 SUBMITTALS

- A. Soil Supplement Product Certification: Submit certificates certifying such products to have a guaranteed analysis in conformity with the Engineer approved laboratory soil supplement recommendations report.
- B. Seed Certification: Submit certificates or certifying tags indicating lawn seed mixture, seed purity percentage, seed germination percentage and weed seed content percentage to certify conformity with the Specifications.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver packaged products to the site in unopened containers with labels intact and legible.

- B. Store packaged products in such a manner to prevent moisture damage and other forms of contamination.

1.07 SITE CONDITIONS

- A. Environmental Requirements: Do not perform Work of this Section when soil or weather conditions are unsuitable. Unsuitable conditions include moisture saturated or frozen in place soil and precipitation of any kind present or occurring during the Work.
- B. Seeding Dates: The following dates shall govern except when environmental conditions warrant, the Engineer may extend the seeding dates.
 - 1. Spring: March 1 to June 1.
 - 2. Fall: August 1 to October 1.
- C. Existing Conditions: Following performance of related construction and prior to finish grading, do such debris removal and site leveling as necessary in preparation for Finish Grading. Dispose of such debris legally off site.
- D. Dust Control: Exercise the necessary means and methods to control dust on the site as well as in the off site work areas where Topsoiling and Finish Grading are required.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Topsoil: Use fertile, friable, natural, productive surface soil such as is available on site (if any). Use topsoil free of subsoil, clay, stones or similar hard objects larger than 2 inches in greatest dimension and partially disintegrated debris and materials toxic or harmful to growth.
- B. Borrow Topsoil: Use productive topsoils from Contractor's source and of a quality meeting the requirements specified above for Topsoil. Provide borrow topsoil only if quantity of stripped and stockpiled, or other acceptable on-site topsoil is not sufficient.
- C. Gravel and polyethylene Sheeting: Crushed aggregate or river gravel of one uniform color throughout and sized from 90 to 100% of the material passing a one inch sieve, 100% passing the 1-1/2 inch sieve, 25 to 60% passing the 1/2 inch sieve and 0 to 10% passing the #4 sieve. Spread gravel on black polyethylene film of at least 10 mils thickness.

2.02 SOIL SUPPLEMENT MATERIALS

- A. Agricultural Liming Materials: Products containing calcium and magnesium compounds capable of neutralizing soil acidity and containing not less than 80% of total carbonates. Use liming materials meeting requirements of ASTM Designation C602 and conforming to applicable state liming material regulations.
- B. Fertilizer: Commercial fertilizer of uniform composition, free-flowing and in conformity with applicable state fertilizer laws.
 - 1. Analysis: As recommended by a local AAN member nursery.

2.03 LAWN AND SEED MATERIALS

- A. Grass Seed: New crop seed, furnished in sealed packages with proof of correct mixture evidenced, age of seed indicated and compliance with applicable state regulations evidenced if required. Seeds and mixture as follows:

<u>Species in Mix</u>	<u>Mix % by Weight</u>	<u>Min % Purity/Germination</u>		<u>Max % Weed Seed</u>
Kentucky 31, Tall Fescue	40	90	90	0.50
Kentucky Bluegrass	40	85	80	0.40
Perennial Ryegrass	20	90	90	0.50

- B. Lawn Mulch: Straw Stalks of any threshed grain or tall hay grass stalks free from seed bearing stalks or roots harmful to lawn growth. Mulch material containing noxious weeds, decomposed material or brittle weed material is not acceptable.
- C. Mulch Binder: Emulsified asphalt conforming to the requirements of AASHTO M 140, Grade RS-1 and which does not contain solvents or other diluting agents toxic to plant life.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Perform site grading as specified in Section 02210.

3.02 PERFORMANCE

- A. Placement: Place topsoil over areas indicated for new grading contours. However,

before topsoil placement, construction work in topsoiled areas shall have been completed. Observe precautions as follows:

1. Do not place topsoil over areas indicated to receive paving or walkways.
2. Do not work topsoil while frozen or wet. Do not work topsoil in a dusting condition but moisten same to prevent a dust nuisance.
3. Scarify subsoil to a depth of 2 inches for bonding topsoil with subsoil.
4. On sloped areas, work topsoil into subsoil to blend so as to eliminate any semblance of slip-planing between the two soils; but leave a sufficient cover of topsoil to insure seed germination. Perform such blending of soils by ridging or serrating the subsoil on the slopes.
5. Place topsoil as needed for dressing-up minor depressions due to settling and erosion and to eliminate any other minor irregularities.

- B. Finished Elevations And Lines: Grade topsoiled areas of the site to within a tolerance of plus or minus one-tenth of a foot of the elevations and lines indicated and in accordance with the following:
1. Grade a uniform longitudinal fall in swales and other surface drainage areas to provide a drainage flow line that can easily be maintained and traversed with normal lawn maintenance equipment.
 2. Establish finish grade of topsoil 1/2 to 3/4 inch below top of abutting walks or paving to provide positive drainage of same.
 3. Do not finish grade topsoil to a depth less than 6 inches nor greater than 12 inches.
 4. Leave finish grade surfaces free of objectionable material larger than 2 inches in greatest dimension. Dispose of such objectionable material in a legal disposal area off site.
- C. Compaction: Compact finish grades as the final operation using a light roller weighing not over 120 pounds per foot-width of roller.
- D. Tillage: Till finish graded soil over areas indicated for lawn regardless of type of lawn work performed. Use equipment and methods common to such work, and till soil to a two inch depth minimum.
- E. Soil Supplement Addition: The soil supplements for lawn areas, as required according to the Engineer approved laboratory test reports, may be incorporated into the soil during tillage operations.
- F. Seeding: Sow seed mixtures when air current is low and not more than five days after soil supplements have been applied. Sow seeds in two applications using either mechanical power seeders or mechanical hand seeders. Sow one-half of the seed mixture in one direction over designated areas and the remainder at right angles to the first sowing. Seeding rates as follows:
1. Grass Seed Mixture: 5 pounds per 1,000 sq. ft. areas.

- G. Seed Cover: Imbed seed mixtures into topsoil 1/4 inch using a light drag or rake and moving in directions parallel to the contour lines. Immediately after dragging or raking, compact seeded areas using a cultipacker or similar design lawn roller, weighing 60 to 90 pounds per linear foot of roller, and roll at right angles to existing slopes.
- H. Contractor Option: Seeding and soil supplement application may be performed by the hydroseeding method. However, rates of application, methods and equipment shall receive Engineer's prior approval.
- I. Lawn Mulching: Evenly apply mulch over seeded areas not more than 48 hours after seeding. Start mulching at windward side of relatively flat areas, or at the upper part of slopes. Spread mulch in a total coverage at a depth not less than 1-1/2 inches nor more than 3 inches.

3.03 MAINTENANCE

- A. Maintenance operations shall begin immediately after seeding and shall continue throughout the construction time and one year guarantee period. In general, maintenance shall include weeding, controlling insects and diseases and performing other particular operations as follows:
 - 1. Keep seed moist continually for proper germination and water thereafter as necessary to prevent drying out or burning. Reseed areas not showing a prompt catch of grass, correct depressions and irregularities and reseed; repeat until a complete coverage is obtained.
 - 2. Cutting of seeded areas at required intervals to maintain grass at a maximum height of 2-1/2 inches will be performed by the Owner.
- B. At conclusion of maintenance period, the Engineer shall make an inspection of the lawn work to determine condition of acceptance. Make such additional repairs as required by the Engineer. Perform such work at no expense to the Owner.

END OF SECTION

SECTION 02444

CHAIN LINK FENCE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Fence Fabric and Fence Supports.
- B. Sliding Gates.

1.02 RELATED SECTIONS

- A. Division 3 - Concrete.

1.03 QUALITY ASSURANCE

- A. Fabricator Qualifications: Continuing member of the Chain Link Fence Manufacturer Institute (CLFMI).
- B. Erector Qualifications: Provide at least one person in a supervisory capacity who is skilled and experienced in erecting chain link fence and who readily understands the proposed layout and is completely familiar with current erection practices of the CLFMI. Said person shall be present at all times during progress of the fence installation.
- C. Product Compatibility: Provide chain link fence components products of one manufacturer.

1.04 REFERENCES

- A. American Society For Testing and Materials:
 - 1. ASTM A 123; Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip.
 - 2. ASTM A 392; Zinc-Coated Steel Chain-Link Fence Fabric.

1.05 SUBMITTALS

- A. Shop Drawings and Product Data: Manufacturer's published details modified to suit design and field conditions. Manufacturer's descriptive literature and specifications covering the products specified. Descriptive literature shall include installation information.
- B. Certificates: Include in Submittals certified mill certificates indicating material conformity to yield strengths of these Specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Galvanizing: Ferrous metal elements of the fence shall receive zinc coating by the hot dip process after fabrication. Metal coated to 1.8 oz. of zinc coating per square foot of surface, in a smooth finish, free from dross, uncoated spots and foreign materials, ASTM A123.
- B. Vinyl Coated Fabric: Fed. Spec. RR-F-191/1C, Type V, thermally bonded PVC coated over galvanized steel No. 9 gauge wire having a .007 inch coating thickness and having a minimum breaking load of 1200 lbs. per Table III of RR-F-191/1C. Wires galvanized prior to vinyl coating, in accordance with ASTM A641. Color of PVC coating-**Black**. Fabric interwoven in a two-inch mesh with top and bottom selvage edges both twisted and barbed. Cut ends of wires coated with vinyl at the factory during the weaving process.
- C. Vinyl Coated Barbed Wire: Three lines of thermally bonded PVC coated steel barbed wire consisting of two 12½ gauge stranded line wires, with 14 gauge aluminum barbs in a four point pattern on three-inch centers. Line wires galvanized prior to vinyl coating in accordance with ASTM A641.
- D. Vinyl Coated Tension Wire: Six gauge coil spring wire PVC coated of same quality and process as specified for Fabric.
- E. Frame Work: Roll-formed shapes or tubular members with zinc hot-galvanized coating per ASTM A 123, and comprised of the following components:

1. Line Posts: Nominal two inch roll formed shapes or tubular members fabricated from 50,000 psi minimum yield strength steel and weighing 2.34 lbs. per ft.
 2. End, Pull and Corner Posts: Nominal three inch roll formed shapes or tubular members fabricated from 42,000 psi minimum yield strength steel and weighing 5.10-lbs. per ft.
 3. Gate, Latch, and Overhang Posts: Nominal four inch steel pipe or tubular members fabricated from 30,000 psi minimum yield strength steel and weighing 9.10 lbs. per ft.
 4. Post Braces: Nominal 1-1/4 inch steel pipe weighing 2.27 lbs. per ft. minimum, with 3/8 inch diameter truss rod and adjustable take-up device. Provide two brace assemblies at each corner post and one brace assembly at each end and gate post.
 5. Top Rail: Nominal 1-1/4 inch steel pipe weighing 2.27 lbs. per ft. Minimum. (Not required unless shown on Drawings.)
 6. Post Tops: Where barbed wire supporting arms are not required cover post ends with pressed steel or malleable iron, weather tight caps designed to permit passage of top rail, if any.
 7. Stretcher Bars: One piece 3/16 x 3/4 inch bar of length equal to full height of fabric. Provide one bar for each gate and end post and two for each corner and pull post. Provide 1/2 inch wide stretcher bar bands spaced not over 15 inches O.C. to secure stretcher bars to posts.
- F. Gate Frame, Cantilever Slide Type: Nominal two-inch tubular horizontal and vertical members and truss members (if required) assembled by welding. Provide the same fabric as fence and install with stretcher bars and bar ties at 15 inches O.C. Provide diagonal cross bracing of 3/8-inch diameter adjustable length truss rods. Attach gate hardware with rivets or by other means which will provide security against removal.
1. Galvanized steel frame.
 2. Aluminum frame.
 3. Top supported, enclosed roller track.
 4. Latch: Plunger-bar type to permit operation either side of gate. Provide padlock eye as integral part of latch.
 5. Hangers, latches, brackets, guide assemblies and stops are to be galvanized malleable iron or steel.
- G. Acceptable Manufacturers:
1. Anchor Fence, Inc.
 2. CYCLONE Fence.
 3. Allied Fence Products.
 4. Or Equal.

- H. Padlocks: Provide padlocks conforming to requirements of Fed. Spec. FF-P-106; all gate padlocks keyed alike and master keyed. Provide two keys per padlock.
- I. Concrete: As specified in Section 03300.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Distorted, deformed or damaged fencing resulting from storage will not be permitted for use.

3.02 INSTALLATION

- A. Do not begin fence installation prior to completion of all forms of Site Grading.
- B. Drill or dig holes for post footings in firm, undisturbed or compacted soil. Holes shall have a diameter equal to three times the diameter of the post. Excavate hole depths approximately three inches deeper than Post bottom, with bottom of posts set not less than 36 inches in concrete base. Space posts a maximum of ten feet on center.
- C. Place concrete around posts in a continuous pour. Tamp concrete for consolidation. Check each post for vertical and top alignment. Crown top of post footings to shed water.
- D. Set keepers, stops, sleeves and other accessories into concrete as required.
- E. Install braces so posts are plumb when diagonal rods are under proper tension.
- F. Install tension wires before stretching fabric and tie to each post with ties or clips.
- G. Pull fabric taut and tie to posts, rails and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tensions after pulling force is released.
- H. Thread stretcher bars through fabric. and secure to posts with metal bands spaced not over 15 inches O.C.

- I. Install gates plumb, level and secure for full opening without interference. Install ground-set items in concrete for anchorage, as recommended by the fence manufacturer and as detailed. Adjust hardware for smooth operation and lubricate where necessary.

END OF SECTION

SECTION 02480

LANDSCAPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Trees.
- B. Soil Supplement Materials.
- C. Mulching Materials.
- D. Protective Materials.
- E. Performance and Maintenance of Landscape Work.

1.02 RELATED SECTIONS

- A. Finish Grading: Section 02260.

1.03 QUALITY ASSURANCE

- A. Work shall be performed by a single firm specializing in landscape work.
- B. Source Quality Control:
 - 1. Packaged Products shall indicate the manufacturer's guaranteed analysis on each package and arrive on-site as originally packaged and unopened.
 - 2. For freshly dug plants, use nursery grown stock acclimated to the soil and climatic conditions in the local area of intended planting.
 - 3. Use plants grown under good nursery practices for a period of two full growing seasons in a State certified nursery.

1.04 REFERENCES

- A. American Association of Nurserymen, AAN American Standard for Nursery Stock.
- B. American National Standards Institute, ANSI Z60.1 Standard for Nursery Stock.

- C. American Society for Testing and Materials, ASTM C602, Agricultural Liming Materials.
- D. Standardized Plant Names, Second Edition, American Joint Committee on Horticultural Nomenclature.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver packaged products to the site in unopened containers with labels intact and legible.
- B. Deliver plant materials to the site in a protected condition to prevent wind damage and drying. Plant material exhibiting a heated or sweated condition due to tight packing or poor ventilation is subject to rejection.
- C. Deliver plants with a securely attached waterproof tag legibly indicating the name and size in accordance with the AAN standards of practice. Provide at least one tagged plant in each bundle or lot. In all cases, botanical names shall take precedence over common names.
- D. Store packaged products in such a manner to prevent moisture damage and other forms of contamination.
- E. Store balled or wrapped and potted plants in accordance with the AAN practices to prevent drying out. Store bare rooted plants by the heeling-in-method immediately after delivery, or permanently plant such bare rooted plant, immediately after delivery.
- F. Prepare dug plants for handling and shipment with balled and burlapped (B&B) root systems. Perform B&B work in accordance with AAN Standards and in accordance with ANSI Z60.1 concerning diameter and depths of balls on B&B plants. B&B plants arriving at the site with broken, loose or fractured balls are subject to rejection.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements: Do not perform Work of this Section when soil or weather conditions are unsuitable. Unsuitable conditions include moisture saturated or frozen in place soil and precipitation of any kind present or occurring during the Work.
- B. Seeding Dates: The following dates shall govern except when environmental conditions warrant, the Engineer may extend the seeding dates.
 - 1. Spring: March 1 to June 1.
 - 2. Fall: August 1 to October 1.

- C. Plant Setting Dates: The following dates shall govern except when environmental conditions warrant, the Engineer may extend the plant setting dates.
 - 1. Deciduous Trees (and Shrubs): October 15 to May 15.
 - 2. Evergreen Trees (and Crownvetch): Spring - March 1 to May 15; Fall - August 1 to September 15
 - 3. Seedlings and Seedling Transplants: March 1 to May 15.
- D. Protection:
 - 1. Protect seeded areas from washouts by one of the methods specified in this Section. Should washouts and bare spots develop resulting from inadequate protection or otherwise, perform such reseedling as required until a healthy, complete coverage stand of grass is obtained.
 - 2. Use temporary barricades to protect lawn areas from foot traffic or other uses until a healthy, total coverage stand of grass is obtained. Barricade materials subject to Engineer's approval.
 - 3. After plant setting work, install stake and guy supports on those plants indicated as being staked to prevent uprooting by wind or otherwise. Do not locate stakes and guy supports where pedestrian safety would be endangered.

1.07 WARRANTY

- A. Warranty trees and shrubs, for a period of one year after date of contract completion, against defects including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond Contractor's control.
- B. Remove and replace trees, shrubs, or other plants found to be dead or in unhealthy condition during warranty period. Make replacements during growth season following end of warranty period. Replace trees and shrubs which are in doubtful condition at end of warranty period.

PART 2 - PRODUCTS

2.01 SOIL SUPPLEMENT MATERIALS

- A. Agricultural Liming Materials: Products containing calcium and magnesium compounds capable of neutralizing soil acidity and containing not less than 80 percent of total carbonates. Use liming material meeting requirements of ASTM Designation C602 and conforming to applicable state liming material regulations.
- B. Fertilizer: Commercial fertilizer of uniform composition. free-flowing and in conformity with applicable state fertilizer laws.

1. Analysis: As recommended by a local AAN member nursery.
- C. Bone Meal: Horticultural grade, pulverized bone meal containing minimums of 4 percent nitrogen and 8 percent phosphoric acid.
- D. Peat: Commercially available material consisting of shredded sedge peat and reed peat or sphagnum moss peat, or combinations of such, from fresh water sites. Peats in advanced stages of decay (parent material not identifiable) not permitted. Use peat having a minimum organic content of 80 percent organic matter by weight, a pH value of 4.5 to 6.0 and a maximum ash content of 15 percent.

2.02 LAWN AND SEED MATERIALS

- A. Grass Seed: New crop seed, furnished in sealed packages with proof of correct mixture evidenced, age of seed indicated and compliance with applicable state regulations evidenced if required. Seeds and mixture as follows:
 1. Mixture:

<u>Species in Mix</u>	<u>Mix Percent by Weight</u>	<u>Min. Percent Purity/Germination</u>		<u>Max. Percent Weed Seed</u>
Kentucky 31, Tall Fescue	31	90	90	0.50
Kentucky Bluegrass	60	85	80	0.40
Perennial Ryegrass	20	90	90	0.50

2.03 PLANT MATERIAL

- A. Plant Stock: Provide plants of species indicated on the Drawings and true to type and name in accordance with the current edition of Standardized Plant Names, American Joint Committee of Horticulture Nomenclatures. Provide healthy plants free from insect infestations, typical of the species or variety, and which conform to the current edition of American Standard for Nursery Stock of the AAN for grading requirements; and ANSI Z60.1 for plant quality and minimum root spread.
- B. Minimum Acceptable Plant Sizes: Measure plants before pruning with branches in normal position; plant size shall conform to measurements indicated on the Drawings. Plants larger in size than indicated may be used, but at no change in Contract Price. If larger plants are used, proportionately increase the root ball or spread of roots in accordance with AAN rules.

- C. Container Grown Plants: Provisions of ANSI Z60.1 shall also govern container grown plants. Provide container grown plants of at least one year but not more than two years growth in the same container.

2.04 MULCHING MATERIAL

- A. Lawn Mulch: Straw Stalks of any threshed grain or tall hay grass stalks free from seed bearing stalks or roots harmful to lawn growth. Mulch material containing noxious weeds, decomposed material or brittle weed material is not acceptable.
- B. Plant Mulch: Tanbark, a by-product of the tanning process, or Hardwood and Pine Bark consisting of ground or shredded bark, a fibrous material free from foreign material and substances toxic to plant growth.
- C. Mulch Binder: Emulsified asphalt conforming to the requirements of AASHTO M140, Grade RS-1 and which does not contain solvents or other diluting agents toxic to plant life.

2.05 PROTECTIVE MATERIALS

- A. Guard Posts: Schedule 20 black steel pipe conforming to ASTM A53 and concrete filled with Class B concrete conforming to the requirements as specified in Section 03300.
- B. Stakes and Wires: Rough-sawn straight-grained hardwood stakes, free of serious defect and of dimensions indicated on the Drawings. Use wires no smaller than No. 12 gauge galvanized steel with fabric reinforced rubber hose not less than 5/8-inch nor more than one inch O.D. of sufficient length to protect trees from damage by wire.
- C. Tree Wrap: Krinkle-kraft waterproof paper 30-30-30 in four inch widths minimum. Use lightly tarred medium or coarse sisal yarn twine to tie tree wrap.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Tillage: Perform tillage of finish graded soil over areas indicated for lawn regardless of type of lawn work performed. Use equipment and methods common to such work, and till soil to a two inch depth minimum.

- B. Soil Supplement Addition: The soil supplements for lawn areas, as required according to the Engineer approved laboratory test reports, may be incorporated into the soil during tillage operations.
 - 1. Perform tilling operations in accordance with Section 02260.
- C. Plant Pits: Prepare planting beds, plant trenches and plant pits to the depths required below finished grade according to the recommended practices of the AAN. However, the following minimum plant pit dimensions shall take precedence over the AAN if in conflict.
 - 1. Excavate plant pits with vertical sides and flat bottoms.
 - 2. Excavate plant pits large enough to allow a minimum of 12 inches beyond the circumference of the root system or ball and six to eight inches beneath the root system or ball.
 - 3. Excavate pits and trenches for bare root shrubs, vines or seedlings large enough to accommodate the root without crowding and to allow space for six inches minimum of backfill mix around the root system.
- D. Plant Beds: Prepare plant beds for ground cover by incorporating peat and the required soil supplements into the top 6 inches of existing topsoil. Incorporate peat into the topsoil in quantity equal to three inches of peat spread uniformly over the plant bed.
- E. Backfill Mix For Plant Pits: Prepare a mix consisting of one part peat to three parts excavated topsoil by volume and one pound of bone meal added for each cubic yard of excavated topsoil.

3.02 PERFORMANCE

- A. Seeding: Sow seed mixtures when air current is low and not more than five days after soil supplements have been applied. Sow seeds in two applications using either mechanical power seeders or mechanical hand seeders. Sow one-half of the seed mixtures in one direction over designated areas and the remainder at right angles to the first sowing. Seeding rates as follows:
 - 1. Grass Seed Mixture: 5 pounds per 1,000 sq. ft. areas.
- B. Seed Cover: Imbed seed mixtures into topsoil 1/4-inch using a light drag or rake and moving in directions parallel to the contour lines. Immediately after dragging or raking, compact seeded areas using a cultipacker or similar design lawn roller, weighing 60 to 90 pounds per linear foot of roller, and roll at right angles to existing slopes.
- C. Contractor Option: Seeding and soil supplement application may be performed by the hydroseeding method. However, rates of application, methods and equipment shall receive Engineer's prior approval.

- D. Lawn Mulching: Evenly apply mulch over seeded areas not more than 48 hours after seeding. Start mulching at windward side of relatively flat areas, or at the upper part of slopes. Spread mulch in a total coverage at a depth not less than 1½ inches nor more than three inches.
- E. Mulch Binding: Immediately following mulch spreading, apply mulch binder to anchor mulch to the soil. The number of passes over the mulch as needed to secure it firmly shall not exceed three passes with maximum applied binder not exceeding ten gallons per 1,000 square feet.
- F. Plant Setting Operations: Set plants to ensure that after settlement the plant stem projects from the soil as much as before transplanting. Set plants plumb and straight with allowance for settlement and in accordance with following:
 - 1. Ground Cover Plants: Set each plant in a slight depression for catching rainwater and top-off such depressions with two inches of mulch spread uniformly and compacted. Thoroughly water groundcover bed immediately following planting.
 - 2. Balled & Potted Plants: Set each plant in prepared circular pits deep enough to accommodate a bed of topsoil not less than six inches deep under the ball or pot of shrubs and 12 inches under the ball of trees. Remove burlap from the top third of root balls, and completely remove ropes, twine and wires from root balls. Completely remove containers from potted plants, however, the earth shall remain unbroken around roots. Place Backfill Mix in plant pits under and around root balls in six inch layers and tamp to eliminate voids. At the half-way point in backfilling, flood pit with water and continue backfilling after water dissipates. Backfill pits to grade, and build up a ring of soil three inches deep over edge of plant pit to facilitate maintenance watering. Place a two inch layer of plant mulch within the ring prior to watering.
 - 3. Bare Root Plants: Set plants with root system properly spread out and work Backfill Mix among the roots. Cut off clean any broken or frayed roots. Backfill in six inch layers to grade using water to settle each layer. Form a ring of soil three inches deep over edge of plant pit to facilitate maintenance watering. Place a two inch layer of plant mulch within the ring prior to watering.

3.03 MAINTENANCE

- A-. Maintenance operations shall begin immediately after seeding and planting is performed and shall continue throughout the construction period. In general, maintenance shall include weeding, applying mulch as needed, controlling insects and diseases and performing other particular operations as follows:
 - 1. Seeded Areas: Keep seed moist continually for proper germination and water thereafter as necessary to prevent drying out or burning. Reseed areas not showing a prompt catch of grass, correct depressions and irregularities and reseed; repeat

- until a complete coverage is obtained. Cut seeded areas at required intervals to maintain grass at a maximum height of $2\frac{1}{3}$ inches.
2. Sod: Perform daily watering if necessary for the establishment of the sod; water thereafter at frequencies required to maintain growth. Cut sod at required intervals to maintain a maximum height of $2\frac{1}{2}$ inches.
 3. Plants: Water the plant root systems at regular intervals and keep surrounding soil in condition for promotion of root growth. Maintain and adjust stake wires if necessary and rewrap tree trunks when necessary. Perform pruning, other than initial pruning, as necessary to remove dead leaders and branches. Replace plants that are dead, unhealthy or in a badly damaged condition with like species plants. Do not make replacements during seasons definitely unfavorable for planting.
- B. At conclusion of construction period, the Engineer shall make an inspection of the landscaping work to determine condition of acceptance. Make such additional repairs and replacements as required by the Engineer. Perform such work at no expense to the Owner.

END OF SECTION

SECTION 02500

PAVING AND SURFACING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Hot Mix Asphalt Paving.

1.02 RELATED SECTIONS

- A. Site Grading: Section 02210.
- B. Soil and Select Materials: Section 02260.

1.03 QUALITY ASSURANCE

- A. Source Quality Control:
 - 1. Use materials conforming to requirements of the Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, July, 2008.
 - 2. Use products of a bituminous concrete producer regularly engaged in production of bituminous concrete conforming to the standards referenced herein.
 - 3. Maintain quality of work by using products of a qualified bituminous concrete producer and qualified plant operating workmen.

1.04 REFERENCES

- A. The MDT sections noted herein refer to sections contained in the Maryland Department of Transportation State Highway Administration Specifications for Construction and Materials. The references pertain only to materials, construction, equipment, methods and labor.
- B. Maryland Standard Method of Tests.
- C. American Society for Testing and Materials:
 - 1. ASTM D 1557, Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10 lb. (4.5 Kg) Rammer and 18-inch (457 mm) Drop, Test Methods for.
 - 2. ASTM D 2167, Density of Soil in Place by the Rubber-Balloon Method, Test Method for.

- D. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180, Moisture-Density Relations of Soils Using a 10 lb. Rammer and an 18-inch Drop.

1.05 SUBMITTALS

- A. Certificates: Furnish certification from bituminous and aggregate producer attesting that materials conform to requirements of Maryland Department of Transportation State Highway Administration Specifications.

1.06 PROJECT CONDITIONS

- A. Protection:
 - 1. Protect paved surfaces outside of the limits of work. Repair pavement outside limits damaged by constructing operations at no additional expense to the Owner.
 - 2. The Contractor shall be liable for damages to municipal roads caused by his equipment. The repairs may include lane or full roadway width overlays as directed by the Owner. No additional payment will be made for repairs to municipal roads damaged by the Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Coarse Aggregate Base Course:
 - 1. Graded Aggregate Base material per MDT Specifications.
- B. Bituminous Materials and Pavements:
 - 1. Bituminous Tack Coat: MDT Section 904.04.
 - 2. Surface Course: Hot mixed, hot laid, Bituminous Surface Course, conforming to MDT Section 904.06.
 - 3. Base Course: Hot mixed, hot laid, Bituminous Base conforming to MDT Section 904.06 and as shown on plans.
- C. Superpave
 - 1. All materials shall meet MDT specifications.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Subsurface Preparation: Perform site grading, roadway grading and finish rolling just prior to subbase installation.
- B. At joints between existing pavements and new paving work, the edges of existing pavements shall be cut and neatly trimmed. An application of Class AC-20 petroleum asphalt shall be provided at all locations where new bituminous paving joins existing bituminous paving.

3.02 INSTALLATION

- A. Subbase Construction: Install coarse aggregate base course in accordance with MDT. Install base course to after-compaction thickness indicated on Drawings.
- B. Hot Mix Asphalt Pavement Construction: Method of preparing mixture, placing mixture, compaction, and protection of in-place asphalt for paving shall comply with MDT Section 504. Minimum thickness of bituminous concrete base and surface courses as indicated on the drawings.
 - 1. Use Bituminous Tack Coat material to seal joints in wearing courses as specified in MDT Section 504.03.07.
 - 2. Dust Control: Provide effective dust control by sprinkling water, by the use of calcium chloride or by any other methods approved by the Engineer. Use dust control measures where, when and in a manner required by the Engineer.

3.03 CLEAN-UP AND MAINTENANCE

- A. During construction, surfaces of all areas including, but not limited to, roads, streets, and driveways shall be maintained on a daily basis to produce a safe, desirable, and convenient condition.
 - 1. Surfaces shall be swept and flushed after backfilling, and recleaned as dust, mud, stones and debris caused by the work, or related to the work again accumulates.
 - 2. Failure of the Contractor to perform this work shall be cause for the Engineer to order the work to be done by others, and backcharge all costs to the Contractor.
- B. Repair or Correction of Unsatisfactory Conditions: All unsatisfactory conditions resulting from the work shall be corrected.

- C. Continuously maintain temporary pavement without additional compensation until it is replaced with permanent pavement.
- D. Any subnormal or dangerous condition caused by the work, on any surface, shall be repaired or corrected within two hours of observance or notification of its existence. If repairs or corrections are not made within this period, the Owner shall cause to have the work completed with the resulting cost subtracted from the Contractor's next monthly payment request. Any such costs shall be deemed a reduction in the total amount due the Contractor under the contract and no subsequent reimbursement shall be made to the Contractor by the Owner for these costs.

END OF SECTION

SECTION 02510

MILLING EXISTING HOT MIX ASPHALT PAVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Removing existing Hot Mix Asphalt Paving by means of milling.

1.02 RELATED SECTIONS

- A. Pavement: Section 02500.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.01 CONSTRUCTION

- A. This item consists of milling the existing pavement as shown on the Plans to a depth of 2 inches. All work shall be in accordance with the State Highway Administration, Standard Specifications for Construction and Materials, July, 2008, except as modified herein.
- B. The Contractor shall furnish all labor, material and equipment to perform the milling of existing bituminous concrete pavement at locations shown on the drawings.
- C. The equipment for removing the bituminous surface shall be a power operated planing machine or grinder. The equipment shall be capable of accurately establishing profile grade elevation. The equipment shall also have an effective means for preventing any dust resulting from the operation from escaping into the air. The surface texture shall provide a smooth skid resistant finish with a tolerance of one-eighth inch (1/8") using a ten foot (10') straight edge. The equipment must observe the weight limit of the bridges.
- D. A street sweeper, vacuum equipped, capable of removing all loose material without causing dust to escape into the air, shall follow immediately behind the milling operation.

- E. In addition, all unstable utility patches or other areas created by the milling operation shall be cleaned, prepared, and filled with bituminous concrete. This work shall be completed by the Contractor at the unit price bid for bituminous asphalt.
- F. The "millings" removed during this operation shall become the property of the Contractor and removed from the site.

END OF SECTION

SECTION 02601

MANHOLES, WET WELL AND VALVE VAULT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Precast Concrete Components.

1.02 RELATED SECTIONS

- A. Earthwork: Section 02200.
- B. Division 3 - Concrete.

1.03 QUALITY ASSURANCE

- A. Shop Inspection:
 - 1. All materials furnished by the Contractor shall be certified by the supplier for compliance with the pertinent specifications. Shop inspections and testing may be required. The cost of shop testing shall be borne by the supplier or the Contractor.
- B. Field Inspection:
 - 1. All materials shall be furnished and installed and tested for defects in material and/or workmanship in the manner specified and in the presence of and as approved by the Engineer.
- C. Source Quality Control:
 - 1. Maintain uniform quality of products and component compatibility by using the products of one manufacturer in the case of precast reinforced concrete manholes.
 - 2. Obtain certificate of construction compliance with ASTM C478 from the precast reinforced concrete manhole manufacturer. Submit same certificate as part of required submittals.

1.04 REFERENCES

- A. American Society for Testing and Materials.
 - 1. ASTM A 276, Stainless and Heat-Resisting Steel Bars and Shapes, Spec. for.
 - 2. ASTM A 307, Carbon Steel Externally Threaded Standard Fasteners, Spec. for.

3. ASTM C 139, Concrete Masonry Units for Construction of Catch Basins and Manholes, Spec. for.
4. ASTM C 270, Mortar for Unit Masonry, Spec. for.
5. ASTM C 361, Reinforced Concrete Low-Head Pressure Pipe, Spec. for.
6. ASTM C 443, Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets, Spec. for.
7. ASTM C 478, Precast Reinforced Concrete Manhole Sections, Spec. for.
8. ASTM C 923, Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
9. ASTM D 2240, Rubber Property-Durometer Hardness, Test Method for.

B. American Water Works Association:

1. AWWA C 302, AWWA Standard for Reinforced Concrete Water Pipe-Noncylinder Type, Not Prestressed.

C. Federal Specifications:

1. Fed. Spec. SS-S-210A, Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints (Type 1 Rope Form).

1.05 SUBMITTALS

A. Shop Drawings and Product Data:

1. Manufacturer's published detail drawings, modified to suit design conditions if required, and Contractor prepared drawings as applicable.
2. Manufacturer's descriptive literature and specifications covering the product specified. Include installation information.

B. Certificates:

1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
2. Manufacturer's sworn certification that components and products will be manufactured in accordance with specified reference standards for components and products.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Transport and handle precast reinforced concrete manhole components and other Products specified herein in a manner recommended by the respective manufacturers of such to prevent damage and defects. Through-wall lifting holes not permitted in manhole component construction.
- B. Store precast reinforced concrete manhole components in accordance with manufacturer's recommendations to prevent joint damage and contamination. Exercise

such care in storage of other specified Products as recommended by the respective manufacturers.

1.07 SITE CONDITIONS

- A. Environmental Requirements:
 - 1. In no instance set or construct manhole bases on subgrade containing frost.

PART 2 - PRODUCTS

2.01 BASIC MATERIALS

- A. Cast-In-Place Concrete Products: Formwork, Reinforcement, and Cast-In-Place Concrete conforming to requirements of Division 3 - Concrete.
- B. Waterproofed Mortar: Material composition meeting requirements of ASTM C270, Type M with waterproofing admixture included.
 - 1. Medusa Cement Company; Medusa Waterproofing Paste or Powder.
 - 2. Grace Construction Materials; Hydratite
 - 3. Chem-Master Corporation; Hydrolox.
 - 4. Or Equal.
- C. Epoxy Bonding Compound: Use product such as A. C. Horn EPOXTITE BINDER; Sika Chemical SIKADUR-HI-MOD or equal.
- D. Concrete Masonry Units for Manholes: Commercially manufactured solid precast segmental concrete masonry units meeting requirements of ASTM C139.
- E. Manhole Steps: Spacing as indicated on Drawings.
 - 1. Aluminum Step: Aluminum Alloy AA Designation 6061-T6. Coat that portion of aluminum step being embedded in concrete with heavy bodied bituminous paint.
- F. Preformed Plastic Sealing Compound: Fed. Spec. SS-S-210A, Type 1, Rope Form, of either bitumastic base compound or butyl rubber base compound, and shipped protected in a removable two-piece wrapper. Size cross-section of rope form to provide squeeze-out of material around entire interior and exterior circumference when joint is completed.
 - 1. K. T. Snyder Company, Inc.; RUB'R-NEK.
 - 2. Hamilton Kent Manufacturing Company; KENT-SEAL NO. 2.
 - 3. Or Equal.

- G. Waterstop: Gasket type waterstop composed of polyisoprene compound, ASTM C923 with stainless steel take-up clamps.
 - 1. Acceptable Manufacturer:
 - a. Press-Seal Gasket Corporation.

2.02 PRECAST REINFORCED CONCRETE MANHOLE COMPONENTS

- A. Materials and Construction: Conforming to requirements specified in ASTM C478 except as follows:
 - 1. Concrete: Composition and compressive strength conforming to ASTM C478 except use Type II or Type III cement in manhole components and increase compressive strength to 4500 psi (at 28 days) in precast bases.
 - 2. Casting and Curing: Wet cast and steam curing process in accordance with Section 3.6.11 and 3.7.2 of AWWA C 302.
 - 3. Manhole Steps: Factory installed in manhole components, prealigned vertically, spaced on equal centers, and located the minimum distance from ends of risers and top sections as indicated on Drawings.
 - 4. Manhole Component Seals: Manhole component joints factory formed for self-centering concrete to concrete bearing employing either a rubber compression gasket or preformed plastic sealing compound.
 - a. Rubber Compression Gasket: Composition conforming to ASTM C361 or ASTM C443.
 - b. Preformed Plastic Sealing Compound: As specified previously.
 - 5. Manhole Component Design: Base, tapered and straight riser section, and top section dimensions and diameters, not consistent with ASTM C478, are as indicated on Drawings.
 - 6. Bases shall be precast.
- B. Pipe Openings: Custom preformed during manufacturing in each base and riser section requiring such, to accommodate type of pipe and pipe opening seal provided.
 - 1. Pipe Opening Seals: Resilient gasket type, cast integrally with manhole component conforming to requirements specified in ASTM C923 and of the following acceptable manufacturers:
 - a. Press-Seal Gasket Corporation.
 - b. A Lok Products Corporation; A LOK Manhole Pipe Seal.
 - c. Thunderline Corporation; LOCK-SEAL Modular Wall and Casing Seal.
 - d. Dual Seal Gaskets Inc.; DUAL SEAL II.
- C. Precast Top Sections: Designs as required by Drawings, of materials and construction as specified previously except additional and differing requirements as follows:

1. Top should be manufactured with the hatches cast in place as specified on the drawings.
- D. Coatings:
1. Prepare surfaces to be coated in accordance with the written instructions of the coating manufacturer, including cleaning, sandblasting or acid etching as necessary.
 2. Coat precast components at the factory.
 3. Exterior Surface Coating: Use one of the following:
 - a. Kop-Coat, Inc.; Bitumastic No. 300-M, 20 mil minimum thickness.
 - b. MAB; Bitu-Chem No. 32-B-4 Pennox-Tar, 20 mil minimum thickness.
 4. Coat interior, except valve vault floor, with Sauereisen Sewergard 210S or approved equal.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect precast reinforced concrete manhole components in accordance with requirements of ASTM C478 regarding repairable defects and defects subject to rejection by the Engineer.
- B. All material found during the progress of the work, either before or after installation, to have cracks, flaws or other defects will be rejected by the Engineer. All defective materials furnished by the Contractor shall be promptly removed from the site.

3.02 PREPARATION

- A. Keep pipe and manhole interiors cleared of debris as construction progresses.
- B. Earthwork: Perform earthwork for manhole installation as previously specified in Earthwork: Section 02200.

3.03 MANHOLE, WET WELL AND VALVE VAULT CONSTRUCTION METHODS

- A. Precast Concrete Bases: Install bases on a 6-inch deep compacted layer of aggregate meeting requirements of Pipe Bedding as specified previously in Section 02200.
 1. When using prefabricated pipe opening seals for connecting pipes into manholes, and such seals create an annular space on interior and exterior of manhole wall after pipe connection is made, fill such annular spaces with preformed plastic sealing compound.
 - a. Tightly caulk sealing compound into annular spaces, completely filling the spaces, and render the installation watertight.

- b. Following sealing compound installation, trowel compound surface smooth and flush with interior face of manhole.
- B. Manhole Wall Erection: Provide precast reinforced concrete straight riser, tapered riser and top sections necessary to construct complete manholes. Fit the different manhole components together to permit watertight jointing and true vertical alignment of manhole steps.
 - 1. Install preformed plastic sealing compound between sections in accordance with manufacturer's recommendations, and join sections in accordance with written instructions of manhole component manufacturer.
 - a. Prime joint surfaces if required by preformed sealing compound manufacturer.
 - b. If sealing compound is installed in advance of section joining leave exposed half of two piece protective wrapper in place until just prior to section joining.
 - c. Use preformed sealing compound as the sole element utilized in sealing section joints from internal and external hydrostatic pressure.
 - d. Following manhole section installation, trowel sealing compound surface smooth and flush with interior face of manhole.
- C. Lifting Hole Sealing: Seal with properly designed tapered rubber plugs. Drive plugs into holes in such manner to render holes completely water and air tight. Sealing of lifting holes with grout not permitted.

3.04 INTERFACING EXISTING CONSTRUCTION

- A. Connections To Existing Sewers:
 - 1. Replace with new, broken or damaged pipe resulting from this work.
 - 2. Connect new pipe to existing, using appropriate rigid couplings.
 - 3. Cut existing pipe with saw or other appropriate equipment to produce a smooth edge. If chipping or breaking of existing pipe occurs, replace to next joint with new material at no expense to Owner.

END OF SECTION

SECTION 02731

GRAVITY WASTEWATER SEWER

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Wastewater Sewer Gravity Pipelines
- B. Pipeline Testing

1.02 RELATED SECTIONS

- A. Trenching Backfilling and Compacting: Section 02221.
- B. Cast-In-Place Concrete: Section 03300.
- C. Grout: Section 03600.

1.03 QUALITY ASSURANCE

- A. Source Quality Control:
 - 1. Shop Tests and Inspection:
 - a. All material furnished by the Contractor shall be certified by the supplier for compliance with the pertinent specifications. Shop inspections and testing may be required. The cost of shop testing shall be borne by the supplier or the Contractor.
- B. Disposition of Defective Material: All material found during the progress of the work, either before or after installation, to have cracks, flaws or other defects will be rejected by the Engineer. All defective materials furnished by the Contractor shall be promptly removed by him from the site at his own expense.

1.04 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A21.4, Cement-Mortar Lining for Cast Iron and Ductile-Iron Pipe and Fittings for Water.

2. ANSI A21.10, Gray-Iron and Ductile-Iron Fittings, 2 through 48 inches, for Water and Other Liquids.
3. ANSI A21.15, Flanged Cast-iron and Ductile-Iron Pipe with Threaded Flanges.
4. ANSI A21.50, Thickness Design of Ductile-Iron Pipe.
5. ANSI A21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
6. ANSI B16.21, Nonmetallic Gaskets for Pipe Flanges.
7. ANSI B18.2.1, Square and Hex Bolts and Screws, Including Askew head Bolts, Hex Cap Screws, and Lag Screws.
8. ANSI B18.2.2, Square and Hex Nuts.

B. American Water Works Association (AWWA):

1. AWWA C104, Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
2. AWWA C207, Steel Pipe Flanges.
3. AWWA C600, Installation of Gray and Ductile Cast-iron Water Mains and Appurtenances.

C. Federal Specifications:

1. Fed. Spec. SS-S-168 (2), Sealing Compound, Sewer, Bituminous, Two Component, Mineral-Filled, Cold-Applied.
2. Fed. Spec. SS-S-210A, Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints (Type 1 Rope Form).

1.05 SUBMITTALS

- A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, catalog cut or other data as required to provide a complete description of piping and piping specialties.
- B. Certificates:
 1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
 2. Manufacturer's sworn certification that pipe will be manufactured in accordance with specified reference standards for each pipe type.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Transport, handle and store pipe materials and other Products specified herein in a manner recommended by the respective manufacturers to prevent damage and defects.

1.07 SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Keep trenches dewatered until pipe joints have been made and concrete cradle or encasement, if any, have cured.
 - 2. Under no circumstances lay pipe in water or on bedding containing frost.
 - 3. Do not lay pipe when weather conditions are unsuitable, as determined by the Engineer, for pipe laying work.

PART 2 - PRODUCTS

2.01 SEWER PIPE AND FITTINGS

- A. For pipe joints, use rubber gaskets suitable for conveying domestic sewage.
- B. Ductile Iron:
 - 1. Pipe: ANSI/AWWA C151/A21.51 and ANSI/AWWA C150/A21.50.
 - 2. Thickness Class: As otherwise noted on drawings. Flanged ductile iron pipe shall have a Class 53 wall thickness.
 - 3. Cement Mortar Linings: Conforming to ANSI/AWWA C104/A21.4, except the thickness of linings should not be less than the following:
 - a. 3" through 12" : 1/8"
 - 4. Fittings: Ductile iron ANSI/AWWA C110/A21.10 or ductile iron compact fittings ANSI/AWWA C153/A21.53.
 - a. Up to 12-inch inclusive; 250 psi. rated.
 - 5. Joints:
 - a. Rubber-Gasket Joints:
 - 1) Use rubber-gasket joints for pipe and fittings installed underground.
 - 2) Provide a pipe joint within five feet of all structures.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Earthwork: Perform earthwork for sewer installation as specified in Trenching, Backfilling, and Compacting: Section 02221.

3.02 PIPE LAYING

- A. General: All pipe shall be laid to a uniform line and grade between manholes, socket ends upgrade, with a firm and even bearing along the barrel of the pipe, close joints and smooth invert. The spigot end of the pipe is to be centered in, shoved tight and secured

against the bell or socket of the previously laid pipe. The interior of each pipe shall be cleaned of all excess joint and foreign material before the next pipe is laid. The pipe shall be laid in the bedding materials as specified in Section 02221. Pipe-laying shall commence at the lowest point and proceed upgrade. At the close of each day's work, and at such other times when pipe is not being laid, the open end of the pipe shall be protected with a close fitting stopper.

- B. Joints: Make joints in joining of pipe materials specified under PART 2 and not specifically covered for installation under PART 3 of this Specification, in strict accordance with manufacturer's installation instructions.
- C. Construction Control: The Contractor shall provide at least three grade boards in advance of pipe laying at all times at intervals not exceeding fifty feet and stretch a line parallel with the grade line. From this line, the trench and every pipe laid shall be tested as to grade and alignment. Base lines and controlling elevations established for the construction of the work shall be preserved and kept uncovered so that they can be examined at any time.
 - 1. The use of laser equipment shall be permitted. Grade boards as specified will not be required if a laser is used.
 - 2. Regardless of control used, the Contractor shall provide alternative verification of grade as work progresses. Pipe not laid to proper line and grade will be removed and reconstructed at the Contractor's expense.
- D. Variations: The Engineer reserves the right to vary the line and/or grade from that shown on the drawings for pipe lines and manholes when such changes may be necessary or advantageous. No claims will be allowed for changes in location or grade except as such changes are made after trenching has been done. Payment for all variances shall be in accordance with the unit pricing as indicated in the Bid and all excavation shall be unclassified.
- E. Handling of Sewer Line Materials into Trench: Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, jointing materials, etc. shall be carefully lowered into the trench piece-by-piece by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to sewer line materials and/or workmen. Under no circumstances shall such materials be dropped or dumped into the trench.
- F. Pipe Clearance in Rocks: Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe and fittings for pipes 24 inches in diameter or less, and 9 inches for pipes larger than 24 inches in diameter.

1. The specified minimum clearances are the minimum clear distances which will be permitted between any part of the pipe and/or fitting being laid and any part, projection or point of such rock, boulder or stone.
- G. Pipes at Manholes or Other Rigid Structures: Pipe directly connected to or supported by rigid structures shall be as indicated on the Drawings.
- H. Drop Connections: Make drop connections where indicated on the Drawings, where drop in invert is two feet or more or as required by the Engineer. Use same pipe material used to construct the main from which the drop connection is made. Construct drop connection in accordance with design shown on the Drawings.
- I. Concrete Cradle and Encasement:
1. Preparation: Prior to the formation of cradle or encasement, if any, temporary supports consisting of timber wedges and solid concrete bricks or cap blocks shall be used to support the pipe in place. Temporary supports shall have minimum dimensions and shall support the pipe at not more than two locations, one at the bottom of the barrel of the pipe adjacent to the shoulder of the socket and the other near the spigot end.
 2. Placing: After jointing of the pipe has been completed, concrete shall be uniformly poured beneath and on both sides of the pipe. Placement shall be done by the use of suitable equipment. The concrete shall be wet enough during placement to permit its flow, without excessive prodding, to all required points around the pipe surface. The width of cradle shall be such as to fill completely the trench width. In case of extremely wide trenches, concrete encasement may be confined above the top of the pipe to a narrower width but in no case shall it be less than the width of trench required for the size of pipe being used. Before depositing concrete, the space within the limits of the pour shall have been cleared of all debris and water. Water shall not be allowed to rise adjacent to, or flow over, concrete deposited for less than 24 hours. Concrete shall be protected from the direct rays of the sun and kept moist, by a method acceptable to the Engineer, for a period of seven days or until backfilling is begun. In no case shall backfilling begin within 24 hours of the time of placing and the Engineer shall have strict control of the rate of backfilling.
 3. Concrete: 3000 psi per requirements of Section 03300.

3.03 TESTS

- A. Alignment: After the mains have been laid and backfilled, a light will be flashed between manholes or manhole locations to determine whether the alignment of the sewer is true and whether any pipe has been displaced, broken or otherwise damaged subsequent to laying. This test will again be conducted before final acceptance of the

sewer. Each section (manhole to manhole) of sewer shall show a good light circle throughout its length and any and all defects shall be corrected by the Contractor, to the satisfaction of the Engineer, before the work shall proceed and before acceptance of and/or payment therefore shall be made.

B. Leakage Tests:

1. Air Testing: The Contractor shall test each section of sewer between manholes and all laterals to the limit of this contract using low pressure air. Testing shall not be performed, until all backfilling has been completed. The Contractor may, at his option, test the section of sewer for his own purposes, prior to completion of backfilling; however, the requirements of this subsection shall not be deemed to be completed until the lines have been tested after the backfilling has been completed and trench settlement has been minimized. The costs of any testing incurred prior to authorization from the Engineer after backfilling has been completed shall be borne by the Contractor.
2. A minimum of two minutes shall be provided to allow equilibrium of the air temperature with pipe wall before test readings shall commence. The rate of air loss shall be determined by measuring the time interval required for the average internal pressure to decrease by 1.0 psig.
3. The initial test pressure to be developed in the sewer and laterals shall be determined as follows:
 - a. For depths six feet or less, the internal pressure shall not be less than 6.0 psig.
 - b. For depths greater than six feet, the internal pressure in psig shall be calculated as the sum of 3.5 plus the maximum height in feet divided by 2.3 between the invert of the sewer and the existing ground surface in the section of sewer to be tested. (For example, if the maximum height is determined to be 9.2 feet, the added pressure would be 4.0 psig. The initial test pressure in the sewer would then be 7.5 psig. The allowable drip would be to 6.5 psig within the time indicated elsewhere in this subsection.)
 - c. In no case shall the test pressure in the sewers or laterals be greater than the maximum internal differential joint pressure recommended by the manufacturer of the pipe.
4. The pipe shall be considered acceptable if the air loss rate does not exceed 0.0030 cubic feet per minute per square foot of internal pipe surface when tested at the initial pressure previously defined in this subsection. The time for the air pressure to decrease 1.0 psig shall not be less than the time indicated in the following table:

<u>Pipe Diameter</u>	<u>Minutes</u>	<u>Seconds</u>
6"	2	50
8"	3	47
10"	4	43

12"	5	40
15"	7	05
18"	8	30
21"	9	55
24"	11	20
27"	12	45
30"	14	10

5. If the above rates of leakage are exceeded, the Contractor shall, at his expense, determine source of leakage and make all necessary corrections and retest.
6. The Contractor shall submit to the Engineer for approval the detailed test procedure and list of test equipment he proposes to use prior to testing.

C. Infiltration:

1. After the air testing described in the preceding paragraph has been completed by the Contractor, regardless of any indications of the test results made by the Engineer or the Owner, the Engineer and the Owner reserve the right to perform field investigations, prior to final written acceptance of each sewer run by the Owner and/or during the maintenance period specified elsewhere in these specifications, to establish the leakage of groundwater into the sewer and laterals constructed under this contract. The cost of these investigations shall be borne by the Owner.
2. Should the leakage exceed 100 gallons per day per inch diameter per mile of pipe for any section, the Contractor shall, at the direction of the Engineer or Owner, and at no cost to the Owner, perform any additional testing or corrective work required to reduce the infiltration in each manhole run from those lines installed by the Contractor to less than 100 gallons per day per inch diameter per mile of pipe. This leakage applies to each manhole run separately and should not be construed to mean total leakage in the total system. The scope of this corrective work shall include, but not be limited to, cleaning, televising and testing the sewer and laterals to the limits installed by the Contractor, to include testing and grouting of joints, excavation and replacement of faulty or damaged portions of the work, and all final restoration.

- D. Acceptance: Observation of successful testing of manholes, sewers or force mains by the Engineer does not constitute acceptance of the system or any portion thereof. Upon completion of any determined portion of a total system, and successful testing thereof, the Engineer may recommend final acceptance to the Owner. Only upon final inspection by the Owner or Engineer, and upon written acceptance for same will the system or portion thereof be considered substantially completed. Upon such acceptance, the warranty period as specified for the manholes, sewers or force main will commence.

1. If, during this final inspection, any irregularities are observed, the condition must be corrected at the Contractor's expense prior to acceptance.

END OF SECTION

SECTION 02732

FORCE MAINS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Wastewater Sewer Force Main Piping.
- B. Thrust Restraint.
- C. Pipeline Testing.

1.02 RELATED SECTIONS

- A. Trenching, Backfilling and Compacting: Section 02221.
- B. Manhole, Wet Well and Valve Vaults: Section 02601.
- C. Division 3 - Concrete.

1.03 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A21.4, Cement-Mortar Lining for Cast-iron and Ductile- iron Pipe and Fittings for Water.
 - 2. ANSI A21.10, Gray- iron and Ductile- iron Fittings, 2 through 48 inches, for Water and Other Liquids.
 - 3. ANSI A21.15, Flanged Cast-iron and Ductile-Iron Pipe with Threaded Flanges.
 - 4. ANSI A21.50, Thickness Design of Ductile-Iron Pipe.
 - 5. ANSI A21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
 - 6. ANSI B16.1, Cast-iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
 - 7. ANSI A21.11, Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
 - 8. ASTM D 3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- B. American Society for Testing and Materials.

1. ASTM A 126, Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
2. ASTM A 536, Ductile Iron Castings.

B. American Water Works Association:

1. AWWA C104, Cement-Mortar Linings for Ductile-Iron and Gray Iron Pipe and Fittings for Water.
2. AWWA C110, Ductile-Iron and Gray-Iron Fittings, 3-in. thru 48-in. for Water and Other Liquids.
3. AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
4. AWWA C150, Thickness Design of Ductile-Iron Pipe.
5. AWWA C151, Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or other liquids.
6. AWWA C600, Installation of Gray and Ductile Cast-iron Water Mains and Appurtenances.
7. AWWA C 906, Polyethylene Pressure Pipe and Fittings, 4-inch through 63-inch for Water Distribution.

1.04 SUBMITTALS

- A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, cuts or other data as required to provide a complete description of piping, piping specialties, restraint systems and valves.
- B. Certificates:
1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
 2. Manufacturer's sworn certification that pipe will be manufactured in accordance with specified reference standards for each pipe type.

1.05 QUALITY ASSURANCE

- A. Source Quality Control:
1. Shop Tests and Inspection: All materials furnished by the Contractor shall be certified by the supplier for compliance with the pertinent specifications. Shop inspections and testing may be required. The cost of shop testing shall be borne by the supplier or the Contractor.
- B. Disposition of Defective Material: All material found during the progress of the work, either before or after installation, to have cracks, flaws or other defects will be rejected by the Engineer. All defective materials furnished by the Contractor shall be promptly removed by him from the site at his own expense.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Replacement of Damaged Material: The Contractor shall replace, at his own expense, all material furnished by him and found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all materials and labor required for replacement of installed material.
- B. Responsibility for Safe Storage: The Contractor shall be responsible for the safe storage of material furnished by or to him, and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter, at all times. All equipment and materials subject to damage from freezing shall be drained and stored in a manner which will protect them.
- C. Hauling: All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor.
 - 1. Pipe, fittings, items of equipment, and other materials of construction shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped.
 - 2. Materials handled on skidways shall not be skidded or rolled against materials already on the ground.
- D. At Site of Work: In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench, or as otherwise directed by the Engineer. Under no circumstances should lawns, grass plots or other private property be used for this purpose without the consent of the property owner.

1.07 SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Keep trenches dewatered until pipe joints have been made and concrete cradle, thrust blocks and encasement, if any, have cured.
 - 2. Under no circumstances lay pipe in water or on bedding containing frost.
 - 3. Do not lay pipe when weather conditions are unsuitable, as determined by the Engineer, for pipe laying work.

PART 2 - PRODUCTS

2.01 PIPE AND PIPE FITTINGS

- A. Ductile Iron:

1. Pipe: ANSI/AWWA C151/A21.51 and ANSI/AWWA C150/A21.50.
 2. Thickness Class: As otherwise noted on drawings. Flanged ductile iron pipe shall have a Class 53 wall thickness.
 3. Cement Mortar Linings: Conforming to AWWA/ANSI C104/A21.4, except the thickness of linings should not be less than 1/8"
 4. Fittings: Ductile iron ANSI/AWWA C110/A21.10 or ductile iron compact fittings ANSI/AWWA A21.53/ C153.
 - a. All fittings shall be minimum Class 250 with cement lining and joints as required for pipe restraint.
 5. Joints:
 - a. Rubber-Gasket Joints:
 - 1) Use rubber-gasket joints for pipe and fittings installed underground.
 - 2) Restraint Joint: Megalug at all fittings by EBAA Iron Works or approved equal. All pipe joints Tyton-joint with field-lok gasket or TR-Flex, or equal.
 - 3) Provide a pipe joint within five feet of all structures.
 6. Pipe and Fittings Coating: Factory coated inside and out with bituminous material; minimum 1 mil dry thickness. Bituminous material and finished coat conforming to seal coat requirements in ANSI A21.4.
- B. Fittings: Ductile iron compact fittings AWWA C 153. All Fittings shall have a minimum pressure rating of 250 psi and shall have cement lining and mechanical joints as required for pipe restraint.
1. Joints: Push-on type conforming to ASTM D 3139.
 - a) Split retainer flanges shall not be used in place of thrust blocks.
 - b) Proposed joint restraint system shall be submitted for Engineer's review and approval if concrete thrust blocks are not used.
 2. Mechanical joints with Megalug or equal are acceptable in lieu of concrete thrust blocks.
- C. Polyvinyl Chloride
1. Materials used for the manufacturing of polyvinyl chloride pipe shall be AWWAC-900, DR-18.
 2. Fittings: Gray iron or ductile iron AWWA C 110 or ductile iron compact fittings AWWA C 153. All fittings shall have a minimum pressure rating of 250 psi and shall have cement lining. Joints as required for proper pipe restraint. All flanged fittings drilled and faced for 125 lb. drilling pattern.
 - a. Joints: Push-on type or mechanical joint type in accordance with AWWA standards for all straight lengths of pipe. Changes in alignment, valves or other conditions requiring pipe restraint or as noted on the Drawings shall have mechanical type joints.

- b. When joint restraint other than thrust blocks or Megalug retainer glands is proposed, the Contractor shall submit information on the proposed joint restraint system to the Engineer for review and approval.
- c. Megalug retainer glands as specified in this Section.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Earthwork: Perform earthwork for force mains as specified in Trenching, Backfilling and Compacting: Section 02221.

3.02 PIPE INSTALLATION:

- A. General: All pipe shall be laid and maintained to the required lines and grades with fittings and valves at the required locations; spigots centered in bells; and all valves plumb. The pipe shall be laid in the backfill materials as specified.
- B. Construction Control: During the installation of pressure lines, the pipe shall be laid at a constantly increasing grade to each high point, air release manhole, or point of discharge, as indicated on the Drawings. The Contractor shall provide sufficient construction control to assure that there are no sags or loss in grade in the force main which could tend to accumulate air other than at the high points shown on the Drawings. Failure to comply with this requirement shall necessitate the Contractor take remedial steps to correct this situation. All such costs shall be borne by the Contractor.
- C. Variations: The Engineer reserves the right to vary the line and/or grade from that shown on the Drawings for the pipe lines and manholes and to vary the location of fittings and valves when such changes may be necessary or advantageous. No claims for extra work will be allowed for changes in location or grade except as such changes are made after trenching has been done.
- D. Caution in Excavation: The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on his part.
- E. Subsurface Explorations: Whenever, in the opinion of the Engineer, it is necessary to explore and excavate to determine the location of existing underground structures, the Contractor shall make explorations and excavations for such purposes. If the Contractor is required to perform additional work in making the explorations and excavations, extra compensation will be allowed for such additional work.

- F. Depth of Pipe: All pipe shall be laid to the depth indicated on the Contract Drawings or a minimum of 4' from grade to the crown of pipe.
- G. Handling of Sewer Line Materials Into Trench: Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, valves, etc., shall be carefully lowered into the trench piece by piece by means of a derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to sewer line materials. Under no circumstances shall such materials be dropped or dumped into the trench.
- H. Cleaning Pipe and Fittings: All foreign matter shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wiped clean and dry and free from oil and grease before the pipe is laid.
- I. Laying Pipe: Every precaution shall be taken to prevent foreign material from entering the pipe while the pipe is being placed in the trench. If the pipe-laying crew cannot put the pipe into the trench and in place without allowing earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and let there until the connection is to be made into the adjacent pipe. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe. After placing a length of pipe in the trench, the spigot end shall be centered in the bell or coupling and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the joints. Pipe and fittings which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipe and fittings of proper dimensions to insure such uniform space.
 - 1. Precautions shall be taken to prevent dirt from entering the joint space.
 - 2. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.
- J. Cutting Pipe: The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner, without damage to the pipe, so as to leave a smooth end at right angles to the axis of the pipe.
- K. Bell Ends to Face Direction of Laying: Bell and spigot pipe shall be laid with bell ends facing in the direction of laying, unless directed otherwise by the Engineer.
- L. Permissible Deflection of Joints: If deflection is required, make after joint is assembled. The amount of deflection shall not exceed fifty percent (50%) of the maximum limits as specified by the pipe manufacturer.

- M. Unsuitable Conditions for Laying Pipe: No pipe shall be laid in water or when, in the opinion of the Engineer, trench conditions are unsuitable.

3.03 PIPE JOINTING

A. Pipe Joining:

1. General: Exercise care when making pipe joints and make joints in accordance with the pipe material manufacturer's recommendations and the following requirements. In each instance of pipe joining, those portions of pipes involved must be absolutely clean just prior to assembly. If a joint is extremely difficult to assemble or sealing is not effected, disassemble the joint and correct the difficulty if possible. Remake the joint using new materials when necessary.
2. Push-on Joints. To make ductile iron pipe push-on joints, properly seat sealing gasket, evenly and sufficiently lubricate the spigot end of pipe, and fully enter joint until joint line is visible. Make deflection, if required, only after the joint has been assembled properly.
3. Mechanical Joints: To make ductile iron pipe mechanical joint, position sealing gasket and gland for bolting and then enter the spigot into pipe bell end until joint line is visible. Tighten bolts evenly maintaining approximate distance between gland and face of flange at all points around the socket. Do not exceed pipe manufacturer's specifications for maximum torque applied to bolts.
4. Flanged Joints: Make ductile iron and steel pipe joints faced true, fitted with gaskets, and drawn up square and tight to insure full gasket flow and satisfactory seal.
5. Compression Type: Make underground cast iron soil pipe joints in accordance with manufacturer's specifications.
6. Soldered Joints: Cut tubing and piping ends square, deburr and ream to size of original bore. Prior to sweating, clean pipe ends and fittings surfaces involved in the joint, to bright metal without marring surfaces. Finished joints shall show no evidence of hard-temper due to overheating, no evidence of improper solder draw, and excess solder must be removed.
7. Compression Fittings/Unions (for below-grade connection of copper pipe): Provide collar piece, shoulder piece (threaded or soldered on pipe) and threaded piece. Provide gaskets as needed.
8. PVC pipe shall be joined in accordance with the pipe manufacturer's recommendations to form a leak-proof joint. Pipe supplier shall also provide equipment necessary for heat fusion of pipe and fittings, and shall also provide training and assistance to the Contractor in joining of pipes and fittings.

3.04 ANCHORAGE

- A. Concrete Thrust Blocks: Provide concrete thrust blocks for all fittings, and at all locations where horizontal and/or vertical deflections are made in the joints of the piping. Thrust blocking and buttresses of design indicated on Drawings.

1. Reaction Backing: Reaction backing shall be 2500 psi concrete as specified in Section 03300. Backing shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be as indicated on the Drawings or directed by the Engineer. The backing shall, unless otherwise indicated or directed, be so placed that the pipe and fitting joints will be accessible for repair.
 2. Metal Harness: Metal harness of tie rods of adequate strength to prevent movement shall be used. Steel rods or clamps shall be type 304 stainless steel
- B. Anchorage for Bends: All bends deflecting 11.25 degrees or more on mains 6-inches in diameter or greater shall be provided with a thrust restrain system to prevent movement.

3.06 FIELD QUALITY CONTROL

A. Hydrostatic Tests

1. Pressure Test: After the pipe has been laid and backfilled as specified, all newly laid pipe or any valves section thereof, shall be subjected to a hydrostatic pressure of 75 pounds per square inch, or 50% in excess of the normal working pressure, whichever is greater. Where any section of a main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least five days have elapsed after the concrete reaction backing was installed. If high early strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least two days have elapsed.
 - a. Duration of Test: Two hours.
 - b. Procedure: Each section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The pump, pipe connections, and all necessary apparatus including gauges, shall be furnished by the Contractor. The Contractor will make all taps into the pipe, and furnish all necessary assistance for conducting the tests.
 - c. Expelling Air Before Test: Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall make the necessary taps at such points before the test is made. After the test has been completed, the Contractor shall insert plugs at the tapping points.
 - d. Examination Under Pressure: Any cracks or defective pipes, fittings, or valves discovered in consequence of this pressure test, shall be removed and replaced by the Contractor with sound material, and the test shall be repeated until satisfactory to the Engineer.
2. Leakage Test: A leakage test shall be conducted concurrently with the pressure test. The Contractor will furnish laboratory calibrated test gauge and measuring device, and all necessary assistance to conduct the test.

- a. Leakage Definition: Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valve section thereof, to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
- b. Permitted Leakage: No pipe installed will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{ND(P^{1/2})}{7400}$$

in which "L" equals the allowable leakage in gallons per hour; "N" is number of joints in the length of pipeline tested; "D" is the nominal diameter of the pipe, in inches, and "P" is the average test pressure during the leakage test, in pounds per square inch gauge.

- 1) The Engineer will record both the makeup water and pressure at one-half hour intervals during the test period.
 - 2) Should any test of pipe laid disclose leakage greater than that specified above, the Contractor shall, at his own expense, locate, repair, and replace the defective joints, pipe, or fittings until the leakage is within the specified allowance.
3. Common Requirements:
 - a. Engineer Presence: The Engineer shall monitor the pressure and leakage tests. The Contractor shall notify the Engineer of the test day at least 48 hours in advance.
 - b. If test fails to meet test requirements, the Contractor shall pay for all additional engineering personnel testing time.
 - c. Weather: No testing will be authorized unless air temperature is 35 degrees F. or higher.
 - d. Field Joints: All field joints of fittings and valves shall be exposed and examined during pressure and leakage test.
 - d. Acceptance: Observation of successful testing of pressure lines by the Engineer does not constitute acceptance of the system or any portion thereof. Upon completion of any determined portion of a total system, and successful testing thereof, the Engineer may recommend final acceptance to the Owner. Only upon final inspection by the Owner or Engineer and upon written acceptance for same will the system or portion thereof be considered substantially completed. Upon such acceptance, the warranty period as specified for the pressure line will commence. If, during this final inspection, any irregularities are observed, the condition must be corrected at the Contractor's expense prior to acceptance.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Formwork for cast-in-place concrete including form coatings and ties.

1.02 QUALITY ASSURANCE

- A. Design Criteria:
 - 1. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure.
 - 2. Maintain formwork construction tolerances complying with ACI 347.
 - 3. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

1.03 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 347; Recommended Practice for Concrete Formwork.
- B. American Plywood Association: APA Grade-Trademarks.
- C. U.S. Department of Commerce Product Standards:
 - 1. PS-1 For Construction and Industrial Plywood.

1.04 SUBMITTALS

- A. Product Data: Submit data for proprietary materials and items, including forming accessories, coatings, and others as requested by Engineer.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

- A. Forms:
 - 1. Forms (Exposed Finish Concrete): Plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints

- and to conform to joint system shown on drawings.
- a. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
 2. Forms (Unexposed Finish Concrete): Plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- B. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- C. Form Ties: Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal.
1. Provide units which will leave no metal closer than 1-1/2" to surface.
 2. Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.
- B. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- C. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.02 ERECTION

- A. General: Construct forms in accordance with ACI 347.
1. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures.
 2. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features required in work.
 3. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
 4. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep

to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

- B. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

3.03 REMOVAL OF FORMS

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Reinforcement bars for cast-in-place concrete
- B. Mechanical Splice Coupler
- C. Anti-Corrosion Primer

1.02 RELATED SECTIONS

- A. Concrete Formwork: Section 03100.
- B. Cast-in-Place Concrete: Section 03300.
- C. Metal Fabrications: Section 05500.

1.03 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:
 - 1. ACI 318 "Building Code Requirements for Reinforced Concrete".
 - 2. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

1.04 REFERENCES

- A. Comply with the latest published for the following referenced standards.
- B. American Concrete Institute (ACI):
 - 1. ACI 117; Standard Specifications for Tolerances for Concrete Construction and Materials
 - 2. ACI 315; Details and Detailing of Concrete Reinforcement.
 - 3. ACI 318; Building Code Requirements for Structural Concrete.
- C. American Society for Testing and Materials (ASTM):
 - 1. ASTM A82; Steel Wire, Plain, for Concrete Reinforcement, Spec. for.
 - 2. ASTM A185; Steel Welded Wire Fabric, Plain for Concrete Reinforcement, Spec. for.
 - 3. ASTM A497; Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement, Spec. for.
 - 4. ASTM A615; Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Spec for.

5. ASTM A663; Steel Bars, Carbon, Merchant Quality, Mechanical Properties, Spec. for.
6. ASTM A767; Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement, Spec. for.
7. ASTM A775; Epoxy-Coated Reinforcing Steel Bars, Spec. for.
8. ASTM A780; Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
9. ASTM D412; Vulcanized Rubber and Thermoplastic Rubber and Thermoplastic Elastomers in Tension, Test Methods for.
10. ASTM D3963; Fabrication and Job-site Handling of Epoxy-Coated Steel Reinforcing Bars, Spec. for.

D. Concrete Reinforcing Steel Institute (CRSI):

1. Manual of Standard Practice
2. Manual of Placing Reinforcing Bars

1.05 SUBMITTALS

- A. Product Data: Submit data for proprietary materials and items, including reinforcement, accessories, and others as requested by Engineer.
- B. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
 1. Reinforcing Shop Drawings shall reflect the approved concrete pour sequence submittal as specified in Section 03300.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle steel reinforcing to prevent bending and damage.
 1. Avoid damaging coatings on steel reinforcement
 2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D3963.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Reinforcing Steel:
 1. Reinforcing Bars: ASTM A615, Grade 60, deformed.
 2. Galvanized Reinforcing Bars: ASTM A767, Class II (2.0 oz. zinc psf) hot-dip galvanized, after fabrication and bending.
 3. Epoxy-Coated Reinforcing Bars: ASTM A775.
 4. Steel Wire: ASTM A82, plain, cold-drawn, steel.
 5. Plain Steel Welded Wire Fabric: ASTM A185, welded steel wire fabric.
 6. Deformed Steel Welded Wire Fabric: ASTM A497.

- B. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.
1. For footings, foundation mats and slabs-on-grade, use chairs with sand plates, horizontal runners, or precast concrete blocks.
 - a. Any metal chairs or spacers in contact with the ground shall be galvanized, epoxy-coated or stainless steel.
 - b. Concrete masonry units or bricks are not acceptable.
 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
 3. For surfaces to be exposed to fluids or high humidity, provide supports with legs that are plastic tipped (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
 4. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
 5. For zinc-coated (galvanized) reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
- C. Mechanical Splice Coupler: Designed to meet ACI 318 Building Code Requirements in axial tension for the grade of reinforcing bar specified. Positive locking manufactured from high quality steel and designed for connections to taper threaded bar ends where one bar can be turned.
1. Internal Coupler Protector: Provide coupler manufacturer's plastic internal coupler protector where couplers are provided for anticipated future additions.
 2. Bar End Protectors: Plastic solid sleeve for placement over bar ends to protect threading from damage, contamination and rust.
 3. Contractor may request to use coupler to facilitate masonry reinforcing placement for Engineer's approval prior to shop drawing submittal.
 4. Acceptable Manufacturer:
 - a. Erico Products, Inc.; Lenton Standard Couplers – A2
 - b. Or Equal.
- D. Dowel Bars:
1. Structural grade steel conforming to requirements of ASTM A663, Grade 70 or better. Cut bars to length with ends square and free of burrs.
 2. Coating of high density Polyethylene and adhesive meeting tensile strength test requirements of ASTM D412.
 - a. Coating thickness: 0.017-inch \pm 20 percent.
 - b. Elongation: 100 percent minimum.
 - c. Adhesive thickness: 0.004-inch nominal.
 - d. Thickness of coating plus adhesive: 0.021-inch \pm 20 percent.
 3. Graphite paste composed of a vehicle (35-45 percent by weight) containing not less than 52 percent of fixed oils and remainder of volatile thinners and dryers, thoroughly mixed with flake graphite composed of Graphitic Carbon (85 percent

min. by weight) or Graphitic Carbon passing number 100 sieve (84-92 percent by weight) or Graphitic Carbon passing number 325 sieve (46-50 percent by weight).

- E. Anti-Corrosion Compound (for existing reinforcing exposed and to remain):
Manufactured product specifically designed to bond patching mortar or fresh concrete to existing reinforcing steel and concrete and to protect rebar from further rusting and corrosion. Acceptable products include:
 - 1. Sika Corp.; Armatex 110 EpoCem
 - 2. StoCorp. Concrete Restoration Division; Bonding/Anti-Corrosion Agent (CR246)
 - 3. Or Equal.
- F. Anchors:
 - 1. Stainless Steel Anchor Bolts: As specified in Section 05500.
- G. Micro-Fiber Reinforcement: As specified in Section 03300.
- H. Epoxy Repair Coating: Liquid two-part epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775.
- I. Zinc Repair Material: Zinc-based solder, paint containing zinc dust, or sprayed zinc; compatible with zinc coating for galvanized reinforcing and complying with ASTM A780.

PART 3 - EXECUTION

3.01 FABRICATION

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- B. Fabrication tolerances shall conform to ACI 117 requirements.

3.02 INSPECTION

- A. Notify Engineer 48 hours before placing concrete so an inspection of the reinforcing placement can be made

3.03 PREPARATION

- A. Coordinate the installation of joint materials and vapor retarders with placement of reinforcing steel.
- B. Verify that items to be embedded in concrete are secured in place and block-outs in formwork are secured in place as required. Formwork installed as work of Section 03100.

3.04 INSTALLATION

- A. Comply with CRSI's "Manual for Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
 - 1. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
 - 2. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
 - 3. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
 - 4. Welding of reinforcement including tack welds are not permitted on this project.
 - 5. A blowtorch shall not be used to facilitate field cutting or bending or any other reinforcing work.
 - 6. Bars shall not be spliced, except where shown on approved Shop Drawings, unless approved by Engineer.
 - 7. Continue reinforcement across construction joints, except as otherwise indicated.
 - 8. Reinforcement shall not be bent after partially embedded in hardened concrete.
 - 9. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction. Lace overlaps with wire.
 - 10. Avoid cutting or puncturing vapor retarder during reinforcement placement and concrete operations.
- B. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damage coating with epoxy repair coating per ASTM D3963.
- C. Zinc-Coated Reinforcement: Use galvanized steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged coatings with zinc repair material.
- D. Mechanical Splice Coupler Installation:
 - 1. Follow manufacturer's requirements to taper and thread reinforcing bar ends.
 - 2. Make mechanical connection in accordance with coupler manufacturers installation instructions.
- E. Dowel Bar Installation:
 - 1. Prepare graphite lubricant, place approximately 3 to 4 pounds of graphite paste and 40 percent by weight of a 60/40 mixture of carbon tetrachloride and naphtha in a suitable container and thoroughly mix.
 - 2. Apply lubricant to the free end of dowels by daubing, mopping, or gloved hand to produce a thorough coating approximately 1/16-inch thick. Do not use brushes for application of lubricant.

3. Mix and apply lubricant at least one hour before the concrete is placed around the dowel assembly.
- F. Place the Anti-Corrosion compound on any exposed reinforcing (20 mils min.) in accordance with the manufacturer's requirements. Apply the concrete within the manufacturer's stated "open" time.
- G. Anchor Bolts Setting: Set at locations indicated on Drawings and secure in place to prevent movement during concrete pours.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cast-in place concrete, including concrete materials, mix design, placement procedures, and finishes.

1.02 RELATED SECTIONS

- A. Concrete Formwork: Section 03100.
- B. Concrete Reinforcement: Section 03200.

1.03 REFERENCES

- A. Comply with the latest published version for the following referenced standards.
- B. American Association of State Highway and Transportation Officials, AASHTO M182 Burlap cloth made from Jute or Kenaf.
- C. American Concrete Institute (ACI):
 - 1. ACI 117; Standard Specifications for Tolerances for Concrete Construction and Materials
 - 2. ACI 301; Standard Specifications for Structural Concrete.
 - 3. ACI 302.1R; Guide for Concrete Floor and Slab Construction.
 - 4. ACI 304R; Guide for Measuring, Mixing, Transporting and Placing Concrete.
 - 5. ACI 305R; Hot Weather Concreting.
 - 6. ACI 306.1; Standard Specification for Cold Weather Concreting.
 - 7. ACI 308; Standard Specification for Curing Concrete.
 - 8. ACI 309R; Guide for Consolidation of Concrete.
- D. American Society for Testing and Materials (ASTM):
 - 1. ASTM C33; Concrete Aggregates, Spec. for.
 - 2. ASTM C94; Ready-Mixed Concrete, Spec. for.
 - 3. ASTM C150; Portland Cement, Spec. for.
 - 4. ASTM C171; Sheet Materials for Curing Concrete, Spec. for.
 - 5. ASTM C260; Air Entraining Admixtures for Concrete, Spec. for.
 - 6. ASTM C309; Liquid Membrane - Forming Compounds for Curing Concrete, Spec. for.
 - 7. ASTM C494; Chemical Admixtures for Concrete, Spec. for.
 - 8. ASTM C881; Epoxy Resin-Base Bonding Systems for Concrete, Std. Spec for.
 - 9. ASTM C1116; Fiber-Reinforced Concrete and Shotcrete, Spec. for.

10. ASTM C1315; Liquid Membrane-Forming Compounds having Special Properties for Curing and Sealing Concrete, Spec. for.
11. ASTM D1544; Color of Transparent Liquids (Gardner Color Scale), Std. Test Method for.
12. ASTM D1751; Pre-formed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types), Spec. for.
13. ASTM D1752; Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction, Spec. for.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items named herein, as requested by Engineer.
- B. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design test as specified. Includes concrete mix design and proof of performance complying with ACI 301. Do not begin concrete production until approved by Engineer.
- C. Method of curing to be used on the project.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C150 of the following Type: Type I
 1. The use of fly ash and blast furnace slag is not permitted on this project.
- B. Normal Weight Aggregates: Meeting requirements of ASTM C33.
 1. Class: Severe weathering region, but not less than 3S.
 2. Coarse Aggregate: Graded crushed angular stone; no rounded aggregate or rounded gravel permitted. Maximum nominal size shall comply with ACI 301.
 3. Fine Aggregate: Natural or manufactured sand.
- C. Water: ASTM C94 Potable.
- D. Concrete Admixtures:
 1. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
 2. Air-Entraining Admixture: ASTM C260.
 3. Water-Reducing Admixture: ASTM C494, Type A.
 4. High-Range Water-Reducing Admixtures (ASTM C494, Types F or G) also called "superplasticizer" are not permitted on this project.
 5. Accelerator, Non-Corrosive, Non-Chloride: ASTM C494, Type C or E.
 6. Water-Reducing, Retarding Admixture: ASTM C494, Type D.

- E. Micro-Fiber Reinforcement: ASTM C1116, Type III 100% polypropylene monofilament fibers designed specifically for secondary reinforcement of concrete such as “Fibermesh” by Synthetic Industries, Fiber Reinforced Concrete Division or Equal.
- F. Preformed Expansion Joint Fillers:
 - 1. Nonextruding and Resilient Bituminous Fiber: ASTM D1751.
- G. Curing Compounds
 - 1. General: Contractor is responsible to verify that the curing compounds submitted are compatible with those materials and products to be applied directly to the concrete. Any problems arising due to a compatibility failure shall be corrected at the Contractor’s expense.
 - 2. Cure and Seal – Standard: ASTM C309, Type I. Non-yellowing shall have a UV Degradation-Yellowing result of 0 or 1 based on ASTM D1544 or Class A from ASTM C1315, VOC-compliant
- H. Curing Covers
 - 1. Absorptive Cover: AASHTO M182, Class 2, 9 oz. per sq. yd. (dry)
 - 2. Moisture-Retaining Cover: ASTM C171, minimum 0.0040 inches thick.
- I. Epoxy Bonding Compound: ASTM C881, two component material suitable for use on dry or damp surfaces.

2.02 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301.
- B. Design Mixes: Provide normal weight concrete:
 - 1. 4,000 psi 28-day compressive strength: All cast-in-place concrete including but not limited to structural slabs, beams, walls, columns, footings. Items excluded are specifically listed in following paragraphs.
 - 2. 3,500 psi 28-day compressive strength: Sidewalks, curbs, fill concrete.
 - 3. 2,500 psi 28-day compressive strength: Concrete encasement, pipe collars, thrust blocks, structural backfill.
- C. Water-Cement Ratio:
 - 1. Subjected to freezing and thawing or not covered below; W/C 0.50.
 - 2. Subjected to deicers; W/C 0.45.
- D. Slump Limits:
 - 1. Foundations, ramps, slabs, and sloping surfaces: 3" maximum.
 - 2. Other concrete: 4" maximum.
- E. Admixtures:

1. Air Entrainment: Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of $\pm 1\frac{1}{2}$ percent within following limits:

- a. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or subjected to hydraulic pressure (all concrete considered severe exposure unless noted otherwise on drawings):

Max. Aggregate Size	Moderate Exposure	Severe Exposure
1½"	4.5%	5.5%
1"	4.5%	6.0%
¾"	5.0%	6.0%
½"	5.5%	7.0%

- b. Other Concrete (not exposed to freezing, thawing, or hydraulic pressure): 2 percent to 4 percent air.

2. Other Admixtures:

- a. Use water-reducing admixture in concrete as required for placement and workability.
 - b. Use accelerating admixture in concrete placed at ambient temperatures below 50°F.
 - c. Use retarder admixture in concrete when required by high temperatures.

- F. Micro-Fiber Reinforcement: All non-reinforced slabs shall contain the specified fibers. At the ready-mix plant add at least 1.5 pounds fiber per 1.0 cubic yard of concrete dosage rate to the mix during batching.

2.03 CONCRETE MIXES

- A. Project-Site Mixing: ASTM C94. Mix materials for concrete in appropriate drum-type batch machine mixer.

1. Contractor to prepare batch ticket for each batch discharged and used in work, indicating project identification name and number, date, location of pour, mix type, mix time, quantity, and amount of water introduced.

- B. Ready-Mix Concrete: ASTM C94.

1. Contractor shall keep a record at the job site showing time and place of each pour of concrete together with transit-mix delivery slip certifying contents of pour, delivery time, other data specified in ASTM C94 and amount of water added in the field.

- C. Upon completion of concrete work, Contractor shall deliver the record and delivery slips to the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prepare formwork in advance and remove snow, ice, water and debris from within forms. Formwork as specified in Section 03100.
- B. Pre-position reinforcement in advance of concrete pours. Concrete reinforcement as specified in Section 03200.
- C. Place and secure joint materials, anchors and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

3.02 JOINTS

- A. Construction Joints: Locate and install construction joints as indicated on the drawings.
 - 1. Use epoxy bonding compound on concrete surfaces that will be joined with fresh concrete.
- B. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces and elsewhere as indicated.
 - 1. Use nonextruding, resilient bituminous fiber unless noted otherwise on Drawings or below.
 - 2. Use sponge rubber between concrete and steel (such as bridgework, bollards, lamp posts, or sign posts embedded into concrete) or between concrete and other dissimilar material with different expansion coefficients.
 - 3. Joint sealant materials are specified in Section 07900.
- C. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown on drawings.

3.03 CONCRETE PLACEMENT

- A. General: Comply with ACI 301 and follow the guidelines set forth in ACI 304R.
 - 1. Do not add water to concrete during delivery, at Project site or during placement.
 - 2. Maintain reinforcing in proper position during concrete placement operations.
- B. Consolidation: Follow the guidelines set forth in ACI 309R.
- C. Cold Weather Placing: Comply with ACI 306.1.
- D. Hot Weather Placing: Follow the guidelines set forth in ACI 305R.

3.04 FINISH OF FORMED SURFACES

- A. Rough Form Finish: This is the concrete surface having texture imparted by form facing material used. Tie holes and defective areas repaired and patched. Fins and other

projections exceeding ½" (Class C Surface "general standard") in height rubbed down or chipped off.

1. Application: Formed concrete surfaces not exposed-to-view in the finish work.
- B. Smooth Form Finish: This is the concrete surface having texture imparted by selected form facing material used, arranged in an orderly and symmetrically manner with a minimum of seams. Tie holes and defective areas repaired and patched. Fins and other projections exceeding ¼" (Class B Surface "coarse textured"), unless 1/8" (Class A Surface "critical appearance") is indicated on the Drawings, in height rubbed down or chipped off.
1. Application:
 - a. Formed concrete surfaces exposed to view.
 - b. Formed concrete surfaces to be covered with a coating or covering material applied directly to concrete such as waterproofing, damp-proofing, veneer plaster, painting or other similar system.
 - c. Formed concrete surfaces where Smooth Rubbed Finish is to be applied.
- C. Smooth Rubbed Finish: Not later than one-day after form removal, moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced.
1. Application: Formed exposed exterior concrete surfaces down to one-foot below finished grade elevation.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.05 FINISH OF MONOLITHIC SLABS AND FLOORS

- A. General: Comply with recommendations in ACI 302.1R for screeding, leveling and finishing operations for concrete surfaces.
- B. Floor and Slab Tolerances: Comply with ACI 117.
- C. Floor Flatness/Levelness Tolerances: Comply with ACI 117.
1. Floor flatness and levelness shall be determined using a ten-foot straightedge placed anywhere in any direction and applied at not less than two different angles. Measure within 72 hours after concrete placement.
- D. Float Finish: Apply float finish to all concrete floor and slab surfaces.
- E. Trowel Finish
1. Flatness/Levelness tolerance:
 - a. Check and level surface plane to tolerance of 3/16 inch gap using the ten-foot straightedge resting on two high spots anywhere on the surface.
 - b. Cut down high spots and fill low spots.

- c. Uniformly slope surfaces to drains or other depressions shown on the Drawings.
 - 2. Application:
 - a. Surfaces that are exposed to view.
 - b. Surface to receive Broom Finish
 - c. Surfaces to be covered with hardeners, sealers, paint or other thin-film coating systems.
 - d. Surfaces to be covered with resilient flooring or carpet.
 - e. Surfaces to be covered with ceramic or quarry tile set over membrane.
- F. Broom Finish
- 1. Immediately after trowel finishing, roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route.
 - 2. Application:
 - a. Exterior concrete platforms, landings, loading docks, walkways, steps, sidewalks and ramps not indicated on the Drawings to receive another finish or coating.
 - b. Interior concrete landings, steps, ramps, corridors and other passages used as a means of egress not indicated on the Drawings to receive another finish or coating.

3.06 CONCRETE CURING AND PROTECTION

- A. General: Comply with ACI 308:
 - 1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 24 hours.
 - 2. Begin final curing procedures immediately following initial curing and before concrete has dried.
 - 3. Final curing shall continue until the cumulative number of days (or fractions thereof), not necessarily consecutive, during which the ambient air temperature is above 50°F has totaled 7 days (168 hours).
 - 4. Avoid rapid drying at end of final curing period (such as leaving coverings in place without wetting, etc.).
- B. Curing Formed Surfaces: Cure formed concrete surfaces, including walls, undersides of beams, supported slabs and other similar surfaces by Moisture-Curing method with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by approved methods, as applicable.
- C. Curing Unformed and Slab Surfaces: Cure unformed and slab concrete surfaces by Moisture-Curing, Moisture-Cover Curing, Curing Compound or Curing/Sealing Compound methods (or a combination thereof).

3.07 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
 - 1. Immediately after form removal, inspect concrete for surface defects. Defects include color and texture irregularities, crazing, cracks in excess of 0.01" in width, cracks of any width that penetrate to reinforcing, cracks of any width that penetrate completely through unreinforced sections, spalls, air bubbles, honeycombs, rock pockets, voids, fins, projections on the surface, stains and other discolorations that cannot be removed by cleaning, and/or other suspect conditions.
 - 2. For remaining duration of the project, periodically inspect concrete for any changes in condition.
 - 3. Notify the Engineer immediately of any defects or changes in condition along with intended method of repairs and/or patching.
 - 4. Proceed with repairs and/or patching only after approval from Engineer.
 - 5. Remove and replace concrete that cannot be repaired and/or patched to the Engineer's approval or Owner's satisfaction.
- B. Materials and Installed Work Testing: The Engineer may require testing and retesting at anytime during the progress of work. All free access to material stockpiles and facilities.
- C. Nondestructive Testing: Impact hammer, sonoscope or other nondestructive device may be permitted but will not be used as the sole basis for acceptance or rejection of concrete.

END OF SECTION

SECTION 03600

GROUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Sand/Cement Grout.
- B. Non-shrink, Non-metallic Grout.
- C. Reinforced Masonry Grout.
- D. Epoxy Grout.

1.02 RELATED SECTIONS

- A. Individual grouting requirements as specified in various other Sections of these Specifications.
- B. Cast-In-Place Concrete: Section 03300.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Grout manufacturer shall furnish the Engineer with current independent laboratory test results indicating the grout as nonshrink from time of placement; indicating no expansion after final set, ASTM C 827; indicating 4,000 psi strength developed with a trowelable mix within 24 hours, ASTM C 109; and indicating placement time based on initial set of not less than 60 minutes, ASTM C 191.
 - 2. Test results, as supplied by the grout manufacturer, shall indicate that in projects of similar scope and size, the effective bearing area was between 95 and 100 percent.
- B. Submit mix design for sand/cement grout in accordance with Section 03300.

1.04 REFERENCES

- A. American Concrete Institute: ACI 308, Recommended Practice for Curing Concrete.
- B. American Society for Testing and Materials:
 - 1. ASTM C 33; Concrete Aggregates, Spec. for.

2. ASTM C 150; Portland Cement, Spec. for.
3. ASTM C 109; Compressive Strength of Hydraulic Cement Mortars (Using two inch or 50-mm Cube Specimens), Test Method for.
4. ASTM C 191; Time of Setting of Hydraulic Cement by Vicat Needle, Test Method for.
5. ASTM C 404; Aggregates for Masonry Grout, Standard Spec. for.
6. ASTM C 476; Grout for Masonry, Standard Spec. for.
7. ASTM C 596; Drying Shrinkage of Mortar Containing Portland Cement, Test Method for.
8. ASTM C 827; Early Volume Change of Cementitious Mixtures, Test Method for.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Prevent moisture damage and contamination of materials.
- B. Store materials in undamaged condition with seals and labels intact as packaged by the manufacturer.

1.06 PROJECT CONDITIONS

- A. Protect against high and low temperatures and bad weather in accordance with American Concrete Institute standards for placement of concrete.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Grout (Sand/Cement):
 1. Portland Cement: ASTM C 150.
 - A. Type II.
 2. Sand: ASTM C 33, fine aggregate.
 3. Concrete Admixtures: Per Section 03300, as needed, subject to Engineer's approval.
- B. Water: Potable quality, free from deleterious amounts of acids, alkalis, and organic substances.
- C. Non-shrink, Non-metallic Grout: Factory premixed material containing no corrosive irons, aluminums, chemicals or gypsums.
 1. Grouts containing water reducers, accelerators, or fluidifiers shall have no drying shrinkage greater than the equivalent sand cement and water mix as tested per ASTM C 596.

2. Grout shall be nonshrink before initial set and show no expansion after set as tested per ASTM C 827.
 3. Initial set of grout not less than 60 minutes per ASTM C 191 Test.
 4. Use Type I (Normal) cement for grout applications.
 5. Acceptable Manufacturer:
 - a. U.S. Grout Corporation; FIVE STAR.
- D. Grout (For Reinforced Masonry): Conforming to ASTM C 476.
1. Use Type I (Normal) Portland cement.
 2. Aggregates: ASTM C 404.
- E. Epoxy Grout (for Reinforcing Bars, Dowels and Anchors):
1. Horizontal Applications:
 - a. Sika Corporation, Sikadur 32 Hi-Mod.
 2. Vertical and Overhead Applications:
 - a. Sika Corporation, Sikadur 31 Hi-Mod Gel.
- F. Setting Grout (for Installing Aluminum Railings):
1. Hallemite Lehn and Fink Industrial; Super Por-Rok.
 2. Metalcrete Manufacturing Co.; Wedjrox.

2.02 GROUT QUALITY

- A. Grout (Sand/Cement): Mixture of portland cement, fine aggregate and water to produce:
1. Minimum of 4000 psi compressive strength at 28 days.
 2. Slump of 2 to 4 inches maximum of 8 inches after superplasticizer is added.
 3. Air entrainment ratio of 6 to 10 percent by volume where subjected to freeze-thaw cycles.
 4. Water/cement ration: Maximum .45.
 5. Air Entrainment: 6 to 10 percent by volume.
- B. Non-Shrink, Non-Metallic Grout: Use ready-mix type requiring only the addition of water. Do not add other materials. Water requirement proportions shall conform to manufacturer's specifications for the desired mix consistency.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Forming:
1. Use forming procedures that allow proper and complete placement of grout.

2. Anchor Support elements so no movement is possible.
 3. Remove supports only after grout has hardened.
 4. Pre-treat with forming oils wood forms that may absorb moisture.
- B. Preparation of Surface:
1. General: Clean areas to be grouted free of oil, grease, laitance, dirt and other contaminants. Remove loose material. Remove rust, paint, and oil from metal components in contact with grout.
 2. Non-Shrink Grout: Perform additional surface preparation in accordance with manufacturer's instructions.
 3. Clarifier Base Slab Grouting:
 - a. Grind down high spots to achieve 2" grout thickness at any point on slab.
 - b. Place and secure joint filler materials on the floor slab joints with top of filler 1/2" below finish grout level.
 - c. Just prior to grouting, wet and dampen floor slab; do not allow standing water.

3.02 MIXING

- A. Equipment: Use power operated mechanical mixer.
- B. Time:
1. Grout (Sand/Cement): In accordance with requirements for cast-in-place concrete.
 2. Non-Shrink Grout: In accordance with manufacturer's instructions.
 3. Masonry Grout: In accordance with ASTM C 476.

3.03 PLACING

- A. Grout (Sand/Cement): Place and cure grout as follows:
1. Following surface preparation, saturate the concrete with water; then remove excess water and brush on a coat of neat cement. Place grout while neat cement is wet.
 2. Place in a single pour. Straight-edge exposed grout surface for trueness, consolidate and finish with a steel trowel.
 3. Cure and seal in accordance with ACI 308.
 4. In vertical applications, place grout in monolithic pours.
- B. Non-Shrink Non-Metallic Grout: Perform grout placement in accordance with the recommendations of ACI and the manufacturer's published specifications for mixing and placing. Place non-shrink non-metallic grout only where indicated on Drawings.

- C. Epoxy Grout: To be applied per manufacturer's exact instructions.

3.04 GROUT APPLICATION SCHEDULE

- A. Grout:
 - 1. To fill spaces and to provide slopes where shown on the Drawings.
 - 2. Other applications as shown on the Drawings.
- B. Non-shrink Grout:
 - 1. Equipment base plates.
 - 2. Structural column base plates.
 - 3. Concrete repair or other works where shown on the Drawings or requested by Engineer during construction.
- C. Non-shrink Epoxy Grout:
 - 1. Base plates for equipment which has driving motor rated 500 HP and above.
 - 2. Other locations where called for on the Drawings.

END OF SECTION

SECTION 05500
METAL FABRICATIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Miscellaneous Metals.
- B. Shop Fabricated Metal Items.
- C. Anchors and Fasteners.

1.02 RELATED SECTIONS

- A. Individual miscellaneous metal items as specified in various other Sections of the general construction specifications.

1.03 QUALITY ASSURANCE

- A. Welder Qualifications: Welds shall be made only by welders, tackers and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code, AWS D1.1 of the American Welding Society to perform the type of work required.
- B. Anchor and Fastener Design Requirements:
 - 1. Sizing: Provide anchors and fasteners for Product installations of such diameters and lengths as recommended by the particular Product manufacturer involved.
 - a. When sizing recommendations are not obtainable, size fasteners in the largest diameter that will pass through bolt holes as provided in the Products for anchoring and fastening purposes.
 - 2. Safety Factor: Determine the lengths of anchors and fasteners based on substrate materials at points of anchor installation and to provide a safety factor of four to one.
 - 3. Materials Compatibility: Where anchors and fasteners contact dissimilar metal Products provide anchors and fasteners of compatible material so that neither will have a deteriorating action on the other.

1.04 REFERENCES

- A. American Society For Testing and Materials:
 - 1. ASTM A 36; Structural Steel, Spec. for.
 - 2. ASTM A 53; Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless, Std. Spec. for.
 - 3. ASTM A 123; Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip, Spec. for.
 - 4. ASTM A 153; Zinc Coating (Hot-Dip) on Iron and Steel Hardware, Spec. for.
 - 5. ASTM A 167; Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip, Spec. for.
 - 6. ASTM A 276; Stainless and Heat-Resisting Steel Bars and Shapes, Spec. for.
 - 7. ASTM A 307; Carbon Steel Bolts, and Studs, 60,000 PSI Tensile Strength, Standard Spec. for.
 - 8. ASTM A 320; Alloy-Steel Bolting Materials for Low-Temperature Service, Spec. for.
 - 9. ASTM A 325; High-Strength Bolts for Structural Steel Joints, Spec. for.
 - 10. ASTM A 480; Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; Spec. for General Requirements.
 - 11. ASTM A 489; Carbon Steel Eyebolts, Spec. for.
 - 12. ASTM A 563; Carbon and Alloy Steel Nuts, Spec. for.
 - 13. ASTM A 569; Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip, Commercial Quality, Spec. for.
 - 14. ASTM B 454; Mechanically Deposited Coatings of Cadmium and Zinc on Ferrous Metals, Spec. for.
 - 15. ASTM F 436; Hardened Steel Washers, Spec. for.
- B. American Welding Society: AWS D1.1 Structural Welding Code.
- C. Federal Specifications:
 - 1. Fed. Spec. FF-B-588 C, Bolts, Toggle and Expansion Sleeve (Screw).
 - 2. Fed. Spec. FF-S-92a, Screws, Machine: Slotted, Cross-Recessed or Hexagon Head.
 - 3. Fed. Spec. FF-S-107 C, Screws, Tapping and Drive.
 - 4. Fed. Spec. FF-S-325, Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry) Group II (Shield, Expansion Bolt Anchor) Type 4 (Wedge Expansion Anchors) Class 1 (One-Piece Steel Expander with Cone Taper Integral with Stud).
- D. Steel Structures Painting Council:
 - 1. Surface Preparation Specifications:
 - a. SSPC-SP 1, Solvent Cleaning.
 - b. SSPC-SP 2, Hand Tool Cleaning.
 - c. SSPC-SP 3, Power Tool Cleaning.

- d. SSPC-SP 6, Commercial Blast Cleaning.
- e. SSPC-SP 8, Pickling.
- f. SSPC-SP 10, Near-White Blast Cleaning.
- 2. Paint Application Specifications: SSPC-PA 1, Shop, Field and Maintenance Painting.

1.05 SUBMITTALS

- A. Shop Drawings and Product Data:
 - 1. Shop drawings shall identify the detail as indicated on the Engineer's Drawings and be complete as to the detail of the product and location in the project, the size of members, the methods of joining various components, the quantity, finish, the location and type of anchors and necessary measurements.
 - 2. Shop assemblies which require markings for erection identification shall have easy-to-read markings on the shop and erection drawings.
 - 3. Note on shop drawings variations in tolerances or clearances between various products.
 - 4. Use standard welding symbols of the American Welding Society on shop drawings.
 - 5. Furnish setting diagrams, templates, and directions for the installation of metal fabrications.
 - 6. Submit product data on type of finish paint system for both shop painting and field touch up painting.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Store steel products above the ground surface on platforms, skids, blocking or other supports.
- B. Protect steel products from exposure to conditions that produce rust on the product.
- C. Handle steel so no parts are bent, broken or otherwise damaged and avoid damage to other material and work during handling and erection.
- D. Store steel beams with webs vertical.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Miscellaneous Metal: Steel used for miscellaneous metal applications shall conform to ASTM A 36.
 - 1. Steel Shapes, Plates and Bars: ASTM A 36.
 - 2. Stainless Steel Shapes and Bars: ASTM A 276, AISC Type 304 and 316.
 - 3. Stainless Steel Plate, Sheet and Strip: ASTM A 167 and A 480.
- B. Shop Paint:
 - 1. Type of shop paint used must be compatible with paint applied in the field.
- C. Pipe Stanchions: Schedule 40 black steel pipe conforming to ASTM A 53, filled with 3,000 psi concrete as specified in Section 03300.
- D. Metal Strut Systems: Type 304 stainless steel; channels cold formed from 12 gauge steel, channels, fittings, and accessories as manufactured by B-Line Systems, Inc.

2.02 ANCHORS AND FASTENERS

- A. Miscellaneous Screws and Bolts:
 - 1. Machine Screws: AISC Type 304 stainless steel conforming to Fed. Spec. FF-S-92a.
 - 2. Stainless Steel Bolts, Nuts and Washers: ASTM A320 Grade B8, AISC Type 304.
 - 3. Standard Steel Bolts, Nuts and Washers: ASTM A307.
 - 4. Toggle Bolts: Conforming to Fed. Spec. FF-B588C.
 - 5. Self-Tapping Drive Screws: Conforming to Fed. Spec. FF-S-107C.
 - 6. U-Bolts: Carbon steel with National Coarse Threads and zinc coated finish.
 - 7. Eyebolts: Carbon steel with National Coarse Threads and zinc coated finish: ASTM A 489.
- B. High-Strength Structural Steel Bolts, Nuts and Washers:
 - 1. ASTM A 325 Specification for Bolts.
 - 2. ASTM A 563 Specification for Carbon and Alloy Steel Nuts.
 - 3. ASTM F 436 Specification for Hardened Steel Washers for Use with High-Strength Bolts.
- C. Steel Anchor Bolts: Shapes as indicated, ASTM A 307.
- D. Anchor Bolts (Pre-Set): Where anchor bolts are indicated or required as Pre-set in cast-in-place concrete or grouted in masonry, provide anchor bolts of lug or bent shape design.
 - 1. Galvanized Anchor Bolts: ASTM A 307 for bolts, nuts and washers; and ASTM B 454 or A 153 for galvanizing.
 - 2. Stainless Steel Anchor Bolts: ASTM A 320, Grade B8, AISC Type 303 or 304.
- E. Drilled-In Expansion Anchors and Fasteners (unless shown otherwise on the Drawings):

1. Applications In Masonry (and Precast Concrete Hollow-Core Structural Elements):
 - a. Anchors: Provide anchors designed to accept both machine bolts and/or threaded rods. Such anchors shall consist of an expansion shield and expander nut contained inside the shield. Expander nut fabricated and designed to climb the bolt or rod thread and simultaneously expand the shield as soon as the threaded item, while being tightened, reaches and bears against the shield bottom.
 - 1) Shield Body: Consisting of four legs, the inside of each tapered toward shield bottom (or nut end). The end of one leg is elongated and turned across shield bottom. Outer surface of shield body ribbed for grip-action.
 - 2) Expander Nut: Square design with sides tapered inward from bottom to top.
 - 3) Material: Die cast Zamac No. 3 zinc alloy of 43,000 psi minimum tensile strength. Shield and nut made in conformance with S.A.E. 90 3 ASTM XI.
 - b. Fasteners: Machine bolts conforming to S.A.E. Grade 2, for use with above anchors; nuts and washers conforming to ASTM A 563.
 - c. Acceptable Manufacturers:
 - 1) U.S.E. Diamond, Inc.; FORWAY System.
 - 2) No substitutions allowed.
 2. Applications in Cast-in-Place Concrete (and Solid Precast Concrete Structural Elements):
 - a. Anchor/Fastener: UL Listed and one-piece stud (bolt) with integral expansion wedges, nut and washer, and meeting physical requirements of Fed. Spec. FF-S-325, Group II, Type 4, Class 1.
 - b. Stainless Steel Anchor/Fastener: UL Listed one-piece stud (bolt) with integral expansion wedges, nut and washer, and meeting physical requirements of Fed. Spec. FF-S-325, Group II, Type 4, Class 1. Stud of AISI Type 303 or 304 stainless and nut and washer of AISI Type 316 stainless.
 - c. Acceptable Manufacturers:
 - 1) U.S.E. Diamond, Inc.; SUP-R-STUD.
 - 2) Hilti Fastening Systems; KWIK-BOLT.
 - 3) Molly Fastener Group; PARABOLT.
 - 4) No substitutions allowed.
- F. Drilled-In Adhesive Anchors (Horizontal Applications Only): Composed of an anchor rod assembly and an anchor rod adhesive cartridge.
1. Stainless Steel Anchor Rod Assembly: Chamfered and threaded stud rod of AISI Type 304 stainless, with nut and washer of AISI Type 316 stainless.
 2. Adhesive Cartridge: Sealed capsule containing premeasured amounts of resin, quartz sand aggregate, and a hardener contained in a separate vial within the capsule. Capsule ingredients activated by the insertion procedure of the anchor rod assembly.
 3. Acceptable Manufacturers:

- a. U.S.E. Diamond, Inc.: SUP-R-SET.
 - b. Hilti Fastening Systems; HVA.
 - c. Molly Fastener Group; PARABOND.
 - d. Or Equal.
- G. Hammer drive-type and explosive charge drive-type anchors and fastener systems not acceptable. Lead shields, plastic-inserts, fiber-inserts, and drilled-in plastic sleeve/nail drive systems also not acceptable.
- H. Welding Electrodes: Table 4.1.1 of AWS D1.1 as required for applicable base metals and welding process.

2.03 FABRICATION

- A. Insofar as possible, fit and shop assemble metal fabrications, ready for installation.
- B. Fabricate in accordance with details, approved shop drawings and referenced standards.
- C. Drill or punch holes required for the attachment of work of other trades and for bolted connections. Burned holes are not acceptable.
- D. Welding shall be in accordance with AWS D1.1.
- E. Dress smooth welds and sharp corners.
- F. Make work square, plumb, straight and true.

2.04 SHOP PAINTING

- A. Surface Preparation: Before cleaning, remove weld splatter and grind smooth to a rounded contour sharp edges and welds.
 - 1. Blast-Cleaning:
 - a. Metal Submerged or Intermittently Submerged in Liquid: SSPC-SP 10 or SSPC-SP-8.
 - b. Metal Non-Submerged and Directly Connected to Submerged or Intermittently Submerged Metal: SSPC-SP 6.
 - c. Remove dust and spent sand from surface by brushing or vacuum cleaning.
 - 2. Mechanical Cleaning:
 - a. Clean steelwork of loose mill scale, loose rust, weld slag or flux deposit, dirt and other foreign matter by Hand Cleaning (SSPC-SP 2) or Power Cleaning (SSPC-SP 3).
 - b. Remove grease, oils, tars and other contaminants by Solvent Cleaning (SSPC-SP 1).

- B. Painting:
 - 1. Apply shop paint to prepared steel before surface starts to rust.
 - 2. Apply shop paint in accordance with SSPC-PA 1.
 - 3. Minimum dry mil thickness of shop paint, 1.5 mils.
 - 4. Steel encased in concrete will not require shop paint.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect the installed work of other trades and verify that such work is complete to the point where this work may properly commence.

3.02 PREPARATION

- A. Field Measurements: Verify measurements in field before fabrication.

3.03 ERECTION

- A. Erect and install miscellaneous metal and metal fabrications in accordance with details, approved shop drawings and referenced standards aligning straight, plumb and level within a tolerance of one in 200.
- B. Provide suitable temporary braces and stays to hold metal fabrications in position until permanently secured.
- C. Draw threaded connections up tight with lock washers or other means to prevent loosening. Screw type fasteners installed in exposed finished surfaces may be slot head or phillips head type, but in either case, screws must be countersunk design.
- D. Drilled-In Expansion Anchor Installation:
 - 1. General: In general, install expansion anchors in strict accordance with manufacturer's instructions and in accordance with the following.
 - 2. Drilling Holes: Use rotary hammer type drill and make drill holes to the required diameter and depth as consistent with anchor manufacturer's instructions for size of anchors being installed.
 - 3. Minimum Embedment: Embed expansion anchors to four and one-half bolt diameters, unless otherwise indicated on Drawings.
- E. Drilled-In Adhesive Anchor Installation:
 - 1. General: In general, install adhesive anchors in strict accordance with manufacturer's instructions and in accordance with the following.

2. Drilling Holes: Use rotary hammer type drill and make drill holes to the required diameter and depth as consistent with anchor manufacturer's instructions for size of anchors being installed.
 - a. Prior to setting cartridge and anchor stud clean drilled holes free of loose material by vacuum process, finishing with a blast of compressed air, and cover hole until actual use.
 3. Anchor Rod Installation: Following cartridge installation in prepared drill holes, set anchor rod to the required depth. Set anchor rods truly perpendicular (normal) to the base plate of item being anchored.
- F. Erect miscellaneous structural steel in accordance with the Drawings, pertinent regulations and referenced AISC standards.
- G. Assemble posts and framing members of railings such that the completed structure shall be capable of withstanding a concentrated load of at least 200 pounds applied at any direction at any point on the top rail. Top railings shall be capable of resisting a uniform loading of 50 pounds per foot applied in any direction. The concentrated and uniform loading conditions shall not be applied simultaneously.
1. Anchor railings to metal structural members by welding and to concrete by insertion into present sleeves with non-shrink, non-metallic grout, or mounted with sleeve anchors.
 2. Make railing bends without the use of fittings, where practical.
- 3.04 FIELD TOUCH-UP PAINTING
- A. General: Paint field bolt heads and nuts, field welds and areas within 2 inches of welds and touch up abrasions in the shop coat.
- B. Surface Preparation: Use methods at least as effective as those specified for the structure itself.
- C. Paint: Specified shop paint.

END OF SECTION

SECTION 05600

ALUMINUM FABRICATIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Miscellaneous aluminum, shapes, plates and bars.
- B. Aluminum access doors and Hatches.
- C. Aluminum ladders and fabrications

1.02 RELATED SECTIONS

- A. Grout: Section 03600.
- B. Metal Fabrications: Section 05500.

1.03 QUALITY ASSURANCE

- A. Applicator Qualifications:
 - 1. Aluminum Pipe Railing: Installer must be approved by pipe railing system manufacturer as a qualified installer.
- B. Welder Qualifications: Welds shall be made only by welders, tackers and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code, AWS D1.1 of the American Welding Society to perform the type of work required.

1.04 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI B18.2.1, Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws.
- B. American Society For Testing and Materials:
 - 1. ASTM A194; Carbon and Alloy Steel Nuts for Bolts for High Pressure and High-Temperature Service.
 - 2. ASTM A320; Alloy Steel Bolting Materials for Low-Temperature Service.
 - 3. ASTM A489; Carbon Steel Eyebolts.
 - 4. ASTM B209; Aluminum and Aluminum-Alloy Sheet and Plate.

5. ASTM B221; Aluminum and Aluminum-Alloy Extruded Bar, Rod, Wire, Shape and Tube.
 6. ASTM B241; Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
 7. ASTM B308; Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
- C. American Welding Society: AWS Handbook Section 4, Chapter 69 Aluminum and Aluminum Alloys.
- D. Federal Specifications:
1. Fed. Spec. FF-S-92a, Screws, Machine: Slotted, Cross-Recessed or Hexagon Head.
 2. Fed. Spec. TT-P-645, Primer, Paint, Zinc-Chromate, Alkyd Type.

1.05 SUBMITTALS

- A. Shop Drawings and Product Data:
1. Include complete information necessary for fabrication and erection.
 2. Indicate size and weight of shapes, type and location of shop and field connection; the type, size and extent of welds and welding sequence when required. Use standard welding symbols of the American Welding Society in shop drawings.
 3. Include manufacturer's descriptive literature and specifications covering products specified herein.
- B. Submit trench coverplates, platforms and stairs' calculations for Engineer's review. Calculations shall be sealed by a Professional Engineer registered in the State of Maryland.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle pre-finished products in a manner that will prevent material damage and deterioration or contamination from the elements.
- B. Provide protective wrapping on pre-finished aluminum products and maintain such in place until project is ready for final inspection.

PART 2 - PRODUCTS

2.01 MATERIALS

- ### A. Aluminum Fabrications:

1. Aluminum Structural Shapes: Aluminum alloy 6061-T6 conforming to ASTM B308, rolled or extruded.
 2. Aluminum Rod and Bars: Aluminum alloy 6061-T6 conforming to ASTM B221.
 3. Aluminum Sheet and Plate: Aluminum alloy 6061-T6 conforming to ASTM B209.
 4. Checkered Aluminum Plate: Aluminum alloy 6061-T6 conforming to ASTM B209. Thickness of the plates shall not include raised portion.
- B. Hardware and Miscellaneous Items:
1. Eye Bolts: Carbon Steel conforming to ASTM A489.
 2. Machine Screws: AISC Type 304 stainless steel conforming to Fed. Spec. FF-S-92a.
 3. Hexagon Head Bolts: ANSI B18.2.1 with bright finish.
 4. Stainless Steel Expansion Anchors: Conforming to Fed. Spec. FF-S-325 Group II, Type 4, Class 1, such as Hilti Kwik-Bolt, Phillips Red Head Wedge-Anchor and Molly Parabolt.
 5. U-Bolts and Standard Bolts, Nuts and Washers: ASTM A194 and ASTM A320.
 6. Guard Chain: Individually welded straight link AISC Type 316 stainless steel with stainless steel hook and eye.
- C. Shop Drawings: Shop drawings shall clearly identify the aluminum items as indicated on the Drawings and be complete as to the detail of the product and location of such in the Project.
1. Shop drawings shall indicate size of members, the methods of joining the various components, the location and type of anchors, and the necessary installation reference measurements.
 2. Shop drawings shall indicate fabricated part number and its location in the assembly.
 3. Shop drawings shall include the mechanical properties of structural members.
 4. Detailed load and deflection calculations for the structural support, and grating system shall be submitted as a supplement to the shop drawings. These calculations shall be certified by the manufacturer as complying with the pertinent design criteria stipulated in this specification.
- D. Shop Fabrication: Fabrication shall not proceed until the Contractor has field verified and coordinated with the system manufacturer all dimensions and existing conditions that may affect the final fabrication of the platform and stair systems. After field verification of the necessary information, shop drawings shall be submitted for the Engineer's review and approval.
1. Gratings shall be factory prefabricated in panels. Part panels shall be shop cut to provide banded edges whenever possible.
 2. Each grating panel, or part panel, shall be factory tagged with the manufacturer's drawing and part numbers for ease of field installation.
 3. Hold-down clips in sufficient quantity (to provide clips on four foot maximum

- center in each direction) shall be provided from the factory in the grating package.
4. Openings Through Panels: Split panels in two individual sections to facilitate removal of panels at pipes, conduits, ducts, and similar objects passing through grating. Band openings as previously specified.
 5. Fabricate all components of the grating system in the factory so that field cutting will not be required.
 6. Manufacturing Tolerances:
 1. Panel plan dimensions: Plus/Minus 1/8-inch.
 2. Panel thickness: Plus 1/16-inch, Minus 0 inches.
- E. Contractor shall design and construct miscellaneous concrete foot pads, piers and any other incidental concrete supports as may be required by the platform system manufacturer.
- F. Size support members to carry the specified loads and to provide a minimum of 1 1/2-inch bearing surface for grating bearing bars.
- G. Fabricate supports to provide standard 1/4-inch grating installation clearance.
- H. For supports anchored to concrete surface, provide suitable stainless steel anchor bolts, nuts and washers. Provide coating for all aluminum in contact with concrete as specified in Paragraph 2.03.
- I. For supports to be attached to metal structures, provide dissimilar material isolation, stainless steel bolts, nuts and washers.

2.02 FABRICATED PRODUCTS

- A. Aluminum Access Doors: The Bilco Company Type J-AL and JD-AL or comparable products by Pennsylvania Insert Corporation, Inland Steel Products Co., or Halliday Products, Inc.
1. Door Leafs: 1/4 inch minimum aluminum diamond plate reinforced to withstand a live load of 300 lbs. per square foot for interior and exterior access doors and reinforced to withstand 18,000 pounds concentrated loading at the center of the door for exterior access doors where concrete slab adjacent to the door is rated for AASHTO H20 loading. Aluminum hatch shall be double leaf with flush type handle and lock.
 2. Channel Frame: 1/4 inch aluminum with an anchor flange around the perimeter.
 3. Door(s): Equip with heavy forge brass hinges, stainless steel pins, spring operators and automatic hold-open arm with release handle.
 4. Lock: Snap lock with removable handle.
 5. Drainage Coupling: Locate a 1-1/2 inch drainage coupling in the corner of the channel frame.
 6. Hardware: Stainless Steel.

7. Safety Chains: Stainless steel; Provide posts and chains on single leaf doors and chains at both ends of the double leaf doors.

2.03 COATINGS

- A. Paint (Dissimilar Surface Isolation Material):
 1. Zinc Chromate Primer: Fed. Spec. TT-P-645.
 2. Mineral filled coal tar pitch: Tnemec 46-449.

2.04 FABRICATION

- A. Insofar as possible, fit and shop assemble aluminum fabrications ready for installation.
- B. Fabricate work square, plumb, straight and true.
- C. Weld Aluminum in accordance with AWS Handbook Section 4, Chapter 69.
- D. Dress smooth welds and sharp corners.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Field Measurements: Verify measurements in the field before fabrication.

3.02 ERECTION

- A. Erect and install in accordance with details, approved shop drawings and referenced standards aligning straight, plumb and level with a tolerance of one in 200.
- B. Draw threaded bolt connections up tight with lock washers or other means to prevent loosening. Screw fasteners in exposed or finished surfaces may be slot or phillips head type, but in either case, screws must be counter-sunk design.
- C. Expansion Anchor Installation:
 1. General: Install expansion anchors in strict accordance with manufacturer's instructions and in accordance with the following.
 2. Drilling Holes: Use rotary hammer type drill and make drill holes to the required diameter and depth consistent with anchor manufacturer's instructions for size of anchor being installed.
 3. Minimum Embedment: Embed expansion anchors to four and one-half bolt diameters, unless otherwise indicated on the Drawings.

D. Dissimilar Surfaces Isolation:

1. Paint aluminum surfaces at point of contact with wood, concrete or masonry construction with one coat (minimum dry mil thickness - 5.0 mils) of bituminous paint.
2. Paint aluminum surfaces at point of contact with steel with one coat of zinc chromate primer.
3. Clean away excess or misplaced paint materials from aluminum surfaces and adjoining construction materials.

END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Exterior and Interior Sealants.
- B. Pourable Sealant.
- C. Sealant Accessories.

1.02 RELATED SECTIONS

- A. Division 3 - Concrete.
- B. Individual sealant and caulking requirements as specified in various other Specifications Sections.

1.03 SYSTEM DESCRIPTION

- A. Definitions: The terms Sealant and Caulking are defined as follows:
 - 1. Sealant: Refers to compounds used to seal exterior vertical and horizontal joints.
 - 2. Caulking: Refers to compounds used to seal interior vertical and horizontal joints except horizontal interior floor joints which will be treated on an individual basis.

1.04 REFERENCES:

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C834; Latex Sealing Compounds, Spec. for.
 - 2. ASTM D412; Rubber Properties in Tension, Test Methods for.
- B. Federal Specifications:
 - 1. Fed. Spec. TT-S-00230C, Sealing Compound Elastomeric Type, Single Component (For Caulking, Sealing and Glazing in Buildings and Other Structures).

1.05 SUBMITTALS

- A. Samples: Include in submission an individual sample of Sealants and Caulking materials presented in Product Data submission.

- B. Product Data: Submit manufacturer's descriptive product data and current specifications covering Sealants and Caulking products and application instructions for such.
- C. Color Selection: Submit manufacturer's standard color charts in submittal for Engineer's color selections. Color to match adjacent surfaces.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver compound products in manufacturer's original, unopened packages and containers bearing manufacturer's name and brand designation.
- B. Store compounds in sealed containers in a dry protected area and protect from freezing.
- C. Do not use compounds that have been stored for a period of time exceeding the maximum recommended shelf life of the materials.

1.07 PROJECT CONDITIONS

- A. Environmental Requirements: Apply compounds during dry weather when air and surface temperatures are within manufacturer's recommended limitations.
 - 1. Do not proceed with compounds installation when joint substrates are damp, wet or frozen.
 - 2. Consult the compound manufacturer for specific environmental instructions before proceeding.
- B. Joint Conditions: In general, joint configuration and joint surfaces are as indicated on the Drawings.
 - 1. Do not proceed with compound installation if a joint width is less than designed.
 - 2. The trade performing the work of this Section shall inform the Contractor of above stated condition and await written acknowledgement with an order to proceed.
 - 3. The Contractor shall inform the Engineer in writing of joint width conditions stated above and await his determination for corrective measures.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Gun-Grade Sealant:
 - 1. Structure Joint Sealant: Moisture cured, one component, polyurethane base, non-sag elastomeric sealant compound meeting requirements of Fed. Spec. TT-S-00230C, Type II Class A, with following properties:

- a. 100 percent modulus: 132 psi cured and tested after 21 days at 73 degrees F according to ASTM D412.
 - b. Shore A Hardness: Minimum 30 plus/minus 3 cured and tested after 21 days at 73 degrees F.
 - c. Tensile Strength (at break): Minimum 175 psi cured and tested after 21 days at 73 degrees F according to ASTM D412.
 - d. Elongation (at break): Minimum 700 percent when cured and tested after 21 days at 73 degrees F. according to ASTM D412.
 - e. Sealants in potable water structures shall be NSF approved.
 2. Acceptable Manufacturers:
 - a. Sika Corporation; Sikaflex - 1a.
 - b. Or Equal.
- B. Pourable-Grade Sealant:
1. Horizontal Joint Sealant: Self-leveling, moisture cured, one component, polyurethane base, elastomeric sealant compound meeting requirements of Fed. Spec. TT-S-00230C, Type I Class A, with following properties:
 - a. 100 percent modulus: 65 plus/minus 5 psi cured and tested after 21 days at 73 degrees F. according to ASTM D412.
 - b. Shore A Hardness: 25 plus/minus 5 cured and tested after 21 days at 73 degrees F.
 - c. Tensile Strength (at break): 250 psi cured and tested after 21 days at 73 degrees F. according to ASTM D412.
 - d. Elongation (at break): 500 percent when cured and tested after 21 days at 73 degrees F. according to ASTM D412.
 2. Acceptable Manufacturers:
 - a. Sika Corporation; Sikaflex - 12SL.
 - b. Pecora Corporation.
 - c. Sonneborn Building Products Division.
 - d. Or Equal.
- C. Sealant Application Products:
1. Sealant Primer: Suitable to substrate surfaces and as recommended by the sealant manufacturer. Obtain directions from manufacturer whether primer is staining or non-staining prior to application.
 2. Joint Backing: Preformed compressible, resilient, non-waxing, non-extruding, non-staining strips (polyethylene foam, urethane foam, butyl) as recommended by sealant manufacturer. Provide backing of sizes and shapes to suit the various joint conditions encountered. Backing must be compatible with sealant, primers and substrates.
 3. Bond Breaker: As recommended by sealant manufacturer.
 4. Cleaning Agent: As recommended by sealant manufacturer.

D. Non-Meltable Mastic Waterstop Sealant:

1. Pressure Grade (Medium-stiff), for locations where movement is slow and expected temperature range is 30-130 degrees F.; IGAS Joint Sealant, Sikaflex 405.
2. Knife Grade (Medium-soft), for locations where temperature changes rapidly and expected range is 10-110 degrees F.; IGAS Joint Sealant, Sikaflex 406.
3. Primer, black asphaltic liquid; Sikaflex 409.
4. Acceptable Manufacturers:
 - a. Sika Corporation.
 - b. Or Equal.

E. Gun-Grade Caulking:

1. Structure Joint Caulking: Provide a one-part gun grade acrylic latex base caulking compound conforming to requirements of ASTM C834.
2. Provide caulking in white color suitable for paint concealment.
3. Acceptable Manufacturers:
 - a. Dap, Inc., DAP Acrylic Latex Caulk.
 - b. Pecora Corporation, AC-20 Acrylic Latex Caulk.
 - c. Woodmont Products, Inc., Chem-Calk 600.
 - d. Or Equal.
4. Caulking Joint Backing: Preformed compressible resilient, non-waxing, non-extruding, non-staining rope forms of polyethylene or urethane foam. No closed-cell foam products permitted. Provide backing of sizes and shapes to suit the various joint conditions encountered.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Conditions:

1. Prepare joint surfaces to a sound, smooth, clean and dry condition free of visible contaminants.
2. In the construction of joint surfaces, control applications of non-visible coatings or contaminants to surfaces of rabbet area prior to applications of compounds.

B. Preparation of Surfaces:

1. Priming: Thoroughly clean joints and apply primer (if recommended by compound manufacturers) to dry surfaces.
2. Joint Backing: In joints where depth of joint exceeds the required depth of compound, install joint backing to provide backing and uniform depth of sealant. Install joint backing with approximately 30 percent compression. Do not stretch, twist, puncture, or tear joint backing. Butt joint backing at intersections.

3. Bond Breaker: Install bond breaker tape smoothly at back of joint where joint backing is not required or cannot be installed.

3.02 INSTALLATION

- A. Application: Apply compound in accordance with manufacturer's application manual and instructions, using hand guns or pressure equipment, with proper nozzle size, on clean, dry, properly prepared substrates.
 1. Force compound into joint and against sides of joint to make uniform. Avoid pulling of the compound from the sides. Fill joint space completely.
 2. Compounds shall adhere only to the sides and not to the back of the joint so as to eliminate three-sided adhesion.
- B. Tooling: Tool compounds to ensure firm contact with joint interfaces and to form smooth, uniform beads with slightly concave surfaces. Finish joints to form a straight, uniform, smooth neat finish.
 1. Tooling agents should only be used if recommended by compound manufacturers.
- C. Masking: Where an irregular surface or sensitive joint border exists apply masking tape at joint edges to ensure joint neatness and Protection. Remove tape following completion of work.
- D. Pourable-Grade Sealant Application: Observe manufacturer's technical notes for sealant application concerning air entrapment, moisture curing and tooling.
 1. To ensure best performance of sealant, pour sealant into joint when joint slot is at mid-point of its designed expansion and contraction.
- E. Locations: The following is a listing of certain joint locations. The list is included for convenience only and is not to be construed as complete. The responsibility for all joint treatment rests solely with the Contractor.
 1. Exterior Structure Joints:
 - a. Use Gun-Grade Sealant to seal exterior structure joints.
 - b. Seal exterior joints in the structure as indicated on Drawings, and also such joints not indicated, to render the structure leak free from wind, water, dust and weather.
 2. Interior Structure Joints:
 - a. Use Gun-Grade Caulking to seal interior structure joints.
 - b. Caulk interior joints between aluminum frames and opening substrates. Color match Caulking to the aluminum finish.
 3. Exterior Trafficked and Non-Trafficked Horizontal Working Joints:
 - a. Use Pourable-Grade Sealant to seal exterior trafficked joints.

4. Interior Trafficked Horizontal Working Joints:
 - a. ONLY where indicated in structure interior use Pourable-Grade Sealant to seal trafficked joints.

5. Mastic Waterstop Sealant Application:
 - a. Use the hot-trowel application method.
 - b. Apply waterstop into joint in three or more separate layers, allowing each layer to cool.
 - c. Compact tightly during application and after cooling.
- F. Cleaning: Clean off excess compounds or smears with cleaning agents as recommended by the compound manufacturers.

END OF SECTION

SECTION 09900

PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Surface Preparation

1.02 RELATED SECTIONS

- A. Prefinishing or shop priming requirements as specified in various other Sections of these Specifications.

1.03 QUALITY ASSURANCE

- A. Applicator Qualifications: Painting applicator shall show evidence of acceptability as a qualified applicator by the manufacturer of products specified herein. Submit such evidence with Submittals as specified herein.
- B. Applicator shall have minimum five years documented experience in Projects of the type and size to be undertaken by this Contract.

1.04 REFERENCES

- A. Steel Structures Painting Council Surface Preparation Specifications (SSPC):
 - 1. SSPC-SP1, Solvent Cleaning.
 - 2. SSPC-SP2, Hand Tool Cleaning.
 - 3. SSPC-SP3, Power Tool Cleaning.
 - 4. SSPC-SP5, White Metal Blast Cleaning.
 - 5. SSPC-SP6, Commercial Blast Cleaning.
 - 6. SSPC-SP8, Pickling.
 - 7. SSPC-SP10, Near-White Blast Cleaning.

1.05 SUBMITTALS

- A. Samples: Submit sample color chips of standard colors and samples of any intermixes required to match colors indicated in Finish Schedule on Drawings.
- B. Schedule and Product Data: Submit paint schedule in same format as the paint scheduled herein, and indicate which of the selected manufacturer's products are intended for use. Do not perform painting or coating work without Engineer's approval of submitted paint schedule.

- C. Certificates: Paint manufacturer's direct factory representative shall certify in writing to the Engineer painting and coating compliance with the following:
 - 1. Factory representative's initial site inspection of conditions pertinent to painting and coating work with Contractor or his authorized painting representative.
 - 2. Factory representative's second site inspection at completion of painting and coating work to check proper application and actual mil thickness compliance with these Specifications.
 - 3. Certification issued to Engineer only following unacceptable Painting and coating work being rectified to Engineer's satisfaction.
 - 4. Factory representative shall make his services available to the Engineer for immediate consultation in regard to the painting and coating work, and shall make above stated inspections in the Engineer's presence.
- D. Operation and Maintenance Data: Upon approval of painting schedule, submit five copies of a detailed maintenance manual including the following information:
 - 1. Name, address and telephone number of manufacturer and local distributor.
 - 2. Product name, number and technical data sheet for each type of paint.
 - 3. Detailed procedures for routine maintenance and cleaning.
 - 4. Detailed procedure for light repairs such as chips, scratches and staining.
- E. Maintenance Materials: Turn over to Owner upon completion of the Project a full set of pipe line identification stencils.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver paint materials to job site in their original, sealed containers with labels intact and legible at time of use.
- B. Store approved materials at the job site in a suitable and designated area restricted to storage of paint and coating materials and related equipment.
- C. Use all means necessary to ensure safe storage and use of paint and coating materials and the prompt and safe disposal of waste. Store paint and coating products protected from weather when such products may be affected by freezing.

1.07 PROJECT CONDITIONS

- A. Field and Shop Coat Compatibility: To ensure satisfactory paint and coating performance, it is a Contract requirement that products applied in the shop and field be mutually compatible.
 - 1. Contractor shall require fabricators and equipment manufacturers to apply shop coats that are compatible with field coats specified herein.
- B. Painting Factory-Finished Items:

1. Equipment, such as motors, pumps and other such items, which when installed become an integral part of a system and which may be delivered fully factory-finished (that is, having finish coatings in addition to the prime coating) shall not require repainting in the field unless:
 - a. Factory finish is unacceptable to the Engineer, that is, not having generic type of paint or proper mil thickness to withstand corrosive atmosphere, immersion, severe exposure; or,
 - b. Factory finish is damaged.
 - c. On factory-finished items requiring repainting, first sand existing paint to a dull finish and then repaint in scheduled finish system for the installed location of such factory-finished items.
 2. Factory finished building structure components, both exterior and interior and fully factory finished general construction products, appliances and panels shall not require field painting.
- C. Painting Caulking Compound: Do not apply paint over caulking compound until integral solvents have been released from the compound.
- D. Color:
1. Paint equipment not furnished with a factory finish, or not finished with an acceptable factory finish, and piping and conduits the same color as adjacent surface.
 2. Final work shall match Engineer approved samples. Engineer shall select colors where not indicated or specified with no extra compensation allowed the Contractor for such.
- E. Placing Into Service: Do not place painted items into service until paints and coatings are fully cured (dry-hard).
- F. Environmental Requirements:
1. Adhere to manufacturer's data on air and surface temperature limits and relative humidity during application and curing of coatings.
 2. Schedule coating work to avoid dust and airborne contaminants.
 3. Apply exterior finishes during daylight hours only.
 4. When painting must be done in confined spaces, or because of unfavorable ambient conditions, longer drying times will be necessary.
 5. Provide supplementary ventilation such as fans and blowers in confined or enclosed areas to carry off solvents during the evaporation stage.
- G. Protection:
1. Protect paint materials before, during and after application, and protect other work and materials with drop cloths or other impervious material.
 2. Clean up or otherwise remedy without additional cost, damage by paint and coatings to public or private property.

3. Provide in-place protection for fully factory finished general construction products, appliances and panels.
4. Provide DUST-TIGHT in-place protective covering, or masking, on such items as motors, controls, bearings and similar items which may be damaged internally by the inclusion of blast cleaning debris and dust created by blast cleaning or abrasive blasting operations.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Paint materials listed in the Paint Schedule are products of Tnemec Company, Inc. Equivalent products of the following manufacturers may be used subject to approval.
 1. Con-Lux Corporation.
 2. M.A. Bruder & Sons, Inc.
 3. Or Equal.

PART 3 - EXECUTION

3.01 RE-PAINT SURFACE PREPARATION

- A. The Contractor is completely responsible for the quality of the repaint work insofar as proper surface preparation will affect finished appearance. Quality of finishes shall be subject to the Engineer's approval or rejection. Recoat work as a result of rejection shall be at no expense to the Owner.
- B. Clean surfaces where deposits of wax, grease or oil are present with suitable solvents, followed by washing with alkaline detergent in water solution. Remove alkaline residues by washing the surfaces with fresh water.
- C. Prepare previously painted surface where rust, powdering, scaling, peeling or flaking is present by wirebrushing, scraping and sanding to solid material. Sand solid edges smooth.
- D. Prepare hard, glossy, repaint surfaces for paint adhesion by sandpapering, followed by surface washing and rinsing. When a de-glosser is used, the washing and rinsing may be eliminated.
- E. To avoid rust showing from nails' heads in repaint wood surfaces, countersink nails and fill the holes, together with all other crevices, with wood filler similar to DAP 33 after the priming coat has dried. Lightly sand wood filler to a smooth surface. Coat knots and sappy spots with shellac before painting.

- F. Do not paint fire protection system detection devices, if any, or sprinkler heads, if any, or exposed or recessed light fixtures. Provide in-place protection for such.
- G. Patch test unknown old coatings for compatibility.

3.02 APPLICATION

- A. General:
 - 1. Strictly follow paint manufacturer's label instructions for mixing, thinning, proper spreading rate and drying time. In no case shall film thickness be less than manufacturer's recommendations nor shall area coverage per gallon exceed manufacturer's recommendations.
 - 2. If material has thickened or must be diluted for application, the coating shall be built up to the same film thickness achieved with undiluted material. Do not use thinner to extend coverage of the paint.
 - 3. Regardless of the surface, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint.
- B. Method of Application:
 - 1. Workmanship: In general, finished surface regardless of method of paint application shall show no evidence of improper application according to accepted trade practice. Do not use paint rollers having nap exceeding 3/8 inch.
 - 2. Multi-coat Application:
 - a. Succeeding coats of paint shall show visual difference from Preceding coats. Each coat shall have a uniform appearance and be tinted to the final coat. The final coat shall present solid hiding with edges of paint adjoining other paint or materials made clean and sharp without overlap. Wipe or otherwise render undercoats dust free just prior to application of succeeding coatings.
 - b. Do not apply additional coats of paint until the film to be recoated is sufficiently cured to receive the next coat.
 - c. If the time limit is exceeded for coatings that have a maximum recoat time, consult paint manufacturer before proceeding with next coat.
- C. Painting Exposed/Concealed Surfaces:
 - 1. Do not paint exposed aluminum surfaces.

3.03 CLEANING

- A. Upon completion of work, remove paint and coating spots, oil and grease stains from floors, walls, fixtures, hardware and equipment, leaving their finishes in a satisfactory condition. Remove materials and debris from the site of work, and leave in a clean condition so far as this work is concerned.

- B. Keep site free from accumulation of paint containers, solvents, thinner and used cleaning cloths and legally dispose of same off premises daily.

3.04 PAINT SCHEDULE

- A. General: Engineer shall select painting system from the Schedule and the color for such surfaces, items, apparatus, materials or equipment not specifically named herein, but requiring paint according to the Engineer's direction in the field.

B. Concrete and Masonry Surfaces:

1. Interior non-submerged walls and ceilings below grade - poured or precast concrete:

		<u>Dry Film-Mils</u>
Surface Preparation:	Brush-off Blast Cleaning	
First Coat:	66-Color Hi-Build Epoxoline	4.0 - 6.0
Second Coat:	66-Color Hi-Build Epoxoline	4.0 - 6.0
		<u>8.0 -12.0</u>

2. Exterior/Interior in contact with sewage or water, poured or precast concrete. (color req):

		<u>Dry Film-Mils</u>
Surface Preparation:	Brush-off Blast Cleaning	
First Coat:	104-1255 Hi-Solids Epoxy **	6.0 - 10.0
Second Coat:	104-Color-Hi-Solids Epoxy ***	6.0 - 10.0
		<u>12.0 - 20.0</u>

** After 1st is dry, fill holes dime size or larger with 63-1500

*** For potable water, specify Series 139

3. Exterior below grade opposite dry interior-poured or precast concrete (or block):

		<u>Dry Film-Mils</u>
Surface Preparation:	Surface shall be clean and dry.	
One Coat:	46H-413 Hi-Build Tneme-Tar	14.0 - 20.0

C. Metal Surfaces:

Location(s): All metal surfaces except galvanized steel, stainless steel or aluminum. All exposed pipe except bituminous coated.

1. Interior - Nonsubmerged:

		<u>Dry Film-Mils</u>
Surface Preparation:	SSPC-SP6 Commercial Blast Cleaning	
First Coat:	66-1211 Epoxoline Primer	3.0 - 5.0
Second Coat:	66-Color Hi-Build Epoxoline	4.0 - 6.0
		<u>7.0 -11.0</u>

2. Interior/Exterior - In contact with sewage or water (color required):

		<u>Dry Film-Mils</u>
Surface Preparation:	SSPC SP10 Near White Blast Cleaning	
First Coat:	104-1255 Hi-Solids Epoxy	6.0 - 8.0
Second Coat:	104-Color Hi-Solids Epoxy***	6.0 - 8.0
		<u>12.0 -16.0</u>
***	For potable water, specify Series 139	

3. Interior Bituminous Coated Piping (Also Exterior):

		<u>Dry Film-Mils</u>
Surface Preparation:	Surface shall be clean and dry	
First Coat:	66-Color Hi-Build Epoxoline	2.0 - 3.0
Second Coat:	66-Color Hi-Build Epoxoline	2.0 - 3.0
		<u>4.0 - 6.0</u>

END OF SECTION

SECTION 11200

BASIC EQUIPMENT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Basic equipment requirements specifically applicable to Division 11 and 15.

1.02 RELATED SECTIONS

- A. Painting: Section 09900.

1.03 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: The construction requirements of State, County, or other political subdivision specifications exceeding the requirements of the codes, standards, and approving bodies referenced herein shall be met and complied with.
 - 1. Both the Underwriters' Laboratories (UL) Listings and Approvals and the National Electrical Manufacturers' Associations (NEMA) stamps or seals shall be evidenced where applicable to electrical apparatus forming parts of the "mechanical" equipment.
 - 2. Electrical Control panels shall be constructed in accordance with the requirements of the Underwriters Laboratory, or other nationally recognized certification agency and shall be appropriately labeled. All panels shall be constructed with UL listed recognized components and shall bear the label of a UL panel builder.
 - 3. Environmental Requirements:
 - a. Chemicals or materials which may come in contact with or affect the quality of water and are used in the construction, treatment processes, containment or conveyance of public water supply systems shall be certified for conformance with ANSI/NSF Standards 60 & 61.
 - b. Submit certificate of conformance with ANSI/NSF Standard 60 & 61 with product data submittals in accordance with Section 01300.
- B. Certificates and Permits: Upon completion of work, and prior to final Payment, furnish to the Engineer formal certification of final inspections from authorities having jurisdiction and secure required permits, if any, from same. Additionally, prepare detailed diagrams and drawings which may be required by those authorities having jurisdiction.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A320; Alloy Steel Bolting Materials for Low-Temperature Service, Spec. for.
- B. Federal Specifications:
 - 1. Fed. Spec. FF-S-325, Shield, Expansion; Nail, Expansion and Nail Drive Screw (Devices, Anchoring, Masonry) Group II (Shield, Expansion Bolt Anchor) Type 4 (Wedge Expansion Anchors) Class 1 (One-Piece Steel Expander with Cone Taper Integral with Stud).
- C. Steel Structures Painting Council:
 - 1. Surface Preparation Specifications.
 - a. SSPC-SP 6, Commercial Blast Cleaning.
 - b. SSPC-SP 8, Pickling.
 - c. SSPC-SP 10, Near-White Blast Cleaning.
 - 2. Paint Application Specifications: SSPC-PA 1, Shop, Field and Maintenance Painting.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit for approval completely dimensioned shop, layout or setting drawings and catalog cuts or other data as required to provide a complete description of system equipment specified in each Section of Division 11.
 - 2. Submit shop drawings certified for construction by the manufacturer and approved by the Contractor which includes location of electrical connections; wiring diagrams; anchor bolt layout; details indicating construction and materials of construction; diameter of shafting; dimensions and rated horsepower of all motors; gear and bearing ratings; service factors and weights of principal parts and completely assembled equipment.
- B. Operation and Maintenance Manuals: Submit to the Engineer and City of Salisbury Water and Sewer Department for review and approval, five copies of manuals prepared by the manufacturer/ supplier, or the Contractor within four weeks following the receipt of approved shop drawings. The submission and approval of each set of manuals will be considered to be an integral part of furnishing and installation of the respective equipment or system. The Contractor will be informed if manuals submitted are incomplete and will supply the information necessary for completion.
 - 1. Include the following elements in each manual:
 - a. Erection or installation instructions.
 - b. Start-up procedures.

- c. Recommended and alternative procedures.
 - d. Schedule of preventive maintenance requirements.
 - e. Schedule of recommended spare parts to be stocked, complete with part number, inventory quantity and ordering information.
 - f. Detailed maintenance procedures.
 - g. Schedule of lubrication requirements.
 - h. Corrected and approved control and wiring diagrams.
 - i. Data sheet listing pertinent equipment or system information, as well as the addresses and telephone numbers of the nearest sales and service representatives.
2. 3 sets of Operation and Maintenance Manuals are required for each of the following items of equipment or systems:
- a. Pumping Equipment and controls.
 - b. Air Blowers and Fans.
 - c. Telemetry Systems.
 - d. Emergency Generator and ATS

1.06 DELIVERY, STORAGE AND HANDLING

- A. When unloading materials, equipment and machinery provide special lifting harness or apparatus as may be required by manufacturers. Handle materials, equipment and machinery in accordance with manufacturer's written instructions.
- B. Store materials, equipment and machinery, both on and off site, in accordance with manufacturer's written instructions. Additionally, provide manufacturer's certificates of proper materials, equipment or machinery storage for the following listed items. Prior to issuance of such certificates, a manufacturer's representative shall visit the site of storage and examine materials, equipment or machinery in actual storage conditions.
 - 1. Wastewater Pumping Equipment.
- C. When transporting materials, equipment and machinery both on site and from Contractor's storage to the site, do so in accordance with recommendations of the respective manufacturers of each.

1.07 PROJECT CONDITIONS

- A. Field and Shop Coat Compatibility: To insure satisfactory paint and coating performance, it is a Contract requirement that products applied in the shop and field be mutually compatible.
 - 1. Contractor shall require fabricators and equipment manufacturers to apply shop coats that are compatible with field coats specified herein.
 - 2. Above requirement does not apply to full factory-finished items, that is, items having both primer and final finish coatings, except as specified in Painting: Section 09900.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Shop Paint:

1. For primer coat use only those primers that are compatible with field coats specified under Painting: Section 09900.

B. Pressure Gauges: Provide a glycerine filled pressure gauge assembly on the discharge side of each pump. Mount pump gauges as close to the pump as possible while providing ample space for gauge assembly valve operation and process sampling. Gages shall be general service type with 3½-inch dial faces.

1. Fittings: Provide Schedule 40 (minimum) 304 stainless steel nipples, tees, and quarter-turn ball valves as required for each gauge assembly.
2. Mounting - Mount gage assembly onto process piping 8-inch diameter and less, and all PVC piping, by service saddle consisting of ductile iron saddle casting, 304 stainless steel strap, SBR gaskets (unless specified otherwise), and 304 stainless steel nuts, bolts, and washers.
3. Acceptable Manufacturers:
 - a. Ashcroft.
 - b. Terice
 - c. Or Equal.

C. Motors:

1. Provide motors of sufficient capacity to operate the given equipment under all conditions of operation without loading beyond the nameplate current or power.
2. In no case are motors offered to be less than the horsepower specified except when it can be demonstrated that because the efficiency of the driven equipment is greater than that specified, a lesser horsepower will suffice.
3. Design motors one-half horsepower and larger to operate at the voltages and phases shown on the electrical diagrams/schedules.
4. Design motors smaller than one-half horsepower to operate on 120 volt, single phase, 60 Hertz current unless otherwise specified.
5. Provide motors of drip proof, energy efficient ball bearing type unless otherwise specified.
6. Design motors to operate in an ambient temperature of 40°C in continuous operation with a service factor of 1.15.
7. Design controls to operate on 120 volt, single phase, 60 Hertz current unless otherwise specified.

D. Equipment Anchors: Provide anchors for equipment requiring such. Size anchors for embedding in concrete and sleeve anchors as recommended by equipment manufacturers. When recommendations are not provided, size anchors in the largest diameter that will pass through the bolt holes in equipment bases. Anchor lengths as

indicated on Drawings.

1. Stainless Steel Anchor Bolts: ASTM A320 Grade B8, AISC Type 304.
2. Expansion Anchors: Conforming to Federal Specification FF-S-325, Group II, Type 4, Class 1 Stainless Steel; such as Hilti Kwik-Bolt, Phillips Red Head Wedge-Anchor and Molly Parabolt, or equal.

E. Spare Parts:

1. Provide manufacturer's recommended spare parts for each piece of mechanical equipment listed in each section.
2. Package each part individually or in sets in moisture-proof wrappings or vacuum packaging. Bulk packaging of dissimilar parts is not acceptable. Each package shall be clearly labeled to indicate the following information:
 - a. Name of equipment that spare part is for.
 - b. Spare part name.
 - c. Manufacturer's part/stock number.
3. The Contractor shall store all spare parts in a secure off-site location until a certificate of substantial completion is issued for the product and in the Engineer's opinion, the spare parts can be properly stored at the project site. The Contractor shall, at the Engineer's or Owner's request, allow for inspection and verification that the spare parts are being properly handled and stored in accordance with the equipment manufacturer's written instructions.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install equipment with skilled mechanical erection labor in accordance with manufacturer's instructions.
- B. Installed equipment shall be inspected, adjusted, approved and certified satisfactory by the manufacturer.
- C. Furnish the Engineer with manufacturer's certificates regarding equipment installation prior to initial mechanical performance tests.
- D. Shop Painting:
 1. Prior to painting remove all rust, dust and scale as well as other foreign substances on ferrous metal surfaces to be prime painted in the shop, by sand-blasting or pickling.
 - a. Blast-Cleaning shall conform to requirements of the latest edition of SSPC-SP6, Commercial Blast Cleaning.
 - b. Pickling shall conform to requirements of the latest edition of SSPC-SP8, Pickling, or SSPC-SP10.
 2. The ferrous metal surfaces thus cleaned shall be prime painted as soon as possible

- after cleaning to prevent new rusting.
3. All ferrous metal surfaces of equipment, apparatus, and devices shall receive a shop coat of primer (except acceptable factory finished surfaces) unless otherwise specified or required by the Engineer.
 4. Painting:
 - a. Apply shop paint in accordance with SSPC-PA-1.
 - b. Minimum dry mil thickness at 1.5 to 2 mils.

E. Field Painting: As specified previously in Painting: Section 09900.

3.02 FIELD QUALITY CONTROL

- A. Initial Operation: Upon completion of all work as well as installation and adjustment of equipment in a manner satisfactory to the Engineer, the Contractor with his own forces, including such equipment and other experts as may be necessary (hereinafter collectively referred to as Contractor's Personnel) shall place equipment in operation.
 1. Give the Owner at least seven days written notice prior to placing equipment in operation.
 2. Operating procedures during said period are subject to Engineer's approval.
 3. Operation of equipment prior to satisfactory completion of Performance Tests is the Contractor's complete responsibility.
 4. Designate a day approved by the Engineer for commencement of the Initial Mechanical Performance Test.
 5. Submit manufacturer's certificate regarding equipment installation.
- B. Initial Mechanical Performance Test:
 1. Contractor's Personnel, with the Personnel of the Owner observing, shall demonstrate to the satisfaction of the Engineer the mechanical performance of each item of equipment when operated in accordance with the design intent indicated by the Drawings and described in the applicable sections of the Specifications.
 2. If the demonstrations are satisfactory to the Engineer (or if equipment deficiencies are found, then subsequent to correction of the deficiencies by the Contractor) the Engineer shall give the Contractor seven days written notice to conduct the Final Mechanical Performance Test.
- C. Test Interim:
 1. Contractor's Personnel, without reliance of Owner's Personnel, shall operate and maintain the equipment in continuous, day-to-day, 24-hour operation except as otherwise approved by the Engineer until commencement of the Final Mechanical Performance Test.
 2. During this interim the Contractor's Personnel shall instruct and train the Owner's Personnel in the maintenance and operation of the equipment. Training shall be for the duration of the interim period, however, in no case will the training be less than three (3) man-days.

- D. Final Mechanical Performance Test: Final Mechanical Performance Test shall cover a 48-hour period while the pump station is in continuous, normal operation.
1. With equipment in continuous, normal operation, the Personnel of the Owner shall assume day-to-day operation of the equipment under the direct supervision of the Contractor's Personnel beginning with the Final Tests.
 2. Contractor's Personnel shall demonstrate to the satisfaction of the Engineer that equipment is coordinated and that installation complies with the applicable Drawings and Specifications.
 3. Performance Tests shall be considered concluded at the end of the forty-eight hour period designated for the tests if the Engineer is satisfied with the test results or should deficiencies be found as a result of said test, then when the deficiencies have been corrected to the satisfaction of the Engineer.
 4. The City Water and Sewer Department shall be notified by the Contractor of the final mechanical performance test date at least 48 hours prior to the test. City Collection System personnel shall observe the complete final test.
- E. Operating Costs:
1. Costs for Initial Operation and Mechanical Performance Tests: Include in the Contract Price the following operating costs for satisfactorily completing the Initial Mechanical Performance Tests on equipment being tested.
 - a. Electrical power.
 - b. Water to provide flow for tests.
 - c. Lubricating grease.
 - d. Lubricating oils.
 - e. Such other materials or utilities not specifically identified herein, but required to conduct the Initial Mechanical Performance Tests.
- F. Costs for Final Mechanical Performance Tests: The Owner will pay operating costs for the Final Mechanical Performance Tests.

3.04 MANUFACTURER'S REPRESENTATIVE

- A. At any time within a two-year period subsequent to completion of previously specified training and Performance Tests, the Contractor at the request of the Owner or Engineer, will furnish the Owner with the services of equipment manufacturer's representatives.
- B. Applicable Contract Lump Sum Prices will include furnishing of said services.
- C. Said services are additional to those furnished in connection with equipment erection, installation, testing, training of Owner's personnel and correction of deficiencies.

- D. Services will consist of furnishing detailed instructions to Personnel of the Owner regarding equipment operation and maintenance after Personnel of the Owner have had an opportunity to become familiar with the equipment.
- E. Furnish services of equipment manufacturer's representatives for periods as indicated in the following table for each item of equipment.

EQUIPMENT	MAN-DAYS
Pumps and Controls	1

END OF SECTION

SECTION 11310

SEWAGE PUMPS, PLUG VALVES, CHECK VALVES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Submersible Non-Clog Pumps
- B. Bronze Fitted Check Valve
- C. Bronze Fitted Plug Valve
- D. Pump Station Control/SCADA System

1.02 RELATED SECTIONS

- A. Instrumentation: Section 13320.
- B. Basic Mechanical Requirements: Section 15010.
- B. Telephone System: Section 16740.

1.03 SUBMITTALS

- A. Submit for approval complete characteristic curves of pumps prior to fabrication.
- B. Prior to pump delivery submit for approval certified copies of factory-run pump performance tests. Characteristics of pumps may have a tolerance of plus 10 percent of rated capacity at rated head or plus 5 percent of rated head at rated capacity. No minus tolerance will be acceptable. Give the Engineer seven days advance notice of performance test date.
- C. Submit catalog information on all equipment, provide schematic wiring diagrams, back panel layout, inner door layout, physical size of enclosure, bill of material, and all programming logic.

1.04 QUALITY ASSURANCE

- A. Design and construct the pumps in accordance with standards of the Hydraulic Institute. The efficiency of the pumps, when operating under conditions of the specified capacities and heads shall be as near peak efficiency as practicable.

- B. Obtain pumping equipment, motors, pump controls and appurtenances from the pump supplier whose responsibility it is to ensure that the pumping equipment is properly coordinated and operated in accordance with these Specifications.
- C. All equipment placed in the wet well shall be explosion proof.

PART 2 - PRODUCTS

2.01 NON-CLOG WASTEWATER PUMP

- A. General Requirements: Furnish and install two (2) submersible non-clog wastewater pumps. Each pump shall be equipped with a maximum 5.0 HP, submersible electric motor connected for operation on 480 volts, 3 phase, 60 hertz, 4 wire service, with enough submersible cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The pump shall be supplied with a mating cast iron 3-inch discharge connection and be capable of delivering 207 GPM at 40' TDH. Shut off head shall be 53 feet (minimum). Each pump shall be fitted with 50 feet of SST lifting chain or stainless steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.
- B. Pump Design:
 - 1. The Submersible Pumping Units shall be self contained, integral pump/motor units designed to operate at continuous full load in a partially or completely submerged condition without the need for any external cooling devices such as water jackets. Pump motor shall be of the sealed submersible type rated 5.0 HP at 1445 RPM 60 Hertz. Motor shall be for three phase 460 volts. Motor shall be NEMA B type. Stator winding shall be of the open type with Class H insulation good for 180°C maximum temperature. Winding housing shall be filled with a clean high dielectric oil that lubricates bearings and seals and transfers heat from winding and rotor to outer shell. The oil-filled motor shall be cooled by an adequately sized motor frame which shall conform to the latest applicable requirements of NEMA, IEEE, ANSI and NEC standards and shall meet the latest design standards of a Totally Enclosed Non-Ventilated NEMA frame motor. Heat transfer shall be accomplished by convection through the stator-housing wall to the surrounding media. Designs which incorporate cooling jackets and in particular, designs which rely on circulation of the pumped sewage or externally sourced water for cooling, are not considered equal to the equipment described in this specification and shall not be acceptable.
 - 2. The nameplate ratings of the motor shall be based on 40° C ambient environment. The pump motors and all associated sealing devices shall be designed to operate submerged at a depth of 150 feet of water. All motors shall be furnished and certified per IEEE 117 with Class F rated insulation materials or better. All motors

not having IEEE 117 certified insulation systems shall be considered not acceptable. Insulation materials related lower than Class F (i.e. Class B or A) are specifically prohibited. A heat sensor thermostat shall be attached to and imbedded in the winding and be connected in series with the motor starter contactor coil to stop motor if temperature of winding is more than 302°F. Thermostat shall reset automatically when motor cools to safe operating temperature. Three heat sensors to be used on 3 phase motors.

3. Pumps shall be Model NP3102 MT3-460 with 202mm impeller as manufactured by Flygt.

C. Bearings and Lubrication

1. Bearings shall be specifically selected to carry all radial and axial loads imposed by the pump and motor.
2. Bearings shall be rated to provide a minimum B-10 Bearing Life of 50,000 hours at any design operating point within the allowable operating region (limit lines). Bearing selection shall limit the bearing temperature rise to a maximum of 60° C under full load operation.
3. All bearings shall be permanently lubricated with a premium moisture resistant grease containing rust inhibitors and shall be suitable for operation over a temperature range of -25°C to + 120°C. The bearings shall not require any additional or periodic lubrication. All bearings shall be commercially available from third party sources other than the pump/motor manufacturer

D. Shaft Seals

1. Two independent, tandem mounted, mechanical seals shall be provided in the oil filled housing to isolate and protect the air-filled motor from the pumped media. The oil level shall not require constant monitoring and shall be suitable for a minimum of two (2) years service under specified operating conditions before requiring replacement for normal maintenance. The oil reservoir shall act as a barrier to trap moisture and provide sufficient time for a planned shutdown in the event of an outer seal failure. For motor frame size 180 and above, the inner mechanical seal shall be constructed with a solid block carbon rotating seal face and a solid block silicon carbide stationary seal face. The outer mechanical seal shall be constructed with a solid block silicon carbide rotating seal face and a solid block silicon carbide stationary face. All metal components of the inner and outer seals shall be AISI 316 stainless steel. All elastomers of both inner and outer seals shall be of viton material. The outer mechanical seal shall be located in a recessed housing outside the main flow path of the pump to avoid damage. Mechanical seals that employ sprayed or laminated seal faces shall neither be considered equal, nor shall they be acceptable.

2. Mechanical seals shall be readily and commercially available from third party sources other than the pump and motor manufacturer, their agents, dealers and/or distributors. Mechanical Seals shall be Type 21 or approved equivalent.

E. Moisture Detection System

1. A dual (2) probe moisture sensing system shall detect the entrance of moisture and provide an alarm. The moisture detection system shall be designed to detect the entrance of moisture in the stator and lower oil seal housing. The use of single probe or float switch type sensor systems shall not be acceptable. The moisture sensing probe leads shall terminate at a conductance relay located in the control panel, which shall provide an alarm in the event of moisture intrusion. The sensing relay (if not specifically ordered from the pump manufacturer) shall be approved by the pump/motor manufacturer.

F. Cable Entry System

1. The power and control cable entry system shall be designed to provide a positive, leak-free seal to prevent liquid from entering the air filled motor housing. The design shall incorporate provisions that prevent moisture from wicking through the cable assembly even in the event the cable jacket has been punctured. All cable type shall be type SEOW-A or better and U.L. Listed for the intended submersible service.
2. The power and control cable entry into the lead connection chamber shall be epoxy encapsulated for positive moisture sealing. For motor frame size 180 and above, all conductor leads shall terminate at a terminal board that is permanently cast into the epoxy-sealed cable entry area. The motor and control leads shall be easily connected and serviced on the motor side of the terminal board. A Buna-N cable grommet or a strain relief fitting shall be provided in addition to the epoxy sealed leads. Compression type grommet fittings employed as the primary sealing system shall neither be considered equal nor shall they be acceptable. Units above 1 ½ HP shall be designed with separate power and control cables to prevent false sensor warnings.

G. Materials of Construction – Motor

1. The submersible motor enclosure including frame, end brackets, flanges and cap assembly shall be constructed of close-grained cast iron, ASTM A-48, Class 30 or better.
2. The top end bracket shall be fitted with a lifting bail and shall be capable of supporting four (4) times the combined weight of the pump and motor.

3. All mating fits on the motor frame shall have rabbet joints with large overlap as well as o-ring seals to provide for a watertight seal. O-rings shall be Buna-N.
4. The one-piece motor/pump shaft shall be constructed of stainless steel and shall be precision machined to ensure proper tolerances at all contact points. The entire rotating assembly shall be designed with sufficient rigidity for minimal shaft deflection at extreme pump operating conditions.
5. The motor rotor shall be of squirrel-cage design and constructed of die cast aluminum, fabricated copper or their respective alloys. The rotor shall have an interference fit to the shaft and the rotating assembly shall be dynamically balance to ISO 1940, G.6.3. Balance weights, if required, shall be secured to the rotor resistance ring or rotor rims. Machine screws or nuts and bolts used to attach balance weights are specifically prohibited.

H. Electrical

1. The submersible motors shall successfully operate under power supply variations per NEMA MG1-1430. Motors shall be NEMA Design B with torque and starting current in accordance with NEMA MG 1-12.
2. The submersible motors shall be of an air-filled, high efficiency design and shall be rated for continuous full load operation. The motor construction shall be of explosion proof, TENV-TEXP design and capable of being certified for use in Class I, Division 1, Groups C & D hazardous locations by Factory Mutual Research Corp. (F.M.) Motors shall be capable of withstanding up to 15 starts per hour and shall have a minimum 1.15 Service Factor at 40°C ambient.
3. Stators shall be solid copper wound and shall be press fitted into the stator housing for true positive alignment and efficient heat transfer. The motor insulation system shall be Class F minimum, utilizing materials and insulation systems evaluated and certified with IEEE 117 classification tests. The entire wound stator assembly shall receive a minimum of two (2) coats of insulating varnish utilizing a dip and bake process.
4. Three (3) normally closed, automatic reset thermostats connected in series shall be embedded in adjoining phases of the stator windings. The thermostats shall be connected to safely shut down the motor upon opening.

I. Materials of Construction – Pump

1. The pump casing, impeller, motor housing and stationary base elbow shall be manufactured of close-grained cast iron, ASTM A48, Class 30.

2. The pump casing shall be of the colute design, of one piece construction, having centerline discharge to minimize clogging or flow interference, and to provide the proper weight distribution for use with the Easy-Lift disconnect system.
3. The impeller shall be of a multi or single-vaned, fully shrouded enclosed design and shall have large passages to provide smooth flow transition and unimpeded passage of large spherical solids. All impellers shall be statically and dynamically balanced to ISO 1940, G.6.3. Solids passing capability of the impeller offered shall be clearly indicated on the manufacturer's performance curve.
4. Wearing Rings – The colute suction shall be fitted with replaceable brass, radial/axial clearance, corrosion and abrasion resistant wearing ring system a minimum of 3/8 inch thick, securely fastened and replaceable. All external casting surfaces of the pump/motor coming into contact with the pumped liquid shall have a surface cleanliness equal to that of a SSPC-SP6 process prior to being factory protected by one (1) coat of an environmentally-safe machinery enamel coating with a high solids content. All external hardware including nameplates on the pump/motor shall be 300 Series stainless steel.

J. Sliding Guide Bracket & Rail System

1. The pump slide bracket shall be of heavy-duty cast iron construction. The base discharge elbow shall meet the slide bracket by method of a three point, wedged engagement that is uniquely designed to match the volute flange to the stationary elbow to eliminate head losses. The discharge elbow shall be designed to carry the full weight of the pump, motor and discharge piping.
2. Guide rail mounting brackets shall be furnished to stabilize the guide rails for installation in deep wet wells. Brackets shall be spaced at proper intervals to provide rigidity and parallelism. The brackets shall be designed to fit exactly into the pipes for which they were designed. Adjustable and/or flexible brackets designed to fit a variety of guide rail pipe sizes shall not be acceptable. All components of the lift out rail system including the mounting brackets shall be of stainless steel construction.

K. Testing

1. The pumps shall be performance tested at the manufacturer's plant prior to shipment. The performance shall be within the limits set forth by the Hydraulic Institute. Certified curves shall be submitted to the design engineer upon request.
2. As a minimum, each finished pump shall be performance tested for total dynamic head, capacity, efficiency and power requirements at six (6) operating points plus shut-off head for the selected impeller diameter, of which, the design capacity operating point shall be included.

3. After installation, a Field Test shall be performed by the installing contractor on each completed Submersible Pump and easy lift assembly under the supervision of the manufacturer's authorized representative. The test shall demonstrate to the satisfaction of the Owner that the equipment meets all specified performance criteria, is properly installed and anchored, and operates smoothly without exceeding the full load amperage rating of the motor or excessive motor heating.

L. Warranty

1. The Pump Manufacturer shall warrant to the Owner the Submersible Pump Units against defects in material and workmanship for a period of 1 year from date of acceptance by the City of Salisbury. This warranty shall cover the cost of labor and materials, excluding removal and reinstallation costs, required to correct any warrantable defect, FOB, Manufacturer's authorized Warranty Service Center.
2. Additionally, the Pump Manufacturer shall provide and administer a 5-year, prorated materials warranty on the Submersible Pump against defects in materials and workmanship. The warranty shall provide for the replacement of any part of the pump found to be defective in accordance with the following schedule.

19 to 31 months Payment of 75% of the Current Replacement Parts Cost.

32 to 45 months Payment of 50% of the Current Replacement Parts Cost.

46 to 60 months Payment of 25% of the Current Replacement Parts Cost.

M. Field Service

1. One day of Field Service shall be provided by an authorized, factory trained representative of the Pump Manufacturer. Services shall include, but not necessarily limited to, inspection of the completed installation to ensure that it has been performed in accordance with the manufacturer's instructions and recommendations, supervision of all field-testing and activation of the Manufacturer's Prescribed Warranty. The contractor shall be responsible for coordinating the required field services with the Pump Manufacturer.

N. Pump Accessories: Provide the following accessories with each pumping unit:

1. Discharge gauge, glycerin filled, 3½ inch diameter.
2. Thermal overload protection on pump.
3. Mechanical seal (packaged and labeled for storage).

O. Acceptable Manufacturer:

1. Flygt Pump Model NP 3102 MT3-460
2. Or equal as approved by the City.

2.02 BRONZE FITTED CHECK VALVE

- A. Supplied check valves shall be bronze fitted, spring-loaded lever type so that the clapper can be lifted to back flush the pumps.

2.03 BRONZE FITTED PLUG VALVE

- A. The plug valves shall have stainless steel shafts with double "O" rings and grease fittings at both ends where the shaft passes through body of the valve. Discharge piping shall be Class 53 ductile iron pipe inside the vault.

2.04. PUMP CONTROL:

- A. Enclosure: The pump controls and SCADA system shall be housed in a NEMA 12 stainless steel enclosure. The entire control assembly and all components shall be UL listed. The controls shall be all inclusive of main circuit breaker, motor starters, motor circuit breakers, control power circuit breaker(s), seal leak and thermal fault lights, selector switches run pilot lights, programmable logic controller (PLC), SCADA system, modem, relays uninterruptable power supply, and all else enclosed within the enclosure. The enclosure shall be gasketed with drip shield. It shall have a hinged front weather door with 3-point padlocking capability and an internally mounted hinged aluminum inner panel, so that all the components normally actuated by operating personnel are accessible without opening the dead front and yet are not exposed to the elements or to unauthorized personnel. The enclosure with pump controls shall be UL-508 and 698A listed and labeled.
- B. Internal Connections:
 1. All wiring shall be minimum 600-volt (UL) type MTW or AWM and have a current carrying capacity of not less than 125% of the full load current. The conductors shall be in complete conformity with the National Electric Code, state, local, and NEMA electrical standards. All field installed conduits, fittings or connections shall enter the enclosure through the bottom only. All major components and sub-assemblies shall be identified as to function with laminated, engraved Bakelite nameplates or similar approved means. A wiring schematic shall be provided and stored in a plastic packet provided in the enclosure. The schematic shall be an exact representation of the panel circuitry identifying the terminal locations for the remote field mounted devices, pumps, and incoming power connections.
 2. All ground wires shall be terminated at the grounding lug furnished inside the enclosure. All conduit, cord connections, and enclosure openings shall be properly sealed in a manner which prevents any liquids or vapors from entering the enclosure.

3. Field wiring shall be terminated on 30-amp, 600-volt, box lug type terminal boards identified with permanent marking that matches the wire number. There shall be a minimum of 20% spare terminals.
- C. Main Circuit Breaker: A 50-amp, 3-pole, molded case circuit breaker shall be provided as the main power disconnecting device for the control panel. The circuit breaker must have a minimum ampere interrupting capacity of 18,000 at 4800 volts symmetrical RMS amps.
 - D. Lightning Arrestor: A lightning arrestor shall be provided in the control and connected to each line of the main power input terminals. The arrestor shall protect the control against damage due to lightning strikes on the incoming power line.
 - E. Pump Circuit Breaker: A thermal magnetic circuit breaker shall be provided as branch circuit protection for each pump motor. The circuit breaker must have a minimum ampere interrupting capacity of 18,000 at 480 volts symmetrical RMS amps. The circuit breaker shall be operable through the operator's door of the enclosure. The circuit breaker shall be properly sized to protect the control circuit conductors, motor starter, and the motor against over current due to short circuit or grounds.
 - F. Motor Starter: A NEMA rated full voltage non-reversing motor starter with manual reset, ambient compensated, 3-phase thermal overload relay shall be provided for each pump.

PUMP DATA

<u>PUMP #</u>	<u>MOTOR HP</u>	<u>FLA</u>	<u>CB SIZE</u>
1	5 HP	7.6 Amp	15 Amp
2	5 HP	7.6 Amp	15 Amp

- G. Control Breaker: The panel shall be supplied with a properly sized control power circuit breaker. The breaker shall be door mounted and shall supply power to all control wiring within the enclosure.
- H. Condensation Protective Heater: Provide a 120 VAC thermostatically controlled, fan driven heater in the control panel to maintain a stable temperature and protect the electrical and electronic equipment from the harmful effects of condensation, corrosion, and low temperatures.
- I. Primary Level and Alarm Controls:
 1. The primary level sensor (Transducer) shall monitor wet well level continuously. The pump(s) shall start and stop as required to maintain wet well level. All level setpoints shall be adjustable and established prior to installation. Contractor shall coordinate all setpoints with the owner prior to shop drawing submission.
 2. The control system shall activate the lead pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", the system shall stop the lead pump. These actions shall constitute one pumping cycle.

3. Should the wet well level continue to rise, the system shall start the second pump when the liquid reaches the "lag pump start level" so that both pumps are operating. When the liquid is lowered to the "lag pump stop level", the system shall stop the lag pump.
 4. Backup floats are provided (Refer to J below) to ensure absolute control of the pumping system in the event of a transducer control system failure. Backup float operation shall be hardwired in a manner that is totally independent of the pump control system.
 5. Return to the transducer system can only be obtained by resetting the system through a reset button.
- J. Secondary (Float Backup) Level and Alarm Controls:
1. Floats shall control the operation of the duplex pumps. As the liquid level rises in the wetwell, the pump's stop float energizes first. As the level increases, the lead start float energizes and starts the lead pump. With the lead pump running, the level decreases to the pump's stop float, and turns the pump off. When the pump stops, the alternator shall index so that the other pump starts on the next rise in level. If the level continues to rise with the lead pump running, the lag start float will energize and start the lag pump. Both lead and lag pumps shall operate together until the stop float is deenergized. A fourth float shall be provided to signal the High Level alarm if the level continues to rise with both pumps running. A fifth float shall be provided to signal a Low Level alarm if the level continues to fall below the normal pumps off level.
- K. Moisture Relay: When moisture is detected between the probes, the output relay energizes and an amber pilot light is lit to indicate that a motor seal leak condition exists. The output relay remains energized until the moisture is removed. The output relay then de-energizes and remains de-energized until moisture is again detected between the probes. The moisture sensing relay shall be SSAC model LLC54AA, Mini-CAS, or engineer pre-approved equal. A Seal Fail alarm light shall be mounted on the deadfront door for each pump. In addition any seal fail alarms should also be sent to the SCADA system via dry contacts.
- L. Over Temperature Pump Protection: Over temperature protection relays shall be provided in the control panel to operate in conjunction with the over temperature switch in each pump motor. An Overtemp Fail alarm light shall be mounted on the deadfront door for each pump. The circuitry shall also include a reset push button for manual reset capability. Provide dry contacts for connection to the SCADA system.
- M. Selector Switches: A 30 mm oil-tight three-position, "Hand-Off-Automatic" selector switch shall be flush-mounted on the operator's door of the control panel for the operation of each magnetic motor starter. In "Hand" position the pump shall run continuously and only overridden by the Low Level float switch. In "Auto" position, the pump shall be controlled through the SCADA system. Provide "Out-of-Auto" contacts or "In-Auto" contacts as the case may be for SCADA detection.

- N. Status Indicators: A 30 mm oil-tight red "Pump Running" pilot light shall be flush-mounted on the operator's door of the control panel for each starter. This pilot light shall be operated from a respective starter auxiliary contact. The pilot light shall be push-to-test LED type.
- O. Panel Interior Lighting: Fluorescent or LED lighting shall be provided to illuminate the control panel interior. The fixture shall have a manually operated switch. The light shall operate on 115 VAC.
- P. Operator Interface
 - 1. General
 - a. The operator interface shall be a 5.7" minimum display size, backlit color TFT, touch screen display. It shall include user programmable soft function keys and a separate system key.
 - 2. Screens
 - a. The touch screen shall be a resistive analog type with 320 x 240 resolution. Expected lifetime shall be greater than 1,000,000 operations.
 - b. The pump control pane touch screen must meet the City's standards, Idec catalog HG-2G-5ST22TF-B, no substitutions.
 - b. It shall include no less than 2 MB of memory and display up to 50 screens with 50 data fields per screen.
 - c. An alarm handling system shall be provided as described below. Additionally, the end user may change the alarm colors to correspond to their standard alarm color scheme should the need arise. The alarm log shall store at least 250 entries before overwriting the oldest entry.
 - 3. Software
 - a. A site license for the operator interface graphic development software shall be provided to the owner and licensed in the owner's name. All cables shall be provided to allow the owner to make changes to the software should the need arise. Software shall be a 32-bit application and operate with any current Windows TMoperating system.
 - b. The software shall allow the operator interface developer to view full size replica on the developer's screen. Screen development tools shall include: editable graphics, pilot device symbol library, water and wastewater symbol library, single or multi- pen trend charts, data display, note pad, numeric keypad pop-up screen, editable fonts and custom drawing toolbox.
 - 4. Environmental Ratings & Agency Approvals
 - a. The operator interface shall be suitable for Type 12, 4 & 4x environments. Additionally the front panel shall be manufactured from a UV resistant polyester substrate.
 - 5. Security
 - a. A four level, multi user security system shall be available for use by the owner. The control system supplier shall provide the owner with a suggested security program in the submittal stage of this project.

Q. PLC

1. General

- a. The PLC with I/O shall be Control Microsystems SCADAPack 32. The unit is standard with the City of Salisbury SCADA system and no substitutes will be allowed. I/O expansion modules shall be provided as necessary to meet project requirements and provide 20% spares. Communications with the telephone modem shall be through a 25-pin EIA connector (RS-232C) compatible.

R. Interlocks & Failure Circuits

1. The pumping system consists of two pumps of equal horsepower.
2. If a pump running signal input is not received within 30 seconds (adjustable) of being called to start, a pump failure alarm shall be annunciated. The pump shall be removed from the alternation scheme and the remaining pump shall operate alone. The pump shall remain cutout until the failure condition has cleared and the reset button has been pressed.
3. Both pumps shall never be permitted to start simultaneously. The system shall provide a 5 second (adjustable) delay between the starting of the two pumps under all operating scenarios, including backup control.

S. System Screens

1. General

- a. The operator interface shall include a main color display screen and multiple secondary screens as required to set setpoints, acknowledge alarms, change pump sequences and other items as required for operating and maintaining the pump control system.
- b. Process variables shall be displayed dynamically as numeric values and as graphics. They shall also be displayed on a trend chart as defined below.

2. Main Display Screen

- a. The main display screen shall be a dynamic illustration of the pump system hydraulic layout. It shall include symbols of the pumps, check valves and wet well.
- b. The wet well water level shall be displayed as a dynamic vertical bar graph.
- c. Pump symbols shall be green when its respective pump is running, white when it is off, and red when in alarm. The words "Running", "Off" and "Failed" shall be placed adjacent to the pump symbol to further indicate status.
- d. Check valve limit switches shall have valve symbols with "Open" "Close" displayed.
3. The pump operating sequence shall be displayed conspicuously. It shall indicate the present pump sequence and whether the pumps are in the automatic mode or manual alternation mode.
4. Soft pushbuttons shall be provided to allow the operator to enter setpoints, change sequence and acknowledge alarms.

T. Alternation

1. The operator shall be able to select the desired pump sequence from a set of soft pushbuttons on the pump alternation screen. The following selections shall be provided:
 - a. Pump No.1 Lead
 - b. Pump No. 2 Lead
 - c. Auto: The system shall provide automatic lead/lag duplex pump control with each pumping cycle.

U. Setpoint Screen

1. Arrangements shall be made for setting each setpoint in the system. The operator shall be able to adjust the setpoints on screen by touching the numbers or by an on screen slider bar.
2. The following setpoints shall be provided in the field for the Transducer System:
 - a. Start Lag Pump XX.X_Ft
 - b. Start Lead Pump XX.X_Ft
 - c. Stop All Pumps XX.X_Ft
3. The following setpoints shall be provided in the field for the Float System:
 - a. High Level Activate Float System and Alarm XX.X_Ft
 - b. Start Lag Pump XX.X_Ft
 - c. Start Lead Pump XX.X_Ft
 - d. Stop All Pumps XX.X_Ft
 - e. Low Level Shutdown and Alarm _XX.X_Ft
4. Soft keys shall be provided at the bottom of the display to allow the operator to navigate between setpoint screens and back to the main screen or alarm screen.

V. Time Delay Settings Screen

1. A "Timers" screen shall be provided to allow operators to enter time delays for the various failure circuits and other timer controlled logic. The following timers shall be adjusted from the "Timers" screen.
 - a. Lag Pump Start Delay
 - b. Pump No.1 Failure (called to run and not running)
 - c. Pump No.2 Failure (called to run and not running)
 - d. Delays between pump starts on power restoration
 - e. High Level Alarm Delay
 - f. Low Level Alarm Delay
 - g. Level Transmitter Failure Alarm Delay
- h. Over Temperature Alarm Delay Pump No. 1
 - i. Over Temperature Alarm Delay Pump No. 2
 - j. Seal Fail Alarm Delay Pump No. 1
 - k. Seal Fail Alarm Delay Pump No. 2
 - l. PLC Failure Delay
 - m. Station Phase Fail Delay
 - n. 24 VDC Power Supply Fail Delay
2. Soft keys shall be provided at the bottom of the display to allow the operator to navigate between timers screen and back to the main screen or alarm screen.

W. Alarms Screen

1. When an alarm condition is active, its respective symbol shall turn red and the words “XXX Failure” shall flash red while the alarm is unacknowledged. Once acknowledged, the device symbol shall remain red and the words “XXX Failure” shall switch to the “steady-on” state. The device symbol shall return to its normal state (designated color for running/off, open/close, etc) once the alarm has been cleared and reset.
2. All alarms shall be displayed in red text in an alarm log when they are active. Once acknowledged, they shall be displayed in blue text. If an alarm condition clears before it is acknowledged, it shall be displayed in a different color text. If the alarm condition reactivates before it is acknowledged, a new alarm shall be displayed in the alarm log. Once an alarm has cleared and been acknowledged, it shall be stored in an event log for future review by the operator.
3. All alarms shall be time and date stamped, and displayed in the alarm log in reverse chronological order up to 99 lines. Logged alarms shall be downloadable to Microsoft Excel.
4. All alarms shall be monitored by the control system. Provide normally open (open to alarm condition) dry contacts for each alarm wired to terminal blocks. Provide the following alarms:
 - a. High Level Alarm (from floats)
 - b. Low Level Alarm (from floats)
 - c. Pump No.1 Failure
 - d. Pump No.2 Failure
 - e. Pump No.1 HOA Out-of-Auto
 - f. Pump No.2 HOA Out-of-Auto
 - g. Pump No.1 Over-Temperature Failure
 - h. Pump No.2 Over-Temperature Failure
 - i. Pump No.1 Seal Failure
 - j. Pump No.2 Seal Failure
 - k. Check Valve No. 1 Closed (Should be Open on Pump Run)
 - l. Check Valve No. 1 Open (Pump Stopped)
 - m. Check Valve No. 2 Closed (Should be Open on Pump Run)
 - n. Check Valve No. 2 Open (Pump Stopped)
 - o. Loss of Utility Power (via ATS)
 - p. Generator Low Fuel (via Gen)
 - q. Generator General Fail (via Gen)
 - r. Generator Fuel Tank Leak (via Gen)
 - s. Communications Failure (Monitor Telephone Line)
 - t. PLC Failure (Relay contact opens)
 - u. Station Phase Fail (From Phase Monitor)
 - v. 24 VDC Power Supply Fail (Relay contact opens)

X. Display Screen

- | | |
|------------------------------|--------------|
| 1. Wet Well Level (Analog) | 0 to XX.X_Ft |
| 2. Pump No. 1 Run | |
| 3. Pump No. 1 Starts Counter | 0 to XXXX |

- | | |
|---|-----------------|
| 4. Pump No. 1 Run Time | 0 to XXXX.X Hrs |
| 5. Check Valve No. 1 Open | |
| 6. Check Valve No. 1 Closed | |
| 7. Pump No. 2 Run | |
| 8. Pump No. 2 Starts Counter | 0 to XXXX |
| 9. Pump No. 2 Run Time | 0 to XXXX.X Hrs |
| 10. Check Valve No. 2 Open | |
| 11. Check Valve No. 2 Closed | |
| 12. ATS in Emergency Position (via ATS) | |
| 13. Generator Running (via Gen) | |

Y. Pumping System Historical Information Screen

1. A separate screen shall be provided to indicate historical information for each pump; this screen shall include the following information:
 - a. Each pump shall be provided with indication of daily run time, a numeric indication of run time, and a numeric indication of daily starts.
 - b. Trend charts shall be provided.
 - c. 7-day and 24-hour trend charts shall be provided.
 - d. Soft keys shall be provided at the bottom of the display to allow the operator to navigate back to the main screen or alarm screen.

Z. Uninterruptible Power Supply (UPS)

1. Provide an uninterruptible power supply in the pump control enclosure that powers the PLC for a minimum period of 15 minutes. The system shall be a true on-line UPS with a sine-wave output, hot-swappable batteries, microprocessor control and monitoring package, Windows software configurable, frequency auto-sensing, no-hassle two-year warranty, 120 VAC.

AA. Phase Fail Relay: Phase Relay with loss of phase, phase reversal, and undervoltage, double-throw contacts, with time delay, 480-volt.

PART 3 - EXECUTION

3.01 INSTALLATION, FIELD QUALITY CONTROL, AND MANUFACTURER'S REPRESENTATIVE

- A. Pumps and as specified previously in Specifications Section 11200.
- B. Additionally, observe and record operation of pumps, voltage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment. Test manual and automatic control systems. Test all alarms. Report any undue noise, vibration, or other operational problems. Make programming changes to the City of Salisbury SCADA system to accept the station I/O. Demonstrate that the SCADA system contains the necessary screens, provides the required functions, and interfaces completely with the City of Salisbury SCADA system.

END OF SECTION

SECTION 13320
INSTRUMENTATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Wet Well Liquid Level Sensor.
- B. Float Switches.
- C. Instrument Surge Protection.

1.02 RELATED SECTIONS

- A. Basic Equipment Requirements: Section 11200.
- B. Instrumentation components or apparatus provided integral with or furnished as part of the products or systems under other Specification Sections will be provided as work of those Specification Sections. Recorder and related electronics shall be installed in the control panel specified in Section 11310.

1.03 SYSTEM DESCRIPTION

- A. Installation System: Comprised of all equipment specified herein along with all auxiliary equipment, components, and devices necessary to achieve the functional intent of control operations.
- B. Furnish and install all instruments, wiring, accessories and appurtenant equipment for a complete instrumentation system.

1.04 QUALITY ASSURANCE

- A. Ensure that the instrumentation system is functionally integrated and operationally complete by obtaining the system equipment and components, which may be products of different manufacturers, from one System Supplier in whom the responsibility for the entire instrumentation system is vested.
- B. Provide instrumentation of manufacturers' latest and proven design.

- C. Furnish equipment listed by UL, FM, CSA as required by local codes.
- D. Document all instrumentation in accordance with Instrument Society of America (ISA) Standard, ISA-S5.1-73-1981.

1.05 SUBMITTALS

- A. Submit information in conformance with provisions specified in Section 11200 - Basic Equipment Requirements.
- B. Submit shop drawings by the System Supplier that include:
 - 1. Component manufacturing data sheet indicating ratings, performance, size, weight, and energy requirements. Clearly identify each component by item number and nomenclature referencing the Drawings and Specifications.
 - 2. Complete Interconnection diagram showing wiring terminals, wire identification routing, and all items to be interfaced.
 - 3. Mounting details and installation hardware.
 - 4. Complete spare parts list including part numbers and quantity.

1.06 SYSTEMS RESPONSIBILITY AND COORDINATION

- A. Responsibility for satisfactory operation of the instrumentation is that of the Contractor.
- B. Upon completion of the installation, the services of the factory trained service engineer shall be provided for a period on not less than two 8-hour days for calibration and start-up of the equipment and instructing the operating personnel. The minimum days specified above do not relieve the manufacturer of providing sufficient service to place the system in satisfactory operation. The costs of these supervisory services shall be included as part of the Contractor's bid.
- C. The Contractor's attention is directed to the fact that all instrumentation is specified to operate under specific field conditions. If the instrument fails to function properly under the specified conditions within the first year of operation after pump station start-up, it shall be the responsibility of the system manufacturer to correct the problem at no additional cost to the Owner.
- D. No form of energy shall be turned on to any part of the instrumentation system prior to receipt by the Engineer of a certified statement of approval of the installation from the Contractor containing his supplier's authorization, including lightning protection and grounding installation. The supplier's service engineer, however, may turn on the energy for the purpose of checkout as described above.

PART 2 - PRODUCTS

2.01 WET WELL LIQUID LEVEL SENSOR

- A. Wet Well Level Sensor: Flexible level sensing element routed inside a 6" schedule 80 pvc conduit attached to each pump discharge pipe. Sensing of the level is accomplished by means of sensing the water pressure in relation to atmospheric pressure, the output signal is 4-20 mA. Receiver unit provides display of level in feet and provides setpoints for pump control. An optional lightning protection unit shall be provided.
1. Transmitter:
 - a. Power: 9-30 VDC; Loop powered at 24 VDC.
 - b. Output Signal: 4-20 mA DC.
 - c. Temperature Limits: -20 to 60 degrees C.
 - d. Maximum Load Resistance: 650 Ohms @ 24 Vdc.
 - e. Lightning Suppression Response Time: < 10 nsecs.
 - f. Long life vent filter.
 - g. Accuracy: $\pm 0.5\%$ nominal.
 - h. Electronics Housing: NEMA 6P, IP68.
 - i. Process Wetted Parts: 316 SS with polyurethane cable.
 - j. Acceptable Manufacturer:
 - 1) KPSI - Series 710 with open-faced port end cap.
 - 2) Or Equal.

2.02 FLOAT SWITCHES

- A. Float switches shall be molded into epoxy filled polypropylene floats and shall not contain mercury. Floats shall be provided for pump operation and/or alarming. Floats shall operate through intrinsically safe circuits. The cables shall be neoprene type SO cable or better with no. 18 A.W.G. minimum size conductors. A stainless steel adjustable collar shall be provided around each cord near the float to steady the float. A stainless steel mounting bracket shall be provided to secure the floats to the wet well walls and to raise or lower the floats. Bracket shall be notched so that float/cable removal can be accomplished without threading the cable through a hole in the bracket.
- B. Acceptable Manufacturers:
1. Anchor.
 2. Healy Ruff.
 3. Or Equal.

2.03 INSTRUMENT SURGE PROTECTION

- A. Provide and install protection for the following:
1. All instrument systems.

- B. The surge protector shall be designed to protect the electrical instrument with which it is used from damage and/or instrument malfunction caused by power and signal line transients, by absorbing induced transients.
- C. The surge protector shall protect against transients on the power supply line and in three separate output signal lines and have approval or pending approval by Factory Mutual for Class I, Division 2, Groups A, B, C, and D. The circuit board used shall be coated with polyurethane for corrosion resistance.
- D. The surge protector shall meet the requirements of IEEE C37.90 and IEEE C62.41.
- E. The surge protector shall be housed in a corrosion-resistant enclosure.
- F. Surge Protector Specifications
 - 1. Power Input: 110/120 VAC, 50/60 Hz, $\pm 10\%$
 - 2. Power Output: 110/120 VAC, 2A
 - 3. Current Output (1 pair): 4-20 mA
 - 4. Performance IEEE C37.90
Transient Immunity IEEE C62.41
(All Circuits):
 - 5. Temperature Limits: -40 to +150°F
 - 6. Humidity: 5 to 100%
 - 7. Environmental Class: Indoors or outdoors; weather and corrosion resistance
 - 8. Safety Classification: Non-incentive Class I, Division 2, Groups A, B, C, and D. Factory Mutual approval or pending approval.
- G. Acceptable Manufacturer
 - 1. ABB
 - 2. Phoenix Contact
 - 3. Or Equal.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Provide the services of manufacturer's service representatives to assist in installation for all instrumentation specified herein.
- B. Each manufacturer's representative shall inspect the installation of each of his instruments, and shall issue an installation certificate to the Owner and the Engineer for each instrument certifying that the instrument has been installed in accordance with the manufacturer's recommendations.

3.02 INSTALLATION

- A. Provide labor, materials, tools, equipment, supplies, and services and auxiliary devices including, but not limited to, brackets and mounting hardware to install the instrumentation.
- B. Provide sufficient clearance around all instrumentation for cover removal, access, and required adjustments.

3.03 FIELD QUALITY CONTROL

- A. Provide instrument manufacturer services for installation assistance, field calibration, start-up, and training. All instruments shall be calibrated in the field by factory-trained engineers.
- B. Remove shipping stickers, paint splatters, dirt, grease, and other contaminants to restore the instrumentation to a clean and like-new condition prior to final acceptance.

3.04 CALIBRATION

- A. Conduct a performance test for each analog instrument. Furnish special tools, calibration equipment, and labor to perform the tests. Demonstrate that the instrument performs as specified. Test analog devices 0, 25, 50, 75, and 100 percent of scale. All tests shall be performed in the presence of the Engineer, City Water/Sewer Department staff, and Operator.
- B. Prepare instrumentation installation and calibration certification sheets, and performance test sheet, as applicable, for primary element. Use these sheets for documenting installation and testing.
- C. For installation certification sheet, include the following information:
 - 1. Project name
 - 2. Description
 - 3. Manufacturer
 - 4. Model and serial number
 - 5. Date, time, and person who performed mechanical installation verification.
 - 6. Date, time, and person who performed electrical installation verification including wiring terminations.
 - 7. Space for comments
 - 8. Space for sign-off and date
- D. For calibration certification sheet, include the following information:
 - 1. Project name
 - 2. Description

3. Manufacturer
 4. Model and serial number
 5. Date, time, and person who performed calibration
 6. Calibration data to include:
 - a. Input, output, and error at 0 percent and 100 percent of span for analog instruments.
 - b. Switch setting, contact action, and deadband, if applicable, for discrete elements.
- E. For analog instrument performance test, prepare a performance test sheet and include the following information:
1. Project name
 2. Tag number and description
 3. Manufacturer
 4. Model and serial number
 5. Date, time, and person who performed test
 6. Test data shall include output and error at each test point.

3.05 CALIBRATION EQUIPMENT

- A. The manufacturer shall provide the equipment required for calibration of its electronic instrumentation.
- B. Contractor shall be responsible for acquiring all calibration equipment.
- C. Contractor shall list type of corresponding calibration equipment.
- D. Cost of calibration equipment shall be included in the Contract Time.

END OF SECTION

SECTION 14300

HOISTS AND CRANES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Hoist System and Sleeve.

1.02 RELATED SECTIONS

- A. Aluminum Fabrications: Section 05600.

1.03 QUALITY ASSURANCE

- A. Both the Underwriters' Laboratories (UL) Listings and Approvals and the National Electrical Manufacturer's Associations' (NEMA) stamps or seals shall be evidenced where applicable to electrical apparatus forming parts of the hoist.
- B. Electric Motor Requirements:
 - 1. Provide motors of sufficient capacity to operate the given equipment under all conditions of operation without loading beyond the nameplate current or power.
 - 2. In no case are the motors offered to be less than the horsepower specified except when it can be demonstrated that because the efficiency of the driven equipment is greater than that specified, a lesser horsepower will suffice.
 - 3. Design motors to operate in an ambient temperature of 40 C. in continuous operation with a service factor of 1.15.
 - 4. Motors shall comply with the Standards of the IEEE and the NEMA in all respects except where requirements exceed these Standards. Bearings for motors one-half horsepower and larger; rated for 20-year life under AFBMA Standards.
 - 5. Motor shall be labeled for Class I, Division 1, Group C & D environment.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit for approval completely dimensioned shop, layout or setting drawings and catalog cuts or other data as required to provide a complete description of system equipment.
 - 2. Submit shop drawings certified for construction by the manufacturer and approved by the Contractor which includes location of electrical connections; wiring diagrams; anchor bolt layout; details indicating construction and materials on construction; diameter of shafting;

dimensions and rated horsepower of all motors; gear and bearing ratings; service factors and weights of principal parts and completely assembled equipment.

- B. Operation and Maintenance Manuals: Submit to the Engineer for review and approval, five copies of manuals prepared by the manufacturer/supplier or the Contractor within four weeks following the receipt of approved shop drawings. The submission and approval of each set of manuals will be considered to be an integral part of furnishing and installation of the respective equipment or system. Incomplete or inadequate manuals will be returned to the Contractor for correction and resubmission.
1. Include the following elements in each manual:
 - a. Erection or installation instructions.
 - b. Start-up procedures.
 - c. Recommended and alternative procedures.
 - d. Schedule of preventive maintenance requirements.
 - e. Schedule of recommended spare parts to be stocked, complete with part number, inventory quantity and ordering information.
 - f. Detailed maintenance procedures.
 - g. Schedule of lubrication requirements.
 - h. Data sheet listing pertinent equipment or system information, as well as the addresses and telephone numbers of the nearest sales and service representatives.

PART 2 - PRODUCTS

2.01 ELECTRIC CRANE

- A. Crane: Provide a crane conforming to the following:
1. Series 572 Davit Crane with 115 vac, single phase electric winch and optional ratchet-style screw jack from Thern or City approved equal.
 2. Hoist should have an one (1) ton load capacity

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install equipment with skilled mechanical erection labor in accordance with manufacturer's instructions and approved shop drawings.
- B. Provide equipment manufacturer's certificate certifying that equipment is installed, inspected, adjusted, tested and satisfactory.
- C. Furnish the Engineer with manufacturer's certificates regarding equipment installation prior to initial operations and mechanical Performance tests.

3.02 FIELD QUALITY CONTROL

A. Operation and Performance Tests:

1. Upon completion of the hoist installations and adjustment of equipment (if required) the Contractor with his own forces, including such equipment and other experts as may be necessary (hereinafter collectively referred to as Contractor's Personnel) will place the hoist in operation.
2. Give the Owner at least seven days written notice prior to so placing the hoist in operation.
3. Operation of the hoist prior to the satisfactory completion of the Performance Tests will be the complete responsibility of the Contractor.
4. Operating procedures during said period will be subject to approval by the Engineer.
5. The Contractor will designate a day approved by the Engineer for commencement of the Performance Tests.
6. The Contractor's Personnel, with the Personnel of the Owner observing, will demonstrate to the satisfaction of the Engineer the mechanical performance of the hoist.

B. Testing Procedures:

1. Perform all operational tests with 100% of rated load.
2. Check for proper adjustment and rail alignment. Adjust as necessary.
3. Operate hoist and trolley through all motions.
4. Make all required corrections to achieve a fully functional hoist/monorail system.

3.03 MANUFACTURER'S REPRESENTATIVE

- A. At any time within a two-year period subsequent to completion of previously specified Performance Tests, the Contractor at the request of the Owner or Engineer, will furnish the Owner with the services of equipment manufacturer's representatives for a period not to exceed one man-day.
- B. Applicable Contract Lump Sum Prices will include the furnishing of said services.
- C. Provide services such as additional to those furnished in connection with equipment erection, installation, testing, and correction of deficiencies.
- D. Services will consist of furnishing detailed instructions to Personnel of the Owner regarding equipment operation and maintenance after Personnel of the Owner have had an opportunity to become familiar with the equipment.

END OF SECTION

SECTION 15010

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Basic mechanical requirements specifically applicable to Division 15 Sections.

1.02 RELATED SECTIONS

- A. Division 1 - General Requirements.
- B. Division 15 Sections as Included.

1.03 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Comply with construction requirements of State, County, and such other local political subdivision specifications as may exceed the requirements of the codes, standards, and approving bodies referenced herein.
 - 1. Comply with requirements of the National Fire Protection Association (NFPA) Standards referenced in the various Specifications Sections, and as directly appropriate to the work and workmanship.
 - 2. Comply with requirements for both the Underwriters' Laboratories, Inc. (UL) Listings, Labels, and Approvals and the National Electrical Manufacturer's Associations (NEMA) Stamps or Seals as applicable to electrical equipment or apparatus forming parts of the Mechanical Equipment.
- B. Source Quality Control: Products used throughout these specifications, and as indicated on the drawings, are those of companies having established reputations in the manufacture of the particular materials, equipment, or apparatus specified. Such products may be of their own make, or products of others for which they assume full responsibility when used in said outfits (which are not manufactured completely by them), and with replacement parts available.
- C. Workmen's Qualifications: In acceptance or rejection of completed work, no allowance will be made for lack of skill on the part of the Contractor's forces performing such work.

1.04 REFERENCES

- A. Steel Structures Painting Council (SSPC) Surface Preparation Specifications:

10518.00

15010-1

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CITY OF SALISBURY – HAMPSHIRE ROAD SEWAGE LIFT STATION

1. SSPC-SP2, Hand Tool Cleaning.
2. SSPC-SP6, Commercial Blast Cleaning.
3. SSPC-SP8, Pickling.

B. Paint Application Specifications; SSPC-PA 1, Shop, Field and Maintenance Painting.

1.05 SUBMITTALS

A. Product Data:

1. Include in submittals manufacturer's descriptive literature, product specifications, published details, performance/capacity rating schedules or charts and installation instructions, all as applicable to items listed under Submittals in each Section of Division 15; and such items as may be Scheduled on the Drawings.

B. Shop Drawings:

1. Submit shop drawings certified for construction by Product manufacturers, and approved by the Contractor, which includes location of electrical connections; wiring diagrams; anchor bolt layout; details indicating construction and materials of construction; diameter of shafting; dimensions; rated horsepower of motors; gear and bearing ratings; service factors and weights of principal parts and the completely assembled item.
 - a. Shop drawings applicable to items listed under Submittals in each Section of Division 15; and such items as may be Scheduled on the Drawings.

C. Operation and Maintenance Data: Submit for approval three sets of product manufacturer's operating and maintenance instructions bound in a hard cover binder with index and index tabs. Manufacturer's advertising literature or advertising catalogs will not be acceptable for operating and maintenance instructions. Equipment and/or systems requiring manuals as stated hereinafter. Data shall include:

1. Installation, operating, and maintenance instructions.
2. Wiring diagrams.
3. Equipment parts lists.

D. Equipment or Systems Requiring Manuals: Operating and maintenance manuals prepared by the manufacturer or contractor are required for each of the following items of equipment or systems.

1. Fans and Blowers.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and equipment to the Project site in a clean condition with openings plugged or capped (or otherwise sealed by packaging) both during shipping and during temporary storage.

- B. Store materials and equipment, both on and off site, in accordance with manufacturer's written instructions.

1.07 SEQUENCING/SCHEDULING

- A. Interferences:
 - 1. The Drawings are generally diagrammatic and indicative of the work. The Contractor is responsible for modifying the work with offsets, bends or other fittings to avoid minor interferences and structural obstruction. Perform such modifications at no increase in Contract Price.
 - 2. Construct Mechanical Systems when and in a manner not to delay or interfere with other operations of work in the Project.
 - 3. Prior to making Mechanical installations, coordinate Mechanical Work locations with other operations of work.
 - 4. In the event that interferences develop, the Engineer's decision will be final and no additional compensation will be allowed for relocation of Mechanical Products.
- B. Electrical Interface: Install or mount as work of this Division 15.

1.08 WARRANTIES

- A. Assigned Warranties: Manufacturer's warranties on material and equipment (including internal components) exceeding the guarantee time period as stated in the Conditions of the Contract, shall be assigned directly to the Owner.
 - 1. Such assigned warranties shall begin on the date of the Owner's acceptance of the Work and so dated.
 - 2. Submit warranties along with submission of Shop Drawings and Product Data.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Products: Material particulars and requirements are as specified in the various Sections included under Division 15 - Mechanical.
 - 1. Provide Products of new and recent manufacture.
 - 2. For each category of materials and equipment (Products), provide Products of the same manufacturer and type.
- B. Shop Painting:
 - 1. Shop Paint: For primer coat provide only those primers that are compatible with field coats specified in Section 09900.
 - 2. Prior to painting remove all rust, dust and scale as well as other foreign substances on ferrous metal surfaces to be prime painted in the shop, by sandblasting or pickling, or by mechanically cleaning.

- a. Sandblasting shall conform to requirements of the latest edition of the Steel Structures Painting Council Standard SSPC-SP6, Commercial Blast Cleaning.
 - b. Pickling shall conform to requirements of the latest edition of the Steel Structures painting Council Standard SSPC-SP8, Pickling.
 - c. Mechanically Cleaning shall conform to requirements of the latest edition of the Steel Structures Painting Council Standard SSPC-SP2, Hand Tool Cleaning.
- 3. Prime paint ferrous metal surfaces thus cleaned as soon as possible after cleaning to prevent new rusting.
- 4. Ferrous metal surfaces of equipment, apparatus, and devices shall receive a shop coat of primer (except acceptable factory finished surfaces) unless otherwise specified or required by the Engineer.
- 5. Painting:
 - a. Apply shop paint in accordance with SSPC-PA-1.
 - b. Minimum dry mil thickness at 1.5 to 2 mils.
- C. Motors:
 - 1. Provide motors of sufficient capacity to operate the equipment under all conditions of operations without loading beyond the nameplate current or power.
 - 2. In no case are the motors offered to be less than the horsepower specified except when it can be demonstrated that because the efficiency of the driven equipment is greater than that specified, a lesser horsepower will suffice.
 - 3. Design motors smaller than one-half horsepower to operate on 120 volt, single phase, 60 Hertz current unless otherwise specified.
 - 4. Motors shall be drip proof, ball bearing type unless otherwise specified.
 - 5. Design motors to operate in an ambient temperature of 40 degrees C. in continuous operation with a service factor of 1.15.
 - 6. Provide totally enclosed fan cooled motors where motors are located outdoors.

PART 3 - EXECUTION

3.01 INSTALLATIONS

- A. General Requirements:
 - 1. Perform required interconnection of the differing mechanical systems in order to ensure the completeness of such mechanical systems.
 - 2. Install mechanical equipment level unless indicated or directed otherwise.

3.02 FIELD QUALITY CONTROL

- A. General: Perform cleaning, testing, adjusting and balancing operations as specified in the various Sections included under Division 15 - Mechanical.
 - 1. Provide instruments, testing equipment, and such other required materials to perform the Field Quality Control Work.

END OF SECTION

SECTION 15090

SUPPORTS, ANCHORS, AND SEALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Equipment Supports.
- B. Pipe Supports.
- C. Sleeves and Seals.

1.02 RELATED SECTIONS

- A. Division 3 - Concrete.
- B. Metal Fabrications: Section 05500.
- C. Basic Mechanical Requirements: Section 15010.

1.03 QUALITY ASSURANCE

- A. Design Criteria:
 - 1. Pipe Support Systems: Provide adequate pipe support systems designed in accordance with recognized engineering practices using, where possible, standard, commercially accepted pipe hangers and accessories.
 - a. Pipe hangers and supports shall conform to the latest requirements of American National Standards Institute Standard ANSI B31.1. Code for Pressure Piping, Manufacturers Standardization Society Standard Practice MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacturer and MSS SP-69 Pipe Hangers and Supports - Selection and Application.
 - 2. Equipment Support Systems: Provide adequate equipment suspension and/or supports designed in accordance with recognized engineering practices using, where possible, standard commercially accepted products and systems.
 - a. Design and size equipment suspension and/or supports based on installation instruction or information as obtained from equipment manufacturer.
- B. Anchor and Fastener Design Requirements:
 - 1. Sizing: Provide anchors and fasteners for Product installations of such diameters and lengths as recommended by the particular Product manufacturer involved.

- a. When sizing recommendations are not obtainable, size fasteners in the largest diameter that will pass through bolt holes as provided in the Products for anchoring and fastening purposes.
 2. Safety Factor: Determine the lengths of anchors and fasteners based on substrate materials at points of anchor installation and to provide a safety factor of four to one.
- C. Materials Compatibility: Where pipe supports contact bare piping or in-line devices, provide supports of compatible material so that neither will have a deteriorating action on the other.

1.04 REFERENCES

- A. American National Standards Institute (ANSI): ANSI B31.1, Code for Pressure Piping.
- B. American Society For Testing and Materials (ASTM):
 1. ASTM A36; Structural Steel, Spec. for.
 2. ASTM A47; Ferritic Malleable Iron Castings, Spec. for.
 3. ASTM A48; Gray Iron Castings, Spec. for.
 4. ASTM A120; Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses, Spec. for.
 5. ASTM A153; Zinc Coating (Hot-Dip) on Iron and Steel Hardware, Spec. for.
 6. ASTM A167; Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip, Spec. for.
 7. ASTM A181; Forgings, Carbon Steel, for General-Purpose Piping, Spec. for.
 8. ASTM A307; Carbon Steel Externally Threaded Standard Fasteners, Spec. for.
 9. ASTM A320; Alloy Steel Bolting Materials for Low-Temperature Service, Spec. for.
 10. ASTM A563; Carbon and Alloy Steel Nuts, Spec. for.
 11. ASTM A576; Steel Bars, Carbon, Hot-Wrought, Special Quality, Spec. for.
 12. ASTM B454; Mechanically Deposited Coatings of Cadmium and Zinc on Ferrous Metals, Spec. for.
- C. American Welding Society (AWS): AWS D1.1 Structural Welding Code.
- D. Cast Iron Soil Pipe Institute, Cast Iron Soil Pipe and Fittings Handbook, CISPI Specifications HS-67 and 301.
- E. Federal Specifications (Fed. Spec.):
 1. Fed. Spec. FF-B-561, Bolts (Screw) Lag.
 2. Fed. Spec. FF-S-107C(2), Screw, Tapping and Drive.
 3. Fed. Spec. FF-S-325, Shield, Expansion; Nail, Expansion and Nail Drive Screw (Devices, Anchoring, Masonry) Group II (Shield, Expansion Bolt Anchor) Type 4 (Wedge Expansion Anchors) Class 1 (One-Piece Steel Expander with Cone Taper Integral with Stud).

4. Fed. Spec. HH-I-521E, Type I, Type II, and Type III Insulation Blankets, Thermal (Mineral Fiber, For Ambient Temperatures).
- F. Manufacturer's Standardization Society (MSS) of the Valve and Fittings Industry:
1. MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacturer.
 2. MSS SP-69, Pipe Hangers and Supports - Selection and Application.

1.05 SUBMITTALS

- A. Product Data: As specified in Section 15010; submittals required for the following items:
1. Pipe Supports.
 2. Sleeve and Seal Materials.
- B. Shop Drawings: As specified in Section 15010; shop drawings required for the following:
1. Submit completely dimensioned shop drawings of piping layouts; indicating the type, design and location of pipe hangers, supports, anchors and guides required for piping installation.
 2. Submit completely dimensioned shop drawings of equipment suspension and/or support systems, including sizing of anchors and fasteners.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Concrete Inserts: For upper attachments in cast-in-place concrete structures provide cast-in inserts made of carbon steel ASTM A36 or malleable iron ASTM A47.
1. Where attached loads exceed the recommended load for an individual insert, provide multiple inserts with a trapeze type connecting member below the concrete.
- B. Beam Clamps: For upper attachments on structural steel provide beam clamps of carbon steel ASTM A36 or forged steel ASTM A181.
1. Holes drilled in structural steel for hanger support rods will not be permitted.
 2. Provide clamps with hardened steel cup-point set screw and lock-nut for anchoring in place.
 3. Base clamp size selection on required load being supported.
- C. Hanger Rods: Carbon steel conforming to ASTM A576.
1. Diameter of rods for piping system support shall conform to ANSI B31.1.

- a. In no case shall hanger rods less than 3/8-inch diameter be provided for support of pipe sizes two inches and smaller, or less than 1/2-inch diameter rod for supporting pipe sizes 2½-inch and larger.
- 2. Size hanger rods for mechanical equipment support based on installation instructions as obtained from equipment manufacturers.
 - a. All-thread hanger rods not permitted for equipment supports.
- D. Auxiliary Steel: Provide auxiliary steel where support of piping systems and equipment is required between building structural elements. Provide light gauge and structural steel shapes conform to requirements of ASTM A36.
 - 1. Contractor shall have the option to use pre-engineered support systems of electro-galvanized steel products such as Kindorf, UniStrut or B-Line. MIXTURE OF SUPPORT SYSTEM MANUFACTURER'S PRODUCTS NOT PERMITTED.
 - 2. Where auxiliary steel is indicated as stainless steel, provide AISI Type 304 stainless steel conforming to ASTM A167, in No. 1 Finish.

2.02 PIPE SUPPORTS

- A. Base Supports: Where base supports are indicated for valves and pipe fittings provide saddles supported by pipe columns.
 - 1. Saddles: Consisting of devices similar to ITT Grinnell Figure 258 Cast Iron Pipe Saddle Support; and pipe column designed to adequately support the applied loads with a steel base anchored to floor.
 - 2. Pipe Column: Pipe nipple of Schedule 80 galvanized steel pipe ASTM A120.
- B. Riser Clamps: Support vertical runs of piping at each floor, or closer where required, with carbon steel clamps ASTM A36 bolted around pipes and attached to the building construction.
 - 1. Provide copper plated clamps for copper tubing support.
 - 2. Provide two bolt type clamps designed for installation under insulation on insulated pipe runs.
- C. Hangers: Fabricated of malleable iron ASTM A47, or carbon steel ASTM A36.
 - 1. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
 - 2. Hangers for pipe sizes 2½ inches or larger shall incorporate a means of vertical adjustment after erection while supporting the load.
 - 3. Adjustable Band Hangers: Carbon steel band type hangers designed for suspension on hanger rods with provisions for vertical adjustments and locking in position using supporting and locknuts. Provide band hangers to support non-insulated pipe.
 - 4. Clevis Hangers for Insulated Pipe: Carbon steel yoke and U-strap type hanger designed for installation under insulation with cross bolt outside the insulation.

5. UL and NFPA Approved Hangers: Clevis type, adjustable swivel type, and/or adjustable flat-iron type. Where adjustable flat iron hangers cannot be used, hangers may be universal channel type or C-type with retaining strap.
- D. Brackets: Where piping is run adjacent to walls or steel columns, Provide welded steel brackets ASTM A36 and pre-punched with a minimum of two fastener holes.
- E. Racks: Multiple pipe racks or trapeze hangers fabricated from steel ASTM A36, and designed to suit conditions at points of installation.
 1. Keep pipes in their relative positions to each other by the use of clamps or clips. Lines subject to thermal expansion must be free to slide or roll.
- F. Pipe Anchors, Guides and Sliding Supports (For Heating System Piping):
 1. Anchors fabricated from carbon steel, ASTM A36.
 2. Guides fabricated from carbon steel, ASTM A36, or cast iron, ASTM A48.
 3. Sliding supports fabricated of cast iron, ASTM A48.
 4. Provide anchors, guides and supports where necessary to keep pipes in accurate alignment, to direct the expansion movement and to prevent buckling and swaying and undue strain.
- G. Wastewater Process Piping Base Supports:
 1. Concrete Base Supports: Conforming to base fitting support detailed on the Drawings.
 - a. Do not use concrete base supports where distance from floor to bottom of unsupported element exceeds five feet.
 - b. Materials and construction as specified in Division 3 - Concrete.
 2. Saddle Base Supports:
 - a. Saddle similar to ITT Grinnell Fig. 258, Cast Iron Pipe Saddle Support.
 - b. Steel pipe column of adequate strength to safely support applied loads and fitted with a steel base anchored to floor.
 - c. Set pipe column base on a one inch thick grout bed of non-shrink, non-metallic grout. Grout as specified in Division 3 - Concrete.
- H. Wastewater Process Piping Pipe Brace: Conforming to Pipe Brace Detail Drawing. Composed of Schedule 80 steel pipe ASTM A120 with steel flanges of types detailed.

2.03 ANCHORS AND FASTENERS

- A. Anchor Bolts (Pre-Set): Where anchor bolts are indicated or required as pre-set in cast-in-place concrete, provide anchor bolts of lug or bent shape design.
 1. Galvanized Bolts: ASTM A307 for bolts, nuts and washers; and ASTM B454 or A153 for galvanizing.
 2. Stainless Steel Bolts: ASTM A320, Grade B8, AISC Type 303 or 304.
- B. Drilled-In Expansion Anchors and Fasteners:

1. Applications In Masonry (and Precast Concrete Hollow-Core Structural Elements):
 - a. Anchors: Provide anchors designed to accept both machine bolts and/or threaded rods. Such anchors shall consist of an expansion shield and expander nut contained inside the shield. Expander nut fabricated and designed to climb the bolt or rod thread and simultaneously expand the shield as soon as the threaded item, while being tightened, reaches and bears against the shield bottom.
 - 1) Shield Body: Consisting of four legs, the inside of each tapered toward shield bottom (or nut end). The end of one leg is elongated and turned across shield bottom. Outer surface of shield body ribbed for grip-action.
 - 2) Expander Nut: Square design with sides tapered inward from bottom to top.
 - 3) Material: Die cast Zamac No. 3 zinc alloy of 43,000 psi minimum tensile strength. Shield and nut made in conformance with S.A.E. 90 3 ASTM XI.
 - b. Fasteners: Machine bolts conforming to S.A.E. Grade 2, for use with above anchors; nuts and washers conforming to ASTM A563.
 - c. Acceptable Manufacturers:
 - 1) U. S. E. Diamond, Inc.; FORWAY System.
 - 2) Or Equal.
2. Applications in Cast-in-Place Concrete (and Solid Precast Concrete Structural Elements):
 - a. Anchor/Fastener: UL Listed and one-piece stud (bolt) with integral expansion wedges, nut and washer, and meeting physical requirements of Fed. Spec. FF-S-325, Group II, Type 4, Class 1.
 - b. Stainless Steel Anchor/Fastener: UL Listed one-piece stud (bolt) with integral expansion wedges, nut and washer, and meeting physical requirements of Fed. Spec. FF-S-325, Group II, Type 4, Class 1. Stud of AISI Type 303 or 304 stainless and nut and washer of AISI Type 316 stainless.
 - c. Acceptable Manufacturers:
 - 1) U. S. E. Diamond, Inc.; SUP-R-STUD.
 - 2) Hilti Fastening Systems; KWIK-BOLT.
 - 3) Molly Fastener Group; PARABOLT.
 - 4) Phillips; RED HEAD Wedge-Anchor.
 - 5) Or Equal.
3. Drilled-In Adhesive Anchors (Horizontal Application Only): Composed of an anchor rod assembly and an anchor rod adhesive cartridge.
 - a. Anchor Rod Assembly: Chamfered and threaded stud rod of ASTM A307 steel with nut and washer of ASTM A563 steel.
 - b. Stainless Steel Anchor Rod Assembly: Chamfered and threaded stud rod of AISI Type 304 stainless with nut and washer of AISI Type 316 stainless.
 - c. Adhesive Cartridge: Sealed capsule containing pre-measured amounts of resin, quartz sand aggregate, and a hardener contained in a separate vial within

the capsule. Capsule ingredients activated by the insertion procedure of the anchor rod assembly.

d. Acceptable Manufacturers:

- 1) U. S. E. Diamond, Inc.; SUP-R-SET.
- 2) Hilti Fastening Systems; HVA.
- 3) Molly Fastener Group: PARABOND.
- 4) Or Equal.

C. Welding Electrodes: Table 4.1.1 of AWS D1.1 as required for applicable base metals and welding process.

2.04 SLEEVES AND SEALS

A. Wall Pipe: Cast iron construction with an integral intermediate anchoring flange midway on the pipe exterior.

1. Wall pipe ends of type indicated on Drawings, and where not indicated, pipe end shall match that of adjoining pipe.
2. Provide wall pipes similar to those manufactured by American Cast Iron Pipe Co., U. S. Pipe and Foundry Co., or equal.

B. Seals and Plates:

1. Wall Seal: Hydrostatic seal designed to seal opening between pipes and a through structure opening. Provide Link-Seal by Thunderline Corp., or equal, with stainless steel nuts and bolts. Caulking, mastic sealants, lead/oakum; not equal.
2. Wall and Ceiling Plates: Cast metal with integral set screw or similar anchoring screw. Hinged or split design plates may be provided.
3. Escutcheons: Provide chrome plated stamped steel hinged plates to close pipe penetrations through structure interior in finished areas. Provide plates designed to lock on pipes using set screws.

PART 3 - EXECUTION

3.01 PIPING SYSTEM SUPPORT INSTALLATION

A. General:

1. Install pipe supports and anchors to hold piping straight and true to line both vertically and horizontally.
2. Where thermal movement in piping systems will occur, provide piping system supports capable of supporting the line in all operating conditions.
3. The supporting force at each hanger shall prevent excessive stress in the pipe and connected equipment.

4. Install pipe supports anchored directly to or suspended directly from structural supports. Where pipe hangers fall between structural members provide auxiliary steel supports to carry pipe hangers.
 5. Do not support piping from metal decks.
- B. Spacing of Hangers and Supports:
1. General:
 - a. Space hangers and supports as stated herein and in ANSI B31.1, MSS SP 58 and SP 69, and as indicated on the Drawings.
 - b. Give special consideration to spacing of hangers and supports where components such as fittings and valves impose concentrated loads.
 2. Ductile Iron Pipe:
 - a. Provide at least one support for each length of pipe with the hanger located adjacent to the joint.
 - b. Hanger spacing shall not exceed 12 feet on center.
 - c. Support each change of direction or branch connection.
 3. Steel Pipe: Space hangers on horizontal runs of steel pipe as follows:
 - a. Pipe sizes 1-inch and smaller - 8 ft. O.C. maximum.
 - b. Pipe sizes 1¼-inches to 2-inches - 10 ft. O.C. maximum.
 - c. Pipe sizes 2½-inches and larger - 12 ft. O.C. maximum.
 4. Copper Tubing: Space hangers on horizontal runs of copper tubing as follows:
 - a. Tube sizes 3/8 through 3/4-inches - 5 ft. O.C. maximum.
 - b. Tube size one inch - 6 ft. O.C. maximum.
 - c. Tube size 1¼-inches - 7 ft. O.C. maximum.
 - d. Tube size 1½ through 2-inches - 8 ft. O.C. maximum.
 - e. Tube size 2½-inches - 9 ft. O.C. maximum.
 - f. Tube size 3-inches - 10 ft. O.C. maximum.
 - g. Tube size 3½ through 4-inches - 12 ft. O.C. maximum.
- C. Plastic Piping: Provide hangers at locations and spacing limitations in accordance with pipe manufacturer's installation specifications.
- D. Seals and Plates Installation:
1. Following pipe installation through sleeves in exterior walls below grade, install Wall Seal to render installation leak free. Wall Seal not required in interior walls, partitions, floor and ceilings.
 2. Install wall seal as close to outside surface of wall as possible to provide a watertight seal below grade. Apply a coating of coal tar paint or other type approved coating on bolt heads and other metal parts on below grade wall seals prior to backfilling.
 3. Install wall and ceiling plates to close pipe sleeve openings.
 4. Install escutcheons to close pipe sleeve openings in finished areas.
- E. Existing Structure Penetrations:

1. Make existing masonry and concrete structure penetrations for piping by the core-drilling method. Make such penetrations true, clean and free from spalling.
2. Make wall penetration sized to accommodate the pipe plus 1/4-inch.
3. Provide cast metal escutcheons to close the opening of the structure penetrations.
4. Wall Seal: Provide hydrostatic Wall Seal, as specified previously herein, for underground piping passing through core-drilled openings.

3.02 ANCHOR AND FASTENER INSTALLATIONS

- A. Auxiliary Steel Fabrication: Insofar as possible, fit and shop assemble steel fabrications and make ready for field installation.
1. Drill or punch holes as required for attachment of work and for bolted connections. Burned holes are not acceptable.
 2. Perform welding of assemblies in accordance with AWS D1.1. Dress welds smooth and free of sharp edges and corners.
 3. Perform shop painting of auxiliary steel as specified in Section 15010.
- B. Threaded Bolts: Draw threaded bolted connections up tight using lock washers to prevent bolt or nut loosening.
- C. Drilled-In Expansion Anchor and Fastener Installation:
1. General: In general, install expansion anchors in strict accordance with manufacturer's instructions and in accordance with the following.
 2. Drilling Holes: Use rotary hammer type drill and make drill holes to the required diameter and depth as consistent with anchor manufacturer's instructions for size of anchors being installed.
 3. Diamond core drills are not permitted.
 4. Minimum Embedment: Embed expansion anchors to four and one-half bolt diameters, unless otherwise indicated on Drawings.
- D. Drilled-In Adhesive Anchor Installation:
1. General: In general, install adhesive anchors in strict accordance with manufacturer's instructions and in accordance with the following.
 2. Drilling Holes: Use rotary hammer type drill and make drill holes to the required diameter and depth as consistent with anchor manufacturer's instructions for size of anchors being installed.
 - a. Prior to setting cartridge and anchor stud clean drilled holes free of loose material by vacuum process, finishing with a blast of compressed air, and cover hole until actual use.
 3. Anchor Rod Installation: Following cartridge installation in prepared drill holes, set anchor rod to the required depth. Set anchor rods truly perpendicular (normal) to the base plate of item being anchored.
 4. Minimum Embedment Table:

Adhesive Anchor

Diameter	3/8 in.	1/2 in.	5/8 in.	3/4 in.	7/8 in.	1 in.
Embedment Depth	3½ in.	4¼ in.	5 in.	6-5/8 in.	6-5/8 in.	8¼ in.

END OF SECTION

SECTION 15250

MECHANICAL INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Piping Insulation.

1.02 RELATED SECTIONS

- A. Basic Mechanical Requirements: Section 15010.

1.03 REFERENCES

- A. American Society For Testing and Materials (ASTM):
 - 1. ASTM C543; Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form, Spec. for.
 - 2. ASTM C585; Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
 - 3. ASTM E84; Surface Burning Characteristics of Building Materials, Test Method for.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 90A; Standard for the Installation of Air Conditioning and Ventilating Systems.

1.04 SUBMITTALS

- A. Product Data: As specified in Section 15010; submittals required for the following items:
 - 1. Pipe Insulation Materials.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver insulation products to the site in unbroken shipping cartons bearing a label indicating the contents and the appropriate ASTM, NFPA and UL flame and smoke hazard ratings as specified herein for the various insulation products.
- B. Deliver and store insulation products protected from the weather. Store insulation on the site elevated off wet and otherwise contaminating surfaces.

PART 2 - PRODUCTS

2.01 INTERIOR PIPE INSULATING MATERIALS

- A. Flexible Sheet or Roll Insulation on piping: Insulation manufactured of closed cell, elastomeric material; 1/2-inch thick for pipes 2-inch and smaller, 3/4-inch thick for pipes 2½-inch through 10-inches; 1-inch thick for pipes 12-inches and larger. Insulation shall have thermal conductivity of 0.27 BTUH per square foot per degree per inch at 75 degrees F. mean temperature, water vapor transmission rating of less than 0.17 perms per inch, and a self-extinguishing fire-rating, (25 flame spread and 150 smoke developed), ASTM E84. Insulation manufactured to meet requirements of ASTM C534. Provide insulation manufacturer's companion joint making/sealing adhesive to make permanent insulation joints.
 - 1. Fitting Insulation (Flexible): Insulate fittings and valve bodies with sleeves of same insulation thickness used on adjacent piping and having an inside diameter large enough to fit over the insulation on adjacent piping.
 - 2. Contractor has option to use tubular pipe insulation on pipes 4-inches and smaller. However, mixing of insulation materials will not be permitted; except where specified otherwise herein or where directed otherwise by the Engineer.
 - 3. Acceptable Manufacturers:
 - a. Armstrong Industry Products Division.
 - b. Or Equal.

2.02 EXTERIOR PIPE INSULATING MATERIALS

- A. Same as 2.01.A. MATERIALS, except manufacturer's weather-proof jacketing shall be applied in accordance with manufacturer's recommendation.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Carefully inspect installed work of other trades in connection with insulating work and verify such work to be complete, including system or equipment testing, to such point where insulating work may begin.

3.02 PREPARATION

- A. Apply insulation on clean, dry surfaces only. Perform cleaning required for removal of

construction debris, spills, etc.

3.03 INSTALLATION

- A. Install insulation continuous through structure penetrations except where special sealing requirements are specified (i.e. fire-rated separations).
- B. Apply insulation on cold surfaces, where vapor barrier is integral with insulation in a continuous unbroken vapor seal. Adequately seal hanger, support, and anchor penetrations of insulation.
- C. Apply specified insulation adhesive, sealers and coatings at the manufacturer's recommended minimum coverage per gallon.

3.04 PIPING INSULATING

- A. Apply insulation materials on piped services listed and in accordance with thicknesses listed in the following paragraphs. Insulate fittings and valve bodies and in-line control devices, except gauge and thermometer faces, setting or measuring scales integral with in-line devices and control handles.
- B. Flexible Insulation Installation: Install on piping according to manufacturer's instructions, using specified adhesive to seal both longitudinal and butt joints. Insulate in-line appurtenances to the same thickness as adjoining insulation.
 - 1. Installed Thickness:
 - a. 1/2-inch thick: Pipes 2-inch and smaller.
 - b. 3/4-inch thick: Pipes 2½-inch through 10-inch.
 - c. 1-inch thick: Pipes 12-inches and larger.

END OF SECTION

SECTION 15370

PROCESS PIPING AND VALVES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. .Process Pipe and Pipe Fittings, and Pipe Specialties.
- B. .Process Valves and Appurtenances.

1.02 RELATED SECTIONS

- A. -. Trenching, Backfilling, and Compacting: Section 02221.
- B. -. Basic Mechanical Requirements: Section 15010.
- C. -. Supports, Anchors, and Seals: Section 15090.

1.03 QUALITY ASSURANCE

- A. Source Quality Control:
 - 1. Shop Tests and Inspection: All materials furnished by the Contractor shall be certified by the supplier for compliance with the pertinent specifications. Shop inspections and testing may be required. The cost of shop testing shall be borne by the supplier or the Contractor.
- B. Field Inspection: All pipe and appurtenances shall be furnished, installed, and tested for defects in material and/or workmanship in the manner specified and in the presence of and as approved by the Engineer.
- C. Disposition of Defective Material: All material found during the progress of the work, either before or after installation, to have cracks, flaws, or other defects will be rejected by the Engineer. All defective materials furnished by the Contractor shall be promptly removed by him from the site at his own expense.

1.04 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A21.4, Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water.

2. ANSI A21.10, Gray-Iron and Ductile-Iron Fittings, 2 through 48 in., for Water and Other Liquids.
3. ANSI A21.11, Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
4. ANSI A21.15, Flanged Cast-Iron and Ductile-Iron Pipe with Threaded Flange.
5. ANSI A21.50, Thickness Design of Ductile-Iron Pipe.
6. ANSI A21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water and Other Liquids.
7. ANSI A21.53, Ductile-Iron Compact Fittings, 3-inch through 16-inch for Water and Other Liquids.
8. ANSI B1.1, Unified Inch Screw Threads.
9. ANSI B2.1, Pipe Threads.
10. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
11. ANSI B16.3, Malleable-Iron Screwed Fittings, 150 and 300 lb.
12. ANSI B16.9, Factory-Made Wrought Steel Buttwelding Fittings.
13. ANSI B16.10, Face-to-Face and End-to-End Dimensions of Ferrous Valves.
14. ANSI B16.12, Cast-Iron Threaded Drainage Fittings.
15. ANSI B16.18, Cast-Iron Bronze Solder Joint Pressure Fittings.
16. ANSI B16.21, Nonmetallic Gaskets for Pipe Flanges.
17. ANSI B16.22, Wrought Copper and Bronze Solder-joint Pressure Fittings.
18. ANSI B16.23, Cast Bronze Solder Joint Drainage Fittings - DWV.
19. ANSI B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
20. ANSI B16.29, Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings.
21. ANSI B18.2.1, Square and Hex Bolts and Screws, Including Askew Head Bolts, Hex Cap Screws, and Lag Screws.
22. ANSI B18.2.2, Square and Hex Nuts.
23. ANSI B31.1, Power Piping (Pressure Piping).

B. American Society for Testing and Materials (ASTM):

1. ASTM A36, Standard Specification for Structural Steel.
2. ASTM A47, Malleable Iron Castings.
3. ASTM A48, Gray Iron Castings.
4. ASTM A53, Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless for Ordinary Uses.
5. ASTM A74, Cast Iron Soil Pipe and Fittings.
6. ASTM A126, Gray Iron Castings for Valves, Flanges and Pipe Fittings.
7. ASTM A183, Heat-Treated Carbon Steel Track Bolts and Carbon Steel Nuts.
8. ASTM A197, Cupola Malleable Iron.
9. ASTM A283, Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality.
10. ASTM A307, Carbon Steel Externally and Internally Threaded Standard Fasteners.
11. ASTM A536, Ductile Iron Castings.
12. ASTM A714, High-Strength Low-Alloy Welded and Seamless Steel Pipe.

13. ASTM B32, Solder Metal.
14. ASTM B61, Steam or Valve Bronze Castings.
15. ASTM B62, Composition Bronze Castings.
16. ASTM B88, Seamless Copper Water Tube.
17. ASTM B306, Copper Drainage Tube (DWV).
18. ASTM B371, Copper-Zinc-Silicon Alloy Rod.
19. ASTM B584, Copper Alloy Sand Castings for General Applications.
20. ASTM C12, Installing Vitrified Clay Pipe Lines Recommended Practice for.
21. ASTM C76, Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
22. ASTM C150, Portland Cement.
23. ASTM C283, Resistance of Porcelain Enameled Utensils to Boiling Acid.
24. ASTM C301, Vitrified Clay Pipe.
25. ASTM C425, Compression Joints for Vitrified Clay Pipe and Fittings.
26. ASTM C564, Rubber for Cast Iron Soil Pipe and Fittings.
27. ASTM C700, Vitrified Clay pipe, Extra Strength, Standard Strength and Perforated.
28. ASTM D1784, Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds.
29. ASTM D1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80 and 120.
30. ASTM D2000, Rubber Products in Automotive Applications.
31. ASTM D2466, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
32. ASTM D2467, Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
33. ASTM D2564, Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
34. ASTM D2665, Std. Spec. for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
35. ASTM D3034, Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
36. ASTM D3212, Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
37. ASTM F477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
38. ASTM F789, Type PS-46 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings.

C. American Water Works Association (AWWA):

1. AWWA C100, Cast-Iron Pressure Fittings.
2. AWWA C104, Cement-Mortar Linings for Ductile-Iron and Gray Iron Pipe and Fittings for Water.
3. AWWA C110, Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch for Water and Other Liquids.
4. AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
5. AWWA C115, Standard for Flanged Ductile-Iron Pipe with Threaded Flanges.
6. AWWA C150, Thickness Design of Ductile-Iron Pipe.

7. AWWA C151, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water and Other Liquids.
8. AWWA C153, Ductile-Iron Compact Fittings, 3-inch through 16-inch for Water and Other Liquids.
9. AWWA C200, Steel Water Pipe 6 Inches and Larger.
10. AWWA C207, Steel Pipe Flanges.
11. AWWA C301, Prestressed Concrete Pressure Pipe, Steel Cylinder Type, For Water and Other Liquids.
12. AWWA C302, Reinforced-Concrete Water Pipe-Noncylinder Type, Not Prestressed.
13. AWWA C500, Gate Valves-3 In. through 48 In. for Water and Other Liquids.
14. AWWA C504, Rubber-Seated Butterfly Valves.
15. AWWA C508, Standard for Swing-Check Valves for Waterworks Service, 2-in. thru 24-in. NPS.
16. AWWA C509, Resilient-Seated Gate Valves, 3 through 12 NPS, for Water and Sewage Systems.
17. AWWA C550, Protective Interior Coatings for Valves and Hydrants.

D. Cast Iron Soil Pipe Institute, Cast Iron Soil Pipe and Fittings Handbook, CISPI 301.

E. Federal Specifications:

1. Fed. Spec. SS-S-168 (2), Sealing Compound, Sewer, Bituminous, Two Component, Mineral-Filled, Cold-Applied.
2. Fed. Spec. SS-S-210A, Sealing Compound, Preformed Plastic, For Expansion Joints and Pipe Joints (Type 1 Rope Form).

1.05 SUBMITTALS

- A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, cuts or other data as required to provide a complete description of valves and piping specialties.
- B. Certificates: Certified records or reports of the results of shop tests, such records to contain a sworn statement that the shop tests have been made as specified.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Chemicals or materials which may come in contact with or affect the quality of water and are used in the construction, treatment processes, containment or conveyance of public water supply systems shall be certified for conformance with ANSI/NSF Standards 60 & 61.
- B. Submit certificate of conformance with ANSI/NSF Standard 60 & 61 with product data submittals in accordance with Section 01300.

PART 2 – PRODUCTS

2.01 PIPE AND PIPE FITTINGS

A. Ductile Iron (Cement Lined):

1. Pipe: ANSI/AWWA A21.51/C151 and ANSI/AWWA A21.50/C150.
2. Wall Thickness: As indicated on the Drawings, except flanged ductile iron threaded for pressure service shall have a Class 53 wall thickness.
3. Cement Mortar Linings: Conforming to ANSI/AWWA A21.4/C104, except the thickness of linings should not be less than the following:
 - a. 3" through 12": 1/8"
 - b. 14" through 24": 3/16"
4. Fittings: Gray iron or ductile iron ANSI/AWWA A21.10/C110 or ductile iron compact fittings ANSI/AWWA A21.53/C153.
 - a. Up to 12-inch inclusive; 250 psi. rated.
 - b. 14-inch through 36-inch; 150 psi. rated.
 - c. 42-inch through 48-inch; AWWA C100, Class B.
5. Joints:
 - a. Rubber-Gasket Joints:
 - 1) Use rubber-gasket joints for pipe and fittings installed underground.
 - 2) Use rubber-gasket joints for pipe and fittings installed underground, except for air piping.
 - 3) Mechanical Joint: ANSI/AWWA A21.11/C111.
 - 4) Push-on Joint: ANSI/AWWA A21.11/C111.
 - b. Flanged:
 - 1) Unless indicated otherwise on the Drawings, use flanged joints for pipe and fittings installed inside of structures, ANSI/AWWA A21.15/C115.
 - a) Gaskets: 1/8 in. thick rubber full face type.
 - b) Bolts: ANSI B18.2.1.
 - c) Nuts: ANSI B18.2.2.
 - c. Mechanical Pipe Couplings:
 - 1) Except where otherwise indicated on the Drawings mechanical pipe couplings may be used in lieu of flanged joints.
 - 2) Use self-entering gasketed couplings designed to mechanically engage grooved or shouldered piping and lock in a positive watertight couple. Housing of malleable iron, ASTM A47, or ductile iron, ASTM A536 and gaskets of molded synthetic rubber ASTM D2000 Grade No. 3BA615A14B13. Bolts and nuts of heat treated carbon steel, ASTM A183, minimum tensile 110,000 psi. Use following coupling by Victaulic Company of America, or equal.
 - a) Victaulic Style 31; up thru 24 inches.
 - b) Victaulic Style 44; larger than 24 inches.
 - c) Vic-Flange Style 341; coupling to flange.
6. Air Piping Joints: Rubber-gasket joints as previously specified, except gasket to be of ethylene-propylene (EPDM), suitable for use at air temperatures up to

250°F. Pipe Coating: Ductile iron pipe factory coated inside and out with Bitumastic No. 300-M by Koppers Company, Inc. or Bitu-Chem No. 32-B4 PennoxTar by Pennsburg Coating Corporation. Prepared pipe surfaces per coating manufacturer's instructions and coat to 20 mils minimum dry mil thickness.

- B. Pipe and Fittings Coating: Factory coated inside and out with bituminous material; minimum 1 mil dry thickness.
- C. Polyvinyl Chloride Pipe (PVC):
 - 1. Pipe: ASTM D1785 Schedule 80 manufactured from Class 12454-B Rigid PVC Compounds with a hydrostatic design stress of 13.8 MPa (2000 psi) designated as PVC 1120.
 - 2. Joints: Socket-Type unless flanged joints are indicated on the Drawings.
 - 3. Socket Type Fittings: ASTM D2467 manufactured from Class 12454-B Rigid PVC Compound.
 - 4. Flanges: PVC Schedule 80 150-lb. flanges manufactured from Rigid PVC Compounds conforming to ASTM D1784.
 - a. Gaskets: Soft rubber full face flat type.
 - b. Bolts: Steel conforming to ASTM A307.
 - 5. Solvent: ASTM D2564.
- D. Polyvinyl Chloride (PVC) ((Up to 6-inch inclusive)) Underground: Schedule 40, Type I PVC soil and waste pipe, ASTM D1785, and fittings, ASTM D2466, with solvent cemented joints, ASTM D2564.
- E. Polyvinyl Chloride (PVC), Aboveground: Drain, waste and vent pipe and fittings, ASTM D2665, with solvent cemented joints, ASTM D2564.
- F. Polyvinyl Chloride Pipe (PVC): ((Use ASTM F679 for over 15" Dia.))
 - 1. Pipe: Type PSM SDR-35, ASTM D3034, or Type PS-46, ASTM F789.
 - 2. Fittings: Conforming to same applicable ASTM Specification requirements for pipe.
 - 3. Joints: Push-on with elastomeric gasket, ASTM D3212; and ASTM F477 for gasket specifications.
- G. Pipe Supports, Anchors and Seals: Material as specified in Supports, Anchors and Seals: Section 15090.

2.02 PIPING SPECIALTIES

- A. Grooved Pipe Couplings: Ductile iron sectional coupling with elastomeric gasket and all necessary nuts, bolts, and washers, and conforming to ANSI/AWWA C 606, Standard for Grooved and Shouldered Type Joints and CSA 242 M1980.
 - 1. Acceptable Manufacturers:
 - a. Victaulic Company of America.

- b. Or Equal.
- B. Flexible Pipe Coupling: Coupling shall consist of a steel middle ring or sleeve, two steel or malleable iron flange or follower rings, two wedge shaped resilient gaskets and sufficient number of track-head bolts and nuts.
 - 1. Middle Ring or Sleeve: Steel construction, ASTM A283, (Grade A), fabricated in a true circular section and free of surface defect.
 - 2. Follower Rings or Flanges: Steel construction, ASTM A47 (Grade 32510), fabricated in a true circular section and free of surface defect, and tested and sized after welding by cold expanding a minimum of one percent.
 - 3. Bolts and Nuts: Steel bolt, ASTM A183, double radius head or buttonhead track type with rolled threads, ANSI B1.1; and steel nuts, ANSI B18.2.2, American Standard Heavy Dimension Series.
 - 4. Gaskets: Resilient wedge-shaped of synthetic base compound designed for raw sewage and sludge service.
 - 5. Shop Paint: Middle and follower rings shop painted with primer compatible with specified field coat for piping where coupling is located.
 - 6. Acceptable Manufacturers:
 - a. Dresser Manufacturing Division of Dresser Industries, Inc.; Dresser Style 38.
 - b. Rockwell-International; 411.
 - c. R. H. Baker & Co., Inc.; Series 200.
 - d. Or Equal.
- C. Overflow Rings: Cast iron overflow rings Figure No. F-1495 manufactured by Clow Corporation or equal.
- D. Harnessed Flexible Pipe Couplings: Flexible coupling portion same as specified above. Harness assembly composed of steel plates and steel rods of required length. Rods threaded both ends and provided with nuts and washers.
 - 1. Acceptable Manufacturers:
 - a. Roots - Connersville Blower, Inc., Division of Dresser Industries, Inc.,; Part No. 810-973.
 - b. General Rubber Corp.
 - c. Or Equal.
- E. Flanged Adapters: For joining plain-end pipe to flanged fittings, valves and pumps.
 - 1. Acceptable Manufacturers:
 - a. Dresser Manufacturing Division of Dresser Industries, Inc.; Dresser Style 127.
 - b. Rockwell-International; 912.
 - c. R. H. Baker & Co., Inc., Series 601.
 - d. Or Equal.
- F. Metal Harness: Metal harness of tie rods of adequate strength to prevent movement shall be used where indicated.
 - 1. Steel rods or clamps shall be type 304 stainless steel.

2. Steel plate of 3/4-inch ASTM A36 steel cut and punched as detailed on the Drawings.
- G. Dielectric (Insulated) Unions: Threaded type ANSI B2.1, 300 lb., WOG malleable iron ASTM A197, with vulcanized fiber insulating sleeve and neoprene gaskets; full size of pipe at point of installation.
- H. Ferrous Metal Unions: Threaded type ANSI B2.1 300 lbs. WOG malleable iron ASTM A197 with bronze-to-iron ground joint; full size of pipe at point of installation.
- I. Non-ferrous Metal Unions: Wrought copper or bronze with solder-joint, ANSI B16.22.
- J. PVC Unions: Socket type ASTM D2467 manufactured from Class 12454-B Rigid PVC Compound with Buna O-Rings.
- K. Nipples: New stock, of same material and thickness of wall as pipe line in which nipple is installed. Close nipples not permitted.

2.03 VALVES

A. General:

1. Provide valves of the same type by same manufacturer; suitable for the intended service.
2. Markings factory cast on the bonnet or body of each valve indicating manufacturer's name or mark, year of valve casting, size of valve, directional flow arrow and designation of working water pressure.
3. Valve pressure-temperature ratings of not less than the design criteria applicable to system components.
4. Valves shall open to the left (counterclockwise). Valves operated by nut, handwheel, lever, floorstand or otherwise as indicated on the Drawings. Operating nuts or wheels shall have cast thereon an arrow indicating the direction of opening.
5. Provide chain wheels and chains for operating overhead or inaccessible valves.
6. Provide extension stems with bronze bushed stem guides where required. The unsupported length of extension stems shall not exceed 10 feet.
7. For wrench operated valves, provide at least one wrench for each type and size valve except where valves are in convenient groups; supply one wrench for each four valves.
8. Valve ends as indicated on the Drawings and unless indicated otherwise shall conform to the following:
 - a. Flanged: ANSI/AWWA A21.15/C115.
 - b. Mechanical: ANSI A21.11.
 - c. Screw End: Threaded in accordance with ANSI B2.1.
 - d. Solder Type: For use in copper tubing lines: ANSI B16.18.

- B. Motor Operators: Standard weatherproof type, and of ample capacity for the intended service.
1. Motor designed for continuous duty and shall include reversing starter, gearing, limit switches, double torque switch in a NEMA 4 enclosure with surface-mounted control station.
 2. Acceptable Manufacturer:
 - a. Philadelphia Gear Works; Limitorque Valve Controls, Type SMB.
 - b. Or Equal.
- C. Gate Valves:
1. General:
 - a. Design working water pressure at 200 psi for valves 12 in. in diameter and smaller, and 150 psi (high pressure) for valves with diameters of 14-inches and larger.
 - b. Design working water pressure at 200 psi for valves 12 in. in diameter and smaller, and 100 psi (medium pressure) for valves with diameters of 14-inches and larger.
 - c. Valves of rising stem type except when installed underground; or otherwise indicated on Drawings.
 - d. Valve stuffing box of such design that valve can be packed under Pressure when in fully open position.
 2. Valves 3-inches through 12-inches in diameter:
 - a. Iron body, outside screw and yoke, bronze mounted with resilient-seated wedge conforming to AWWA C 509.
 - b. Resilient seat of Styrene Butadiene SBR or Urethane Rubber bonded to cast iron wedge.
 - c. Stem seals of O-ring type.
 - d. Exterior to be asphalt varnish or epoxy coated; interior ferrous metal parts to be epoxy coated, AWWA C550.
 - e. Acceptable Manufacturers:
 - 1) Clow Corporation.
 - 2) American Darling Valve.
 - 3) Kennedy Valve.
 - 4) Or Equal.
 3. Valves Smaller Than 3-inches In Diameter:
 - a. Solid bronze with tapered split wedge disc.
 - b. Physical properties of brass pressure containing parts shall conform to ASTM B62.
 - c. Stems fabricated of ASTM B-371, Alloy A (rolled silicon brass), ASTM B-584 Copper Alloy No. 876 (silicon bronze + silicon brass), or other material equally resistant to dezincification.
 4. Hose End Type: Bronze construction, tapered solid wedge disc, nonrising stem, female inlet and outlet having American Standard Taper Pipe thread. (Provide quick disconnect couplings in polypropylene material and manufactured by Plastic Piping Systems.)
 - a. Crane Company; No. 451 with cap and chain; 1-inch through 2½-inch.

- b. Wm. Powell Co.; No. 502HS; 1/2-inch through 3-inch.
 - c. Or Equal.
- 5. Tapping Valve:
 - a. Oversize seat rings.
 - b. Raised male face on flanged end for bolting to tapping sleeve.
 - c. Mechanical or push-on joint with slotted holes for bolting to tapping machine.
- D. Check Valves:
 - 1. 3 in. In Diameter and Larger:
 - a. Designed for a minimum working water pressure of 150 psi.
 - b. Iron body, bronze mounted, full opening swing check type with bolted cover, stainless steel hinge and malleable iron clapper arm.
 - c. Disc of cast iron with bronze seat ring.
 - d. Valves 10 in. and larger furnished with outside lever and spring.
 - e. Valves less than 10-inches furnished with outside lever and weight.
 - f. The check valves on each pump discharge line located in the valve vault shall be provided with a factory installed Allen Bradley or Square D limit switch.
 - g. Acceptable Manufacturers:
 - 1) M & H Valve Company; Check Valves.
 - 2) Clow Corporation; Horizontal Swing Check Valves.
 - 3) Mueller Co.; Swing Type Check Valve.
 - 4) Or Equal.
 - 2. Smaller Than 3 inches In Diameter:
 - a. Designed for minimum working water pressure of 200 psig.
 - b. Solid bronze Y pattern horizontal swing check type with screwed cap.
 - c. Disc of solid bronze; renewable type.
 - d. Bronze material shall conform to ASTM B62.
 - e. Acceptable Manufacturers:
 - 1) Crane C .; Swing Check Valve.
 - 2) ITT Grinnell; 125 lb. Bronze Check Valve.
 - 3) Nibco Inc., 125 lb. swp Bronze Check.
 - 4) Or Equal.
- E. Swing Check Valve (Oil Controlled):
 - 1. General: Cast iron oil controlled swing check valve per AWWA C508 with integral flanges and centrifugally cast bronze body seat. Valve designed for control open and three stage closing with each stage infinitely, independently adjustable and the oil system self-contained and separate from the main line media.
 - 2. Body and Cover: Cast iron per ASTM A126, Class B.
 - 3. Disc: Cast iron per ASTM A126, Class B.
 - 4. Disc Arm: Ductile iron per ASTM A536.
 - 5. Body Seat Rings: Aluminum bronze per ASTM A148.
 - 6. Disc Seat: Buna-N.
 - 7. Dashpot Cylinder: Commercial steel.
 - 8. Pivot Shaft: T17-4PH stainless steel.

9. Exterior Finish: Phenolic primer red oxide.
 10. Acceptable Manufacturers:
 - a. APCO Valve and Primer Corp.; Series 6100.
 - b. Or Equal.
- F. Non-Lubricated Plug Valves (Eccentric Type):
1. Designed for a minimum working water pressure of 175 psi for valves through 12-inch, 150 psi for valves 14-inch through 36-inch and 125 psi for valve sizes 42-inch through 54-inch.
 2. Provide non-lubricated eccentric type plug valve with valve bodies of cast iron conforming to ASTM A126 Grade B or valve bodies of semi-steel with coated plug suitable for wastewater and nickel or stainless steel seats.
 3. Provide full pressure, drip-tight shutoff, with rated pressure from either direction.
 4. Provide straight through, round port configuration or rectangular style design, however, port area shall be a minimum of 80% of corresponding pipe area.
 5. Valves 8-inch and larger operated by enclosed worm and gear.
 6. Provide enclosed worm and gear operator for valves less than 8 in. that must be chain operated.
 7. Acceptable Manufacturers:
 - a. DeZurik; Series 100 Eccentric Valves.
 - b. Keystone, USA Valve Division; Ballcentric.
 - c. Clow.
 - d. Or Equal.
- G. Lubricated Plug Valves:
1. Designed for a minimum working water pressure of 150 psi.
 2. Provide lubricated plug valves with valve bodies of cast iron conforming to ASTM A126 Grade B, and cylindrical plug with full pipe area rectangular or round part.
 3. Lubricating system shall have hydraulic type fitting for lever-operator pressure hand-gun (bulk lubricant or cartridge). Where valves are installed in a buried location, provide extended grease lines to grade through the valve box and terminate in a lubricant fitting under the valve box cover.
 4. Acceptable Manufacturers:
 - a. Resun Manufacturing Company.
 - b. Rockwell.
 - c. Homestead.
 - d. Or Equal.

PART 3—EXECUTION

3.01 PREPARATION

A. Field Measurement:

1. The Drawings are in general indicative of the Work, with symbols and notations for clarity. However, the Drawings are not an exact representation of all conditions involved, therefore, layout piping to suit actual field measurements. No extra compensation will be made for Work due to differences between indicated and actual dimensions.
2. Submit details of proposed departures necessitated by field conditions or other causes to the Engineer for approval.

3.02 INSTALLATION

A. General:

1. Clean piping prior to installation and following installation to prepare for painting. Keep open ends of piping and pipe attachment openings on equipment capped or plugged until actual connection.
2. Construct piping from full lengths of pipe using short sections only for runs of less than full pipe length. Make changes in direction of pipe runs with fittings only.
3. Cut pipe accurately to measurements established in the field and assemble in place without springing, forcing, excessive cutting or weakening of the structure.
4. Cutting of glass-lined pipe in the field shall be limited to only one piece per run of pipe and this shall be for closure purposes only. Field cut pipe shall not spall back from the cut section, greater than 1/8". There shall be no fishscaling or crazing beyond this point. All cutting shall follow the recommendations of the manufacturer.
5. Use reducing fittings where reduction in pipe sizes is necessary. Bushings will not be accepted.
6. Place and support piping runs as specified in Section 15090.

B. Exposed Piping:

1. Run piping parallel or perpendicular to the lines of the structure. Keep piping a sufficient distance from other work to permit clearance of not less than one inch between the piping or insulated piping and adjacent work. Install piping as close as possible to walls, overhead construction, columns, and similar to facilitate insulating work and removal of piping later.
2. Run piping to compensate for structural interferences, to preserve headroom, and not to interfere with openings, passageways and equipment.
3. Do not install piping with joints and fittings over motors, switchboards, panels, or similar electrical apparatus.
4. Install unions and flanges in accessible locations and where indicated or not, install union adjacent to all equipment and wherever removal of equipment for repair or replacement is required. Use dielectric unions at points of connection of copper tubing and piping to ferrous metal piping or equipment.

C. Underground Piping:

1. Perform trenching as specified previously in Section 02221.

2. Unless indicated otherwise, piping outside of structures shall be installed with not less than 3'-6" of cover.
3. Keep trenches dewatered until pipe joints have been made and concrete bedding and blocking, if any, have hardened. Under no circumstances lay pipe in water or on subgrade containing frost.
4. Rest each section of pipe on pipe bedding for the full length of its barrel, with recesses excavated for pipe bells so joints can easily be made. Backfill recesses with bedding material immediately following pipe joining operations.
5. Take up and relay pipe that is not laid true to required alignment or grade or has its joints disturbed after laying. No deviation from the required line and grade permitted, except with approval of the Engineer.

D. Pipe Joining:

1. General: Exercise care when making pipe joints and make joints in accordance with the pipe material manufacturer's recommendations and the following requirements. In each instance of pipe joining, those portions of pipes involved must be absolutely clean just prior to assembly. If a joint is extremely difficult to assemble or sealing is not effected, disassemble the joint and correct the difficulty if possible. Remake the joint using new materials when necessary.
2. Push-on Joints: To make ductile iron pipe push-on joints, properly seat sealing gasket, evenly and sufficiently lubricate the spigot end of pipe, and fully enter joint until joint line is visible. Make deflection, if required, only after the joint has been assembled properly.
3. Mechanical Joints: To make ductile iron pipe mechanical joint, position sealing gasket and gland for bolting and then enter the spigot into pipe bell end until joint line is visible. Tighten bolts evenly maintaining approximate distance between gland and face of flange at all points around the socket. Do not exceed pipe manufacturer's specifications for maximum torque applied to bolts.
4. Flanged Joints: Make ductile iron and steel pipe joints faced true, fitted with gaskets, and drawn up square and tight to ensure full gasket flow and satisfactory seal.
5. Compression Type: Make underground cast iron soil pipe joints in accordance with manufacturer's specifications.
6. No-Hub Joints: Cast iron no-hub pipe joint ends must be properly entered in the gasket shield/clamp assembly prior to tightening. Make no hub joints in accordance with procedures outlined in Pamphlet No. 100 of CISPI 301.
7. Welded Joints: Responsibility for quality of welding, competency of welding operators and their ability to make sound welds rests with the Contractor. Technique of welding employed, appearance and quality of welds made and methods used in correcting defective work shall conform with requirements of ANSI B31.1 and its Supplements.
8. Threaded Joints: Cut pipe ends square, deburr and ream to size of original bore. Cut threads to American Standard tapered pipe threads, free of oil and cuttings. Use an approved joint tape or joint paste to aid in joint lubrication and sealing. After fabrication, paint exposed threads with red lead paint.

9. Rubber Gasket Joints: Make reinforced concrete pipe rubber gasket joints in accordance with pipe manufacturer's written instructions. In addition, fill annular space remaining in the interior and exterior pipe joint with Joint Filler Material.
 - a. a. Make joints in accordance with requirements of AWWA C 302 and as specified herein.
 - b. b. In addition to rubber gasket joint seal in rubber and steel joints, fill remaining annular space of pipe joint interior and exterior using Joint Filler Material. Apply Joint Filler Material in strict accordance with manufacturer's written instructions. Remove excess filler material from pipe interior and trowel joint interior surface to produce a continuous smooth surface across the joint.
 10. Compression Joints: Joint assembly for vitrified clay pipe according to ASTM C12 and pipe manufacturer's written instructions.
 11. Soldered Joints: Cut tubing and piping ends square, deburr and ream to size of original bore. Prior to sweating, clean pipe ends and fittings surfaces involved in the joint, to bright metal without marring surfaces. Finished joints shall show no evidence of hard-temper due to overheating, no evidence of improper solder draw, and excess solder must be removed.
 12. Flared Joints: Cut tubing and piping ends square, deburr and ream to size of original bore. Finished joints shall show evenness of flaring and Proper seating of joining parts.
 13. Solvent-Weld Joints: Use chemical solvent welding components to join PVC pipe of the type specified in manufacturer's printed recommendations.
- E. Field Touch-up of Pipe Coating For 20-mil Pipe Coating:
1. Prior to placement of coated pipe touch up chipped, cracked or abraded pipe surfaces with two coats of the previously specified coating material.
 2. Bring coating materials for field touch-up to job site in original sealed and labeled containers.
 3. Contractor shall submit to the Engineer, immediately upon completion of field applied coating, certification from the manufacturer indicating that the quantity of each coating purchased was sufficient to properly coat all surfaces.
 4. In addition to field touch-up of pipe surfaces, thoroughly cover completed pipe joints with pipe coating material.
- F. Valve Tags: Install valve tags in accordance with list furnished by Engineer.

3.03 FIELD QUALITY CONTROL

- A. General Requirements: Conduct tests specified herein so that each pipe line installed in the Project is tested to the Engineer's satisfaction.
1. Provide tools, materials (including water), apparatus and instruments necessary for pipe line testing.
 2. Conduct tests of every kind in the presence of and to the satisfaction of the Engineer.

3. Remove testing equipment at completion of testing.

B. Gravity Line Leak Test (Infiltration):

1. The occurrence of a rate of infiltration of ground water, or other water, into the gravity line (including in line structures) in excess of 200 gallons per inch pipe diameter per mile of pipe per day during periods of high ground water levels will be considered as evidence of defective workmanship and will require repair or replacement at no increase in Contract Price.
2. Regardless of whether the rate of leakage exceeds or is below the allowable maximum rate, repair detectable leaks in pipe lines.

C. Pressure Line Leak Test (Hydrostatic):

1. Conduct tests in accordance with test conditions prescribed in ANSI B31.1. Additionally test piping systems under normal service conditions to demonstrate compliance with the requirements of the Specifications in all respects.
2. Before tests are made, remove in-line gauges, diaphragms, delicate pressure instruments, or any other apparatus which may be damaged by test pressure.
3. At the completion of testing, immediately make tight those leaks which developed under test and correct defects or deficiencies disclosed as a result of tests. Repeat tests until ANSI test requirements are fully complied with. Do not repair leaks with temporary materials. Use only materials as specified for joint making.

END OF SECTION

SECTION 15800

AIR DISTRIBUTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Air Distribution Devices.
- B. Supply and Exhaust Fans.

1.02 RELATED SECTIONS

- A. Basic Mechanical Requirements: Section 15010.
- B. Supports, Anchors, and Seals: Section 15090.
- C. Mechanical Insulation: Section 15250.
- D. Basic Electrical Requirements t: Section 16010.

1.03 REFERENCES

- A. Air Movement and Control Association (AMCA):
 - 1. AMCA Standards 210 and 300, Capacity Ratings.
 - 2. AMCA Standards 300 and 301, Sound Ratings.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM C553; Mineral Fiber Blanket and Felt Insulation.
 - 2. ASTM B209; Aluminum and Aluminum-Alloy Sheet and Plate, Spec. for.
 - 3. ASTM D1784; Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (PVC) Compounds.
 - 4. ASTM B209; Aluminum and Aluminum-Alloy Sheet and Plate, Spec. for.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 90A; Standard for the Installation of Air Conditioning and Ventilating Systems.
 - 2. NFPA 90B; Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
 - 3. NFPA 255; Method of Test of Surface Burning Characteristics of Building Materials.

- D. NBS PS 15 - Voluntary Product Standard for Custom Contact-molded Reinforced-Polyester Chemical Resistant Process Equipment.
- E. Sheet Metal and Air-Conditioning Contractors' National Association, Inc. (SMACNA):
 - 1. SMACNA HVAC Duct Construction Standards.
 - 2. SMACNA Thermoplastic Duct (PVC) Construction Manual.
 - 3. SMACNA HVAC Systems - Testing, Adjusting and Balancing.
- F. Underwriters' Laboratories, Inc. (UL): Listings and Labels shall govern the quality and performance of certain Products as specified herein.
 - 1. UL 181; Factory-Made Air Ducts and Connectors.
 - 2. UL 555; Tests for Fire Resistance of Vault and File Room Doors.
 - 3. UL 723; Test for Surface Burning Characteristics of Burning Materials.

1.04 SUBMITTALS

- A. Shop Drawings and/or Product Data: As specified in Section 15010; submittals required for the following items:
 - 1. Air Distribution Devices.
 - 2. Ventilators.
 - 3. Fans.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Wet Well Fresh Air Supply Fan:
 - 1. Fan shall be a belt driven, forward curved model SFD 6-4A ¼ Hp by Greenheck or equal capable of supplying a minimum of 597 cfm. An optional weatherproof weatherhood shall be provided.

PART 3 - EXECUTION

3.01 PERFORMANCE

- A. Installation Instructions: Install those Products, as specified previously under PART 2 and not specifically covered for installation herein under PART 3, in strict accordance with manufacturer's installation instructions and at locations indicated on the Drawings.
 - 1. When manufacturer's installation instructions do not exist, and when installed locations are not specifically indicated, perform work in accordance with current accepted Trade practices concerning installation of such Products.
 - 2. Equipment support and anchoring as specified in Section 15090.

- B. Electrical Interface: As specified in Section 15010.
- C. Equipment Start Up: Perform equipment start up in accordance with Section 01650 and ensure its proper operation prior to acceptance of Work by the Engineer.

3.02 INSTALLATION

- A. Ventilation Fan Installation:
 - 1. Install ventilation fans using stainless steel anchors and fasteners as specified in Section 15090. Size and quantity required as recommended by fan manufacturer. Installations shall be fastened to the inside of wall opening, due to rough surface of split-faced block. Provide all frames, clips, or other supports required to firmly attach unit as specified.
- B. Materials and Equipment Exposed to Weather: Provide stainless steel fasteners for both exposed and concealed attachments. Install gaskets and seals, when provided with materials and equipment, to ensure weatherproof installations.

3.03 FIELD QUALITY CONTROL

- A. Balancing and Adjusting: Perform air distribution system balancing and adjusting work in accordance with the procedures and standards described in the SMACNA Manual For The Balancing And Adjusting Of Air Distribution Systems. Additional precautions and requirements as follows:
 - 1. Examine equipment and distribution systems to see that they are free from obstructions. Determine that air control equipment is open, that moving equipment is lubricated, that filters are functioning, and perform other before-start up inspections and maintenance activities as required by the respective equipment manufacturers for proper operation of their equipment.
 - 2. Adjust external air control devices and duct internal air control devices so that each air outlet and inlet delivers and removes, respectively, the designed CFM of air as indicated.
 - 3. Tabulate the results of the final balancing, adjusting and testing on copies of the SMACNA Forms (forms as included in the SMACNA Manual herein referenced) or similar forms meeting with Engineer's approval. Submit completed forms in duplicate.
 - 4. Deficiencies and defects manifested by above stated balancing and adjusting work forms must be rectified immediately at no increase in Contract Price.
 - 5. Finally, leave equipment and distribution systems in operation under their respective controls.

END OF SECTION

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Basic electrical requirements specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements.

1.02 RELATED SECTIONS

- A. Division 1 - General Requirements.
- B. Basic Equipment Requirements: Section 11200.
- C. Division 16 Sections as Included.

1.03 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Comply with electrical construction code requirements of State, County, and such other local political subdivision specifications as may exceed the requirements of national codes, standards and approving bodies. Modify electrical construction work to conform to such laws, ordinances, rules, regulations and specifications, and at no increase in Contract Price for such modifications.
 - 1. Code Compliance Inspection: Have the work inspected by an authorized inspection agency for compliance with National Electrical Code and obtain certificates of approval, acceptance, and compliance with code regulations. Work shall not be deemed complete until such certificates have been delivered to the Owner.
- B. Certificates and Permits: Upon completion of work, and prior to final Payment, furnish formal certification of final inspections to the Engineer from authorities having jurisdiction in the State of Maryland and secure required permits or certificates (if any) from such authorities. Additionally, prepare detailed diagrams and drawings which may be required by those authorities having jurisdiction. Costs for certificates and permits shall be borne by the Contractor.

- C. Source Quality Control: Products used throughout these Specifications, and as indicated on the Drawings, are those of companies having established reputations in the manufacture of the particular materials, equipment, or apparatus specified. Such products may be of their own make, or products of others for which they assume full responsibility when used in said outfits (which are not manufactured completely by them), and with replacement parts available.

1.04 REFERENCES

- A. Basic References: The following codes, standards, and approvals as referenced throughout the Sections of Division 16, shall serve as the minimum standards and quality requirements directly appropriate to the work and workmanship.
 - 1. American National Standards Institute (ANSI): ANSI C2; National Electrical Safety Code.
 - 2. National Electric Manufacturer's Association (NEMA) Standards as apply to specified Products.
 - 3. National Fire Protection Association (NFPA): NFPA 70; National Electrical Code, and current amendments.
 - 4. Underwriters' Laboratories, Inc. (UL) Listings, Labels, and Approvals shall govern the quality and performance of certain specified Products.
 - 5. National Fire Protection Association (NFPA): NFPA 70E – Standards for the Electrical Safety in the Workplace.

1.05 SUBMITTALS

- A. Product Data:
 - 1. Include in submittals manufacturer's descriptive literature, product specifications, published details, performance/capacity rating schedules or charts and installation instructions, all as applicable to items listed under Submittals in each Section of Division 16; and such items as may be Scheduled on the Drawings.
- B. Shop Drawings:
 - 1. Submit shop drawings certified for construction by Product manufacturers, and approved by the Contractor, which includes location of electrical connections; wiring diagrams; anchor bolt layout; details indicating construction and materials of construction; dimensions; and weight of the completely assembled item.
 - a. Shop drawings applicable to items listed under Submittals in each Section of Division 16; and such items as may be scheduled on the Drawings.
- C. Operation and Maintenance Data: Submit for approval three sets of Product manufacturer's operating and maintenance instructions bound in a hard cover binder with index and index tabs. Manufacturer's advertising literature or advertising catalogs will not be acceptable for operating and maintenance instructions. Equipment and/or systems requiring manuals as stated hereinafter. Data shall include:

1. Installation, operating and maintenance instructions.
 2. Wiring diagrams.
 3. Equipment parts lists.
 4. Copies of all approved Shop Drawings.
- D. Submit Operation and Maintenance Manuals in compliance with Section 01700.
- E. Overload Relays: Obtain actual horsepower, service factor and full load running current for all electrical motors provided in the Project and submit an Overload Relay Schedule containing motor nameplate information for the Engineer's approval.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and equipment to the Project site in a clean condition with openings plugged or capped (or otherwise sealed by packaging) both during shipping and during temporary storage.
- B. When unloading materials and equipment provide special lifting harness or apparatus as may be required by manufacturers. Handle materials and equipment in accordance with manufacturer's written instructions.
- C. The Contractor shall determine the required equipment needed for unloading operations and have such equipment on site to perform unloading work on the date of equipment delivery.
- D. Store materials and equipment, both on and off site, in accordance with manufacturer's written instructions.

1.07 JOB CONDITIONS

- A. Interferences:
1. The Drawings are generally diagrammatic and indicative of the work. The Contractor is responsible for modifying the work with offsets, bends or other fittings to avoid minor interferences and structural obstruction. Perform such modifications at no increase in Contract Price.
 2. Construct Electrical Systems when and in a manner not to delay or interfere with other operations of work in the Project.
 3. Prior to making Electrical installations, coordinate Electrical Work locations with the work of other operations.
 4. In the event that interferences develop, the Engineer's decision will be final and no additional compensation will be allowed for relocation of Electrical Products.

1.08 DEFINITIONS

- A. The following definitions apply when used in the context of these Specifications.
 - 1. Provide: Furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site ready for installation..
 - 3. Install: Place in position for service or use.
 - 4. Dedicated: Means one circuit in one metal conduit between device and circuit breaker.

1.09 WARRANTIES

- A. Assigned Warranties: Manufacturer's warranties on material and equipment (including internal components) exceeding the guarantee time Period as stated in the Conditions of the Contract, shall be assigned directly to the Owner.
 - 1. Such assigned warranties shall be dated to begin at the date of the Owner's acceptance of the Work.
 - 2. Submit warranties along with submission of Shop Drawings and Product Data.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Products: Material particulars and requirements are as specified in the various Sections included under Division 16 - Electrical.
 - 1. Basic Electrical Materials and Methods as applicable to several Electrical Specifications Sections are specified in Section 16050. Products applicable to specific Electrical Specifications Sections, or for special applications, are specified in those Sections.
 - 2. Provide Products of new and recent manufacture.
 - 3. For each category of materials and equipment (Products), provide Products of the same manufacturer and type.
- B. Shop Paint:
 - 1. For primer coat provide only those primers that are compatible with field coats specified in Section 09900.

PART 3 - EXECUTION

3.01 INSTALLATIONS

- A. General Requirements: Installation particulars and requirements are as specified in the various Sections included under Division 16 - Electrical.
 - 1. Perform required interconnection of the differing electrical systems to the various electrical equipment, devices, or apparatus, regardless of where such Products are

specified throughout Division 16 - Electrical, in order to ensure the completeness of such electrical system.

2. It is the contractor's responsibility to become familiar with the existing equipment that will remain on the project and to allow for rewiring, rerouting, and reconnection of that equipment to equipment provided through this contract. It is incumbent on the contractor to provide the necessary interface for existing equipment that will remain but does not have any mention of interface.

B. Field Painting: As specified in Section 09900.

3.02 FIELD QUALITY CONTROL

A. General:

1. Unless waived in writing by the Engineer, the Contractor shall be present during performance of the tests.

B. Electrical Systems Testing:

1. Render the entire installation free from short circuits and improper grounds. Test feeders disconnected from the branch.
2. If the insulation on any conductors becomes compromised after being pulled, the Engineer has the right to require the Contractor to perform an electrical system test using Meggers, ammeters, voltmeters, insulation resistance testers, or high-pot testers prior to placing electrical systems into complete operation.
 - a. Use Meggers with an adjustable voltage range up to 5.0 KV, which will permit reading of 0.05 to 100,000 Megohms. Minimum testing voltage obtained by adding 1000 volts to twice the rated voltage of cable, device, apparatus or equipment. In no case shall the insulation resistance be less than 100 Megohm. However, the recommended insulation resistance measurements of each test shall conform to IEEE and ANSI Standards.
 - b. Correct failure in a manner satisfactory to the Engineer.

END OF SECTION

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Basic electrical materials and methods.
- B. Conduit Systems.
- C. Low Voltage Conductors.
- D. Wiring Devices.
- E. Supports, Anchors, Fasteners & Seals.
- F. Grounding Products.
- G. Identification Products.

1.02 RELATED SECTIONS

- A. Trenching, Backfilling, and Compaction: Section 02221.
- B. Division 3 - Concrete.
- C. Basic Electrical Requirements: Section 16010.

1.03 SUBMITTALS

- A. Shop Drawings and Product Data: As specified in Section 16010. Submittals required for the following items:
 - 1. Wiring Devices.

PART 2 - PRODUCTS

2.01 CONDUIT SYSTEM MATERIALS

- A. Rigid Metal Conduits: Fabricated of mild steel piping, galvanized inside and outside, and protected against corrosion by a dichromate rinse or a zinc chromate coating. Each conduit shall bear the UL label, be defect free, furnished in 10 ft. lengths minimum, and of the following types:
 - 1. Intermediate Metal Conduit (IMC) and Fittings: Products meeting requirements of NEC Article 342 for materials and uses.

2. Rigid Metal Conduit and Fittings: Product meeting requirements of NEC Article 344 for materials and uses.
- B. PVC-Coated Flexible Metal Conduit (LFMC): Conduit meeting the requirements of NEC Article 350 for materials and uses. Each conduit length shall bear NEC inscription stamp, manufacturer's trademark, and shall conform to the following:
1. Flexible, galvanized, interlocking spiral strip steel core having a smooth, liquid-tight polyvinyl chloride jacket designed to withstand temperatures from -50°F to +220°F.
 2. Interlocking spiral strip construction of such to permit bending of conduit to a minimum radius of five times its diameter without deforming the spiral strips, both inside and outside of the conduit.
 3. Interior and exterior of flexible conduit finished smooth and free from burrs, sharp edges, and other defects which may injure wires.
 4. Conduit sizes 1/2-inch through 1¼-inch furnished with an integral continuous copper ground. Install flexible conduit sizes 1½-inch through 3-inch using a separate ground conductor.
 5. Acceptable Manufacturers:
 - a. Anaconda American Brass Company, Sealtite, Type H.C.
 - b. Or equal.
- C. Rigid PVC Conduit: High impact PVC (polyvinyl chloride) Conduit and Fittings conforming to NEMA Spec. TC-2, as Listed and Labeled by UL, and meeting the requirements of NEC Article 352 for PVC materials and uses. Provide schedule 40 conduit and fittings, except where required by NEC use schedule 80.
- D. PVC-Coated Galvanized Conduit: Galvanized conduit, prior to coating shall conform to ANSI C80.1, UL#6, and conform to the following for plastic coating:
1. Preparation: Conduit conditioned for plastic coating with chromic acid; threads hot-dipped galvanized prior to plastic coating operation. Conduit coated inside and out with a heat polymerizing lacquer, such as an epoxy acrylic, to approximately 0.005-inch thick as final preparation for liquid plastic coating.
 2. Plastic coating bonded to conduit the full length, except the threads, at thickness between 0.035-inch and 0.045-inch. A plastic coupling, having a plastic sleeve extending one pipe diameter or 2 inches (whichever is less) beyond the end of the coupling, factory furnished with each conduit length. All plastic coating shall have 3,500-psi tensile strength.
 3. Sleeve inside diameter same as outside diameter of the conduit used with it. Sleeve wall thickness the same as the plastic jacket on conduit.
 4. Bond between conduit and plastic and conduit sleeves and plastic equal to or greater than tensile strength of plastic coating.
 5. Provide Plastic coated condulets, fittings, unions, hubs, couplings and Plastic coated supports as necessary to form a complete system.
 6. Acceptable Manufacturers:
 - a. KorKap Products.
 - b. Perma-Cote.

- c. Plasti-Bond RedH2ot.
 - d. Thomas & Betts Ocal.
 - e. Or equal.
- E. Conduit Expansion Joints: Telescoping sleeve type designed for 4-inch maximum expansion; galvanized, weatherproof, vaportight, insulated bushing, lead-wool packing.
 - 1. Acceptable Manufacturers:
 - a. Crouse-Hinds, Type XJ, with ground strap GC100, and brass clamps GC102.
 - b. Appleton.
 - c. Or Equal.
- F. Conduit Unions: Erickson Couplings where necessary to complete a conduit run when neither end can be turned.
 - 1. Acceptable Manufacturers:
 - a. Thomas and Betts Company.
 - b. Appleton.
 - c. Or Equal.
- G. Metallic Outlet, Switch, Junction, and Pull Boxes, and Fittings: Provide such products meeting requirements of NEC Article 314 for materials and uses in conduit systems. No set-screw or indented type couplings or connectors permitted on this project.
 - 1. Provide cast steel outlet boxes, with integrally cast conduit hubs, for surface-mounted or exposed installations. White metal is not allowed.
 - 2. Provide NEMA Type 4X construction outlet, pull or junction boxes for outdoor installations, complete with required fittings and hubs.
 - 3. Provide NEMA Type 7 construction pull or junction boxes where indicated on the Drawings, complete with required fittings or hubs. Use in Class I, Divisions 1 and 2 environments.
- H. Conduit Seal-Off Fittings:
 - 1. Fittings shall conform to classification as defined in NEC Article 500 for Wiring in Hazardous Locations as specified herein. Seal with approved compound and fiber dam materials.
 - 2. Acceptable manufacturers:
 - a. Crouse-Hinds.
 - b. Appleton Electric Company.
 - c. Or Equal.
- I. Non-metallic Fittings:
 - 1. Provide such products meeting requirements of NEC Article 314 for materials and uses in conduit systems. Provide manufacturer's approved bonding agent utilized for permanently securing two devices or material together.

2. Non-metallic fittings fabricated from molded, high impact strength, fiberglass reinforced polyester. Fittings shall meet or exceed a Class 1 flame spread rating of less than 25 and a smoke rating of 5.
- J. Pull Rope: All spare conduits shall have nylon or polypropylene pull rope that is immune to mold and mildew. Pull rope shall have the capacity to be able to pull the largest conductors possible through that size conduit. Securely fasten the ends.
- K. Wireway (Raintight): Lengths, connectors and fittings UL listed and constructed in accordance with Underwriters' laboratories Standard UL 870 for Raintight Wireways, Auxiliary Gutters and Associated Fittings.
1. Wireway constructed with knockouts in bottom of trough and no gasketing that can rip or tear during installation that would compromise the raintight capability of the wireway.
 2. 16-gauge galvaneal sheet metal parts provided with corrosion-resistant phosphate primer and ASA-49 gray enamel finish.
 3. Acceptable Manufacturers:
 - a. Square D. Company; Type Square-Duct.
 - b. Eaton Cutler-Hammer.
 - c. Cooper Industries.
 - d. Or Equal.

2.02 LOW VOLTAGE CONDUCTORS

- A. Low Voltage Copper Wire (600 Volts Maximum): UL Listed conductors of 98 percent conductivity copper with type THWN/THHN insulation, and XHHW insulation rated 600 volts. Provide conductors of proper size and ampacity ratings according to NEC Article 310 except for the following modifications:
1. Minimum Conductor size:
 - a. No. 12 AWG in power and branch feeder circuits.
 - b. No. 14 AWG in control and alarm circuits.
 2. Maximum Number of Conductors In Raceways or Conduits: Not to exceed three conductors except for control wires when so indicated on the Drawings. (Exclude grounding conductors from conductor count.)
 3. Conductors #10 and smaller shall be solid conductors; conductors #8 and larger shall be stranded.
 4. Instrumentation wiring shall be stranded regardless of the size.
- B. Wire and Cable Connections:
1. Wire Nuts: Reinsulated UL Listed hand or tool installed solderless connectors of the spring-lock type or compression type for solid COPPER wire.
 2. Split Bolt Connectors or Compression Type Connectors: UL Listed connectors for making parallel or butt splices of stranded COPPER wire. Provide companion preformed plastic insulating covers or tape insulation conforming to NEC requirements.

3. Screw Lock Connectors: UL Listed connectors for making terminal connections of solid COPPER wire. Contractor option to provide UL Listed crimp type ring tongue connectors.
 4. Screw-Compression Lugs: UL Listed connectors for making terminal connections of stranded COPPER wire. Contractor shall provide an approved crimp tool for the type compression lugs furnished. Contractor option to provide UL Listed crimp tool compression style Lugs.
- C. Waterproof Splice Kit: Molded rubber composition and designed to create a watertight seal on the cable jacket as well as the splice.
1. Acceptable Manufacturers:
 - a. 3M.
 - b. Joy Manufacturing Company.
 - c. Or Equal.

2.03 WIRING DEVICES

- A. Switches and Receptacles: UL Listed Specification Grade switches meeting NEMA Standard WD-1-2, and UL Listed Specification WD-1-3. Switches and receptacles shall have SCREW TERMINALS and be of voltages indicated. A mixture of manufacturers' products not permitted.
1. Toggle Handle Snap Switches: 20-amp, single-pole, double-pole, 3-way or 4-way as indicated, 120/277 volt, heavy-duty, quiet design Hubbell Series 1220, BROWN color.
 2. Weatherproof Snap Switch: Press switch of quality as previously specified; Hubbell Series 1780 in a cast aluminum weatherproof box with Hubbell No. 1750 weathersealing cover.
 3. Standard Face Design Receptacles: 20-amp, two-pole, 3-wire, 125 volt grounding duplex, Hubbell Series 5362, BROWN color.
 4. GFCI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle.
 5. Weatherproof Receptacles: Receptacle as previously specified in a cast aluminum weatherproof box with Clear In-use heavy-duty Cover.
- B. Disconnect Switches: UL-Listed, General Duty and Heavy-Duty safety switches meeting NEMA KS1 Standard and UL 98 Standard. Switch horsepower rating, size, and type as indicated on the Drawings.
1. Enclosure: Code gauge (UL 98) sheet steel treated with a rust-inhibiting phosphate and finished in gray baked enamel, stainless steel, or non-metallic enclosures for non-hazardous areas. Enclosure NEMA Type 12 or NEMA Type 4X as indicated on the Drawings or required by the environment into which they are installed. Enclosures shall bear the manufacturer's permanent record of switch type, catalog number, and horsepower rating.
 2. Switch Mechanism: Quick-make, quick-break operating handle and mechanism, with positive padlocking provisions in the "off" position and padlocking provisions in the "on" position by drilling the indent. Switch current carrying parts

electroplated for resistance to corrosion. Switch lugs UL-Listed for copper cables and front removable.

3. Interlocks:
 - a. Mechanical: Interlock to prevent unauthorized opening of switch in “on” position.
 - b. Electrical: Normally open auxiliary contact when required on the drawings. One auxiliary contact shall be provided when used with variable frequency drives for opening the control circuit.
4. Cover Viewing Window: Windows for verifying the blade positions; for 30-amp and larger disconnect switches. Not required on fiberglass reinforced polyester or Krydon® enclosures, or on 120-volt control circuits.
5. General Duty: For 120-volt instrument supply with NEMA 12 or 4X enclosures; where other enclosure ratings are required use Heavy Duty switches.
6. Heavy Duty switches used elsewhere.
7. Acceptable Manufacturers:
 - a. ABB.
 - b. Eaton Cutler-Hammer.
 - c. General Electric.
 - d. Hubbell Circuit-Lock.
 - e. Mennekes.
 - f. Siemens.
 - g. Square D Company.
 - h. Or equal.

- C. Limit Switch: NEMA 7, N.C. 10-amp contact, single or double pole as shown on the drawings, 120 volts, and heavy-duty turret head with lever arm or offset lever arm as necessary. Square D type 9007CR or equal.

2.04 SUPPORTS, ANCHORS, FASTENERS AND SEALS

- A. Supporting Devices:
 1. Field fabricated angles, channels, and bars.
 - a. Exterior Areas – 304 or 316 Stainless Steel.
 2. Pre-engineered UL-Listed supporting system products may be used in lieu of field fabricated support systems, 304 or 316 stainless steel.
 - a. Acceptable Manufacturers:
 - 1) Kindorf.
 - 2) Unistrut.
 - 3) Famet Channel.
 - 4) Or equal.
 3. Conduit Supports: One-hole fastener style, Stainless steel. Provide pipe straps similar to those as manufactured by Thomas & Betts, or equal.
- B. Anchors and Fasteners:
 1. Anchor Bolts (Pre-Set): Where anchor bolts are indicated or required as pre-set in cast-in-place concrete, provide anchor bolts of lug or bent shape design.

- a. Stainless Steel Bolts: ASTM A320, Grade B8, AISC Type 303 or 304.
 2. Drive (Deep-Pitch) Screws: Self-tapping type.
- C. Wall Seal: Hydrostatic seal designed to seal opening between conduit and a through-structure opening. Provide stainless steel Link-Seal by Thunderline Corporation, or equal. Caulking, mastic sealants, and lead/oakum are not permitted.

2.05 GROUNDING PRODUCTS

- A. General: Provide Products conforming to UL requirements for grounding applications as specified in NEC Article 250. Materials as follows:
1. Bare Ground Wire: UL Listed soft drawn copper, Class A or Class B stranded, meeting the requirements of ASTM B8, and sized in accordance with the NEC except where the sizes specified herein or indicated on the Drawings are larger than those required by the NEC.
 2. Insulated Ground Wire: UL Listed, copper, Class B stranded, 600 volt 90 degrees C insulated and jacketed according to NEC. Sizes as indicated on the Drawings.
 3. Clamps and Connectors: UL Listed and conforming to use requirements of NEC Article 250.
 - a. Multi-bolt Solderless Compression Clamps: High strength electrical bronze with silicon bronze clamping bolts and hardware. Bolts, nuts, lockwashers, and similar hardware designed not to damage ground wire.
 4. Conduit Ground Bushings: Galvanized malleable iron with screw pressure connector; insulated throat where required.
 5. Ground Rods: UL Listed rods of medium carbon steel core and copper clad.
 6. Use ground rods of 3/4-inch diameter by ten feet long, unless indicated otherwise on the Drawings.

2.06 NAMEPLATES

- A. Provide permanent heavy-duty vinyl cloth material tape, pressure sensitive labels, or markers which, when applied to conductors, are easily read. Tape and labels shall be as manufactured by W. H. Brady Company, Len Products, Inc., or Stanco Products, Inc.
- B. Back-of-Panel Mounted: Use plastic markers with white letters on a black background in the panel interior to identify each device mounted on the panel exterior or interior. Locate the markers adjacent to, but not on, the given device and do not obstruct visibility by wire bundles or other equipment. Include device identification number as well as descriptive name on all nameplates.
- C. Provide laminated plastic nameplates such that the background is black with white letters showing through. Letters shall be 1/2" in height for control panels, panelboards, disconnect switches, circuit breakers, and other larger components; and 1/4" letter height

for smaller components such as contactors, starters, relay enclosures, etc. Fasten with stainless steel screws.

- D. Provide laminated plastic nameplates such that the background is red with white letters showing through. Letters shall be 1/4" in height. Use for warning labels. Fasten with stainless steel screws.
- E. Provide self-adhesive arc-flash warning label on switchboards, panelboards, industrial control panels, meter socket enclosures, and any other equipment that likely to require examination, adjustment, servicing, or maintenance while energized. Labels shall be as required by NEC article 110.16, exhibit 110.8 of the handbook.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Carefully inspect the structural and other construction work, which may affect the work of this Section. Coordinate performance of electrical work accordingly and furnish such Products as required to accommodate conditions and to preserve access to other equipment, or areas.
- B. Prior to performance of work required by Division 16, submit detailed drawings of proposed departures from original design, due to field conditions, or other cause, and submit for Engineer's approval.
- C. Inspect installed conduit and remove obstructions, dirt, and debris if present.

3.02 PREPARATION

- A. Field Measurement: The Drawings are generally diagrammatic and indicative of the work. Contractor is responsible for modifying the work as needed to accommodate offsets and other structural obstructions. Perform such modifications at no increase in the Contract Price.
- B. Obtain roughing-in dimensions of electrically-operated Products being installed in other construction work. Set conduit and boxes only after receiving approved dimensions and checking such equipment locations.
- C. Install electrical Products to suit actual field measurements and according to accepted trade standard practice. All electrical work shall conform to NEC 300 for wiring methods general requirements, and to all other applicable Articles of the NEC governing methods of wiring.
- D. Obtain the full load running current and service factor for all motors and size the overload relays in accordance with this data.

3.03 INSTALLATION

- A. Methods of Wiring: In general fabricate conduit and raceway systems in accordance with accepted trade standard practice. The following installation requirements are in addition to requirements set forth in Article 300 of the NEC.
1. Cut conduits and raceways square and deburr cuts to the same degree as cuts made by the material manufacturer. Ream cuts of conduits per NEC requirements with openings not restricted more than cuts made by the material manufacturer.
 2. Conduit smaller than 3/4-inch trade size is not permitted, unless indicated otherwise. Running threads are not permitted; provide approved threaded couplings and connectors for metal conduits where such are required.
 3. Avoid bending conduits as much as possible and practical; use an approved conduit bending tool or machine when bends are required. Do not install crushed or deformed conduits, and remove them from the site. Use flexible conduit only to the extent permitted by NEC.
 4. Mount conduit and raceway systems directly on structural members, except where indicated as being wall-mounted. Space supports in accordance with NEC requirements.
 5. Attach wall-mounted conduit and raceway runs tight to walls, following contour of walls and securely attach anchors into walls.
 6. Do not weaken the structure by excessive or unnecessary cutting.
 7. Make provisions for expansion in conduit and raceway runs where same cross building expansion joints.
 8. The means and methods are the responsibility of the Contractor.
 9. Use the properly-sized fittings based on the wire size, quantity of conductors, and bending radii of conductors.
 10. Make grounding connections so that there is only one point of earth ground per separate system.
- B. Exposed Work: Make conduit and raceway runs in exposed work parallel to centerlines and structure surfaces, and perpendicular to centerlines where required, with right angle turns consisting of symmetrical bends or fittings. Maintain at least 6 inches clearance between conduit and raceway runs and mechanical system pipes.
- C. Underground Systems: Install underground conduit systems in accordance with Article 300-5 of the NEC, in accordance with previous requirements of this Section, and the following requirements exceeding NEC:
1. Earthwork: Perform earthwork for buried conduit as specified previously for electrical work under Trenching, Backfilling, and Compacting: Section 02221.
 2. Install Concrete Encasement use 3,000 psi concrete as specified in Section 03300.
 3. Use concrete encasement for utility conduits unless specifically told otherwise by the utility.
 4. Secure conduits in place with approved separators installed at 5-foot intervals. Separators shall have sufficient strength to prevent displacement of conduits when placing backfill or pouring concrete.

5. Where conduits are not encased in concrete coat with two coats of bitumastic paint such as Tnemec Company, Inc. No. 46-449 Heavy-duty Black, equal; Rigid Steel only.
 6. Where conduit lines run to underground structures, grade conduits to drain to such.
 7. Construct underground conduit lines to be absolutely watertight. Stagger conduit couplings in banks of conduits.
 8. Where conduits change direction or turn up at equipment, etc., use long sweep elbows.
 9. Provide two feet minimum cover over conduit or concrete encasement of conduit, unless indicated otherwise on the Drawings.
- D. Conduit Installation Schedule:
1. Exposed Outdoor Locations: Rigid Steel.
 2. Underground Locations: Encased Rigid Schedule 40 PVC or Rigid Steel.
 4. Conduits within below grade structures: PVC coated Rigid Steel.
 5. Connections to motors, transformers, instruments, and control devices: Liquidtight flexible conduit not more than 24 inches long for 1½-inch conduit and less, and not more than 48 inches long for two-inch conduit and greater.
 6. Signal and Instrumentation Cables: PVC Coated Rigid Steel in all locations.
 7. Where penetrating or exiting a concrete slab or floor, use PVC coated rigid steel conduit, regardless of the conduit type used within or under the slab. Extend above the slab at least 6" with the rigid steel conduit.
- E. Wiring: Install wiring in conduit unless indicated otherwise on the Drawings.
1. Do not perform wiring until work, which might cause damage to the wires, cables or conduits, has been completed. Take the necessary precautions to prevent the accumulation of water, dirt or other foreign material in the conduits during the execution of the work.
 2. Before installing wires or cables thoroughly clean conduits of foreign, gritty or other matter that would in any way damage the sheath materials or the wire or cable. Abrasions to wires, cables, or sheaths will not be acceptable, and shall be replaced at the Contractor's expense.
 3. Color code wiring as recommended in NEC.
 4. Make wire and cable splices in outlet or junction boxes per NEC, and install such boxes in accessible locations.
 5. A common neutral wire may be used on multiple circuits, within code limitations, provided the neutral conductor is one size larger than the capacity of the phase wires in the circuit.
- F. Grounding: Perform grounding of conduit systems, metal enclosures, equipment frames, motors and receptacles in accordance with Article 250 of the NEC.
1. In addition to grounding and bonding requirements of NEC as referenced in the preceding paragraph, the following shall also apply:
 - a. Make equipment grounds in spaces accessible to authorized personnel only. Leave in-place made-grounds open until inspection and approval. Equipment grounds shall have resistance not to exceed the limits set by NEC.

2. Use approved grounding connectors only. Clean the surfaces involved in the made-grounds before connecting and finish the installation with touch up painting or other protective coating to prevent corrosion.
 3. Be sure there is only one point of grounding so that there are no ground loops when complete.
- H. Controls and Wiring: Install systems as designed and according to equipment manufacturer recommendations. Test circuits and operations to be certain the systems and components are functionally correct according to the design intent.

3.04 ANCHOR AND FASTENER INSTALLATIONS

- A. Threaded Bolts: Draw threaded bolted connections up tight using lock washers to prevent bolt or nut loosening.
- B. Drilled-In Expansion Anchor Installation:
1. General: In general, install expansion anchors in strict accordance with manufacturer's instructions and in accordance with the following.
 2. Drilling Holes: Use rotary hammer type drill and make drill holes to the required diameter and depth as consistent with anchor manufacturer's instructions for size of anchors being installed.
 3. Minimum Embedment: Embed expansion anchors to 4½ bolt diameters, unless otherwise indicated on Drawings.

3.05 IDENTIFICATION

- A. Nameplates/Warning Labels: Provide nameplates on equipment such as enclosed circuit breakers, disconnect switches, panelboards, starters, and control stations, to name a few.

3.06 FIELD QUALITY CONTROL

- A. Electrical Systems Test: As specified in Section 16010.

END OF SECTION

SECTION 16060
ELECTRICAL DEMOLITION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Electrical demolition of existing facility after completion of the new facility.

1.02 SEQUENCING/SCHEDULING

- A. The Contractor shall be responsible for disconnection of electrical equipment indicated on the Drawings or as required to achieve the final renovation results.
- B. The Contractor shall notify 72 hours prior to any required shutdowns.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Provide all materials and equipment required for patching and repair work.
- B. Provide any equipment, which may be required to perform demolition work.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Verify field measurements and circuiting.
- B. Beginning of demolition means Contractor accepts existing conditions.

3.02 PREPARATION

- A. Disconnect electrical systems scheduled for removal.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations.
- C. Existing Electrical Systems: Maintain existing systems in service until new systems are complete and ready for service. Disable systems only to make switchovers and

connections. Obtain permission from Engineer at least 72 hours before partially or completely disabling systems. Minimize power outage duration.

- D. Provide temporary generator power when the normal power outage duration exceeds the allowable outage allowed by the Owner.

3.03 GENERAL DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Remove, relocate, and extend existing installations to accommodate new construction.
- B. Extend existing facilities using materials and methods compatible with existing electrical installations. New wiring and conduit shall be used.

3.04 CLEANING AND REPAIR

- A. The Contractor is responsible for maintaining a safe and clean project; this demands housecleaning the area after each day's work.

3.05 DISPOSAL

- A. The Owner shall be contacted before removing any equipment from the site. Deliver claimed equipment where designated by the Owner; otherwise remove from the site.
- B. The Contractor shall be responsible for the proper disposal of all equipment being removed from the site.

END OF SECTION

SECTION 16200

POWER GENERATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. General provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. This Section includes a packaged engine generator set with the following features and accessories:
 - 1. Exhaust System.
 - 2. Fuel System.
 - 3. Outdoor Sound-Attenuated Enclosure.
 - 4. Alarming.
 - 5. Automatic Transfer Switch.
 - 6. Miscellaneous Items.

1.02 RELATED SECTIONS

- A. Basic Electrical Materials and Methods: Section 16050.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualification: Provide generating set built, tested and shipped by one manufacturer to ensure single source of supply and responsibility. Manufacturer shall have printed literature and brochures describing the standard series specified, not a one-of-a-kind fabrication. Performance of the engine-generating set series shall be in accordance with procedures certified by an independent testing laboratory. Manufacturer shall have successfully tested a prototype of the generating set series. Consideration will be given only to manufacturers meeting the following qualifications:
 - 1. Twenty-four hour, seven days a week operating service facility with complete spare parts stock within 75 miles of Project Site. Delegation of this service responsibility for any or all of the equipment listed herein will not be considered fulfillment of these Specifications.
 - 2. Service capability to provide, after acceptance of equipment, one service call per year for two years by a qualified maintenance or service representative, with provision that each call shall not exceed one day of service. Service calls will not include materials or parts.
 - 3. Include furnishing of above stated services in contract Price.
 - 4. This generator was designed around Cummins; Kohler, or Equal generators may be bid but the Contractor shall ultimately be responsible for correct operation and starting of all loads for the entire building at one time without causing the generator to fall below the listed voltage and frequency levels on starting.

- B. Design Criteria: Standby generator set rated continuous standby (defined as continuous for the duration of any power outage) at the following capacities:
 - 1. Generator Rating Capacity at 0.8 power factor for standby applications (with fan), and rated in accordance with NEMA Class F temperature rise, shall be as shown on the drawings.
 - 2. Generator Characteristics:
 - a. Voltage: 480/277
 - b. Phases: 3
 - c. No. of wires: 4
 - d. Site Rated Max SkW: 29
 - e. Max SkVA: 102
 - f. Temperature Rise at Full Load: 125°C
- C. Requirements of Regulatory Agencies: Work involving fuel storage tank and piping installation shall conform to the regulations of the State of Maryland, Regulations for the Storage, Handling and Use of Flammable and Combustible Liquids and the Federal Environmental Protection Agency, Hazardous Waste Management Division regulations.
- D. Diesel Engine Exhaust Emissions: Manufacturer shall provide a Low Exhaust Emissions engine certified to U.S. EPA Stationary Source Emission Standards, 40 CFR 89 accordingly:
 - 1. Tier Level: 4.
 - 2. Emission levels shall be certified to operate below the EPA maximum allowable levels. Corrections necessary to lower the emissions to meet allowable limits shall be the responsibility of the Contractor if the levels are high.
 - 3. Assist the Owner with registration with the local governing offices responsible for emissions; fees shall be paid by the Owner.

1.04 REFERENCES

- A. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. IEEE Std. 446; Recommended Practice for Emergency and Standby Power Systems.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA Standard IC10-1993 (formerly ICS 2-447).
 - 2. NEMA MG 1; Motors and Generators.
- C. Underwriters Laboratories Inc. (UL):
 - 1. UL 1008: Automatic Transfer Switches.
 - 2. UL 2200: Stationary Generator Assemblies.
 - 3. UL 508: Standard for Industrial Control Equipment.

1.05 SUBMITTALS

- A. Certificates: Furnish manufacturer's factory test report certifying the unit's full power rating, stability, voltage, and frequency regulation; start up report; and full load on-site test report.
- B. Product Data: Required for the following items:
 - 1. Packaged Power Generator.
 - 2. Generator Set Enclosure.
 - 3. Fuel Tank and Detection.
 - 4. Automatic Transfer Switch.
 - 5. Miscellaneous items and appurtenances.
- C. Shop Drawings: Required for the following:
 - 1. Engine and Generator Details.
 - 2. Wiring diagrams.
 - 3. Fuel Tank and bolt-down requirements.
 - 4. Generator housing and bolt-down requirements.
 - 5. Automatic Transfer Switch mounting arrangements.
 - 6. Miscellaneous items and Appurtenances.
- D. Diesel Engine Low Emission Certification.
- E. The fuel tank and rupture basin pressure test results.

PART 2 - PRODUCTS

2.01 ENGINE GENERATOR SET

- A. Diesel Engine: Heavy-duty industrial type, water-cooled, 4-stroke compression ignition operation, having fuel-injection, and of either vertical in-line or V-type design.
 - 1. Provide engine with removable wet or dry type cylinder liners of alloy cast iron.
 - 2. Provide engine capable of satisfactory performance when operating on commercial grade diesel oil.
 - 3. 1800 rpm speed.
- B. Isochronous Electronic Governor: Engine provided with an electronic solid state governing system for precise speed control of the prime mover. Provide a governor capable of operation in a droop or constant speed system with control at any set speed.
- C. Lubrication:
 - 1. Engine provided with a gear-type lubricating oil pump for supplying oil under pressure to main bearings, crank pin bearings, pistons, piston pins, timing gears, cam-shaft bearings and valve rocker arm mechanism.
 - 2. Provide a suitable water-cooled oil cooler.
 - 3. Threaded spin-on type oil filters provided and so located and connected that lubricating oil is continuously filtered and cleaned. Filters conveniently located

for servicing. Equip filters with a spring loaded bypass valve as an assurance against stoppage of lubricating oil circulation in the event filters become clogged.

4. Oil drain extension tubing.

D. Diesel Fuel System Components:

1. The fuel pump shall be capable of supplying fuel from the sub-base tank through filter(s) and water separator(s) to the injectors.
2. Fuel system shall be equipped with a fuel filter(s) having elements, which may be easily removed from their housing for replacement without breaking any fuel line connections. Water separator(s) shall be easily drained without breaking any fuel line connections. No screens or filters requiring cleaning or replacement will be permitted in the injection pump or injection valve assemblies.

E. Air Cleaners: Engine provided with one or more dry type replaceable element air cleaners of sufficient capacity to effectively protect working parts of the engine from dust and grit. Crankcase connected together with engine air intake with a tube to eliminate crankcase emissions.

F. Automatic Starting System:

1. Engine equipped with an electric starting system with positive engagement drive and of sufficient capacity to crank the engine at a speed, which will allow full diesel starting of the engine. System may be 12 or 24 volts as recommended by engine manufacturer.
2. Automatic Controls: Fully automatic start-stop controls provided in generator control panel. Include a minimum 30-second single cranking cycle limit with lockout.
3. Starting Aid: 1000-watt or as required engine jacket water heater to maintain engine jacket water temperature at 90°F. in an ambient temperature of 0°F. Heater suitable for 120 volt, single-phase, 60-Hertz operation.
4. Batteries: Lead-acid or lead-calcium storage battery set of heavy-duty diesel starting type. Battery voltage compatible with starting system. Batteries of sufficient capacity to provide five consecutive full starts or four complete cranking cycles of ten seconds each and ten seconds rest. Provide battery rack, necessary cables, and clamps.
 - a. Provide battery hold-down and battery cables.
5. Battery Charger, 6 Ampere.

G. Cooling:

1. Engine equipped with an engine driven centrifugal-type water circulating pump for circulating water through engine jacket, cylinder heads and radiator.
2. Engine-mounted 50°C rated radiator with blower type fan provided and sized to maintain safe operation at full load in an ambient temperature not to exceed 130 degrees F.

2.02 ALTERNATOR

- A. Brushless revolving field type, coupled directly to the engine flywheel though a flexible coupling arrangement designed for positive alignment. Alternator housing shall bolt directly to the engine flywheel housing.
1. Standards: Alternator construction shall comply with NEMA standard MG1-78 and latest revision thereof.
 2. Field: Equipped with full armature windings and PMG (permanent magnet generator) excitation system or as directed otherwise.
 3. Stator: Four pole, 2/3 pitch.
 4. Voltage Regulation from No Load to Full Load: $\pm 0.5\%$
 5. Random Voltage Variation: $\pm 0.5\%$
 6. Frequency Regulation: Isochronous
 7. Random Frequency Variation: $\pm 0.5\%$
 8. The Alternator shall be able to pick up full rated load in one step.
 9. Circuit Breaker: A generator-mounted, main-line, molded-case circuit breaker shall be provided as a load circuit interrupting and protective device which shall operate both manually for normal switching functions and automatically during overload and short circuit conditions. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit conditions; breaker AIC rating shall be no less than 35,000 amps.
- B. Exhaust System Components:
1. Internally mounted critical type silencer sized for the unit to which it is mounted.
 2. Rain Cap: Provide hinged design cap with suitable integral cap counterweight.
 3. Flexible stainless steel exhaust coupling.
- C. Generator Control Panel: Provides visual and audible indication of alarm and status conditions, vibration isolated. Provide the following features:
1. Provide a NEMA 1 type vibration isolated dead front 14-gauge steel control panel.
 2. Control panel shall contain, but is not limited to the following:
 - a. Voltmeter and ammeter digital readouts.
 - b. Automatic starting controls.
 - c. Voltage level adjustment via keypad.
 - d. Engine oil pressure digital readout.
 - e. Required Indications:
 - 1) Generator running
 - 2) Pre-Low Oil Pressure
 - 3) Low Oil Pressure
 - 4) Pre-High Coolant Temperature
 - 5) High Coolant Temperature
 - 6) Low Coolant Temperature
 - 7) Overspeed
 - 8) Overcrank
 - 9) Not in Auto

- 10) Battery Charger Malfunction
- 11) Low Fuel
- 12) Low Coolant Level
- 13) Fuel Tank Interstitial Leak
- 14) Spare Indicators
- f. "Run-Stop-Remote" pushbuttons or switch.
- g. Emergency "Stop" push-pull switch.
- h. Water temperature digital readout.
- i. Field circuit breaker.
- j. Running time digital readout.
- k. Frequency digital readout.
- l. Common dry alarm contact.
- m. Two spare contacts for customer use.
- n. Control panel face illumination on battery voltage.
- 3. Power Command Control 1.1 with NFPA 110 level 1 compliance or Equal.

2.03 ACCEPTABLE MANUFACTURERS

- A. Provide diesel electric generating systems as manufactured by:
 - 1. Cummins Model 25DSKCA.
 - 2. Kohler.
 - 3. Or Equal.

2.04 GENERATOR SET ENCLOSURE

- A. Weatherproof Sound-Attenuating Enclosure: Provide a non-walk-in completely enclosed vandal-resistant, weatherproof enclosure capable of withstanding winds to 100 mph. Enclosure shall conform to the following requirements.
 - 1. Construction: Galvanized steel, metal-clad, integral structural-steel frame erected around the generator.
 - 2. Stationary Louvers.
 - 3. Lockable access doors all around.
 - 4. Sub-base of structural steel channel iron box design with wide-flange beam cross-members. All-welded construction.
 - 5. Rodent protection.
 - 6. Opening for exhaust pipe.
 - 7. Standard manufacturer's paint.
 - 8. Access for installing radiator fluids.
 - 9. Sound-attenuating materials and baffles restricting the sound level to 72 dB(A).

2.05 FUEL OIL STORAGE TANK

- A. Skid-Base Tank: Factory-installed and piped, UL listed and labeled fuel oil tank complying with UL 142 and NFPA 30.
 - 1. Skid base tank shall consist of double-wall construction with interstitial space.
 - 2. Leak detection system and alarm contacts.
 - 3. Tank fitted with fuel sight gauge, suction line fitting, return line fitting, 2-inch filler neck with padlockable cap and one extended vent.
 - 4. Low fuel float and output contacts.
 - 5. Skid-base finished in rust-inhibiting standard manufacturers enamel.
 - 6. Tank Capacity: Minimum 24 hours of full load run time.
- B. Fuel Lines: Heavy-duty flexible braid covered hoses, which are suitable for the system pressure and fuel type. Provide corrosion resistant metal connectors on hose ends.

2.06 AUTOMATIC TRANSFER SWITCH

- A. Automatic Transfer Switch: Conforming to requirements of NEMA Standard ICS 2-447 and UL-1008 and be UL Listed. Switch shall consist of a power transfer module and a control module, interconnected to provide complete automatic operation. Switch of the mechanically held type and electrically operated by a single-solenoid mechanism energized from the source to which the load is to be transferred. Switch rated for continuous duty with double-throw capability. Switch mechanically interlocked to ensure only one of two possible "ON" positions (normal or emergency).
 - 1. Ratings: 40-amp minimum, 480 volts, 3-phase, 4-wire, 60 Hz with three (3) switched poles, neutral bar, and equipment ground terminal. Withstand current rating of 22,000 RMS symmetrical amperes when used with molded case circuit breaker.
 - 2. Transfer Control:
 - a. Programmed transition shall be provided. This feature shall enable switch to hold in the center position (unconnected) for an adjustable time delay on transfer and retransfer. The time delay shall be field adjustable.
 - 3. Capacitors, fuses or thermal protection in the main operator control circuit are prohibited.
 - 4. Contacts, coils, springs, and control elements shall be front removable without major disassembly or power disconnection.
 - 5. Switches using molded-case circuit breaker components, contactors (or parts of such), not intended for continuous duty or repetitive load transfer switching are not acceptable.
 - 6. Automatic transfer switch shall include separate door-mounted control panel, which is provided with a protective cover and an isolation plug in the wiring harness to disconnect all the control wires between the control panel and the main transfer panel.
 - 7. Provide control panel and main transfer panel by same manufacturer including all solid state components of control panel and its accessories, and main operating coil and contacts of main transfer panel.

8. Provide close differential voltage sensing with pick up voltage adjustable from 85 to 100 percent of nominal and drop-out voltage adjustable from 75 to 98 percent of the pick up value. Transfer to emergency initiated upon reduction of normal source to 85 percent of nominal voltage and retransfer to normal shall occur when normal source restores to 95 percent of nominal.
9. Provide independent voltage and frequency sensing of the emergency source with pick up adjustable from 85 to 100 percent of nominal. Pick-up frequency adjustable from 90 to 100 percent of nominal. Transfer to emergency upon normal source failure when emergency source voltage is 90 percent or more of nominal and frequency is 95 percent or more of nominal.
10. Provide time delay to override momentary normal source outages to delay all transfer switch and engine starting signals. Time delay field adjustable from 0.5 to 6 seconds and factory set at one second.
11. Provide time delay on transfer to emergency. Factory set at zero but field adjustable up to 5 minutes for controlled timing of load transfer to emergency, where indicated.
12. Provide time delay on retransfer to normal source. Time delay automatically bypassed if emergency source fails and normal sources is available. Time delay field adjustable from zero to 30 minutes and factory set at ten minutes.
13. Provide unloaded running time delay for emergency generator cooldown. Time delay field adjustable from zero to 5 minutes and factory set at 5 minutes.
14. All of above time delay and sending functions solid state and field adjustable over the ranges indicated. Repetitive accuracies of the voltage sensors ± 2 percent, of the frequency sensors plus/minus one percent, and of the time delays ± 10 percent over a temperature range of minus 20 degrees C to plus 70 degrees C. Motor driven and pneumatic type time delays not acceptable.
15. Provide a contact closure when normal source fails for initiating engine starting, rated 10 amps, 32 VDC. Contacts gold-plated for low voltage service.
16. Provide a green signal light to indicate when the automatic transfer switch is connected to the normal source and a red signal light to indicate when the automatic transfer switch is connected to emergency source.
17. Provide one auxiliary contact that is closed when the automatic transfer switch is connected to "Normal" and one auxiliary contact that is closed when the automatic transfer switch is connected to "Emergency." Rated 10 amps, 240 VAC.
18. Switch Enclosure:
 - a. NEMA 3R.
19. Required Accessories:
 - a. Engine exerciser with and without load.
20. Acceptable Manufacturer:
 - a. ASCO 4000 Series.
 - b. Cummins OTPC.
 - c. Or Equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install equipment with skilled mechanical erection labor in accordance with manufacturer's instructions and these Specifications.
- B. Generator Mounting:
 - 1. Provide a concrete foundation as detailed on the drawing and mount the generator on the foundation.
 - 2. Provide vibration dampeners as recommended by the generator manufacturer. The number of dampeners shall be as recommended by the engine-generator manufacturer.
 - 3. Provide manufacturer recommended anchor bolts for securing engine-generator and tank in place on concrete foundation. Drill holes as necessary for installation of the bolts into the existing foundation. Maintain a separation between the bottom of fuel tank and the concrete foundation.
 - 4. Fill engine coolant system with water and anti-freeze to protect engine from freezing to a temperature of -20°F.
 - 5. Fill the engine with required engine oil.
 - 6. Fill the subbase tank with #2 diesel fuel. If installed during the winter months, provide additives as recommended by the fuel oil supplier.
- C. Install the transfer switch where shown.

3.02 FIELD QUALITY CONTROL

- A. Provide equipment manufacturer's certification that the power generation equipment is installed, inspected, tested, adjusted, and approved satisfactory by equipment manufacturer's service representative.
 - 1. Provide lubricating oils, tank of fuel, electrical instruments, portable load bank, etc., as required for tests.
 - a. Provide any additional modifications to the automatic transfer switch. Test the entire system consisting of the generator, automatic transfer switch, and network system for correct operations.
- B. With the Owner's operating personnel observing, demonstrate the performance of power generation equipment to the satisfaction of the Engineer, when operated in accordance with design intent of the Drawings and Specifications, and when tested with a portable load bank as follows:
 - 1. Start and idle for ten minutes.
 - 2. Operate generator set at 25 percent rated load for 30 minutes.
 - 3. Operate generator set at 50 percent rated load for 30 minutes.
 - 4. Operate generator set at 75 percent rated load for 1 hour.
 - 5. Operate generator set at 100 percent rated load for two hours.

- C. If during the full load test, any problem occurs that stops the test, fix the problem and repeat the test from the beginning.
- D. Top off the fuel tank after all testing is complete.
- E. Following the mechanical performance test, instruct the Owner's operating personnel regarding the engine-generator operation and maintenance. Further instruct the Owners on the operations and maintenance of the automatic transfer switch. Provide instructional information on the use of the software program.
- F. Submit certified load test data to the engineer.

END OF SECTION

SECTION 16400

SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Service Entrance Equipment.
- B. Surge Protective Device.
- C. Distribution Equipment.

1.02 RELATED SECTIONS

- A. Division 2 - Site Work.
- B. Division 3 – Concrete.
- C. Basic Electrical Requirements: Section 16010.
- D. Basic Electrical Materials and Methods: Section 16050.

1.03 SUBMITTALS

- A. Product Data: As specified in Section 16010, submittal information as required for the items mentioned in this section.
- B. Shop Drawings: As specified in Section 16010, submittals shall include required information for the items mentioned in this section.
- C. Operation and Maintenance Manuals: Provide operation and maintenance manuals as specified in Section 16010.

1.05 PROJECT CONDITIONS

- A. Utility Company:
 - 1. Serving Utility Company: Delmarva Power
 - 2. Telephone: 800-260-6306
 - a. Delmarva Service No. 000G1N912703.

- B. Electrical Parameters:
 - 1. Pumping Station:
 - a. 480/277V, 3 phase, 4W service will be required.
 - b. 100-amp service.
- C. Delmarva charges shall be paid by the City of Salisbury.
- D. All other costs associated with the service, such as fees and inspection charges, shall be included in the Contract Price.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Basic Electrical Materials: Those Products such as conduit, wireways, wire and connectors, cable (other than that as specified in this Section), support devices, fasteners, and similar devices, as required for the Work of this Section are as specified in Section 16050.

2.02 SERVICE EQUIPMENT

- A. Meter Socket: The meter socket will be provided by the Utility Company and installed by the Contractor.
- B. Surge Protective Device (SPD): Provide the SPD protection on each phase in accordance with Article 280 of the National Electrical Code. The SPD unit shall meet ANSI/IEEE C62.41 Location C, B & A; UL 1449 3rd edition; UL 1283 Tracking Filter; NEMA LS1 Compliances, 2.2-9 and 3-9; component level fusing, NEMA 4 enclosure; 25-year unlimited free replacement warranty.
 - 1. Main Service Entrance:
 - a. Maximum Rated Surge Current: 120kA per phase; 60kA per mode.
 - b. Acceptable Manufacturer:
 - 1) Total Protection Solutions; Model SurgeTrack TK-ST120-3Y480-L.
 - 2) Surge Suppression Inc.
 - 3) Or Equal; equal means it must meet or exceed the above requirements and those of the SurgeTrack published data with confirmation of such. The warranty period must extend for 25-years and provide complete unlimited replacement due to defect in workmanship, materials, or any electrical anomaly including lightning. Warranty shall not be a one-of-a-kind.

2.03 DISTRIBUTION EQUIPMENT

- A. Mini-Power Center:

1. Transformers shall be encapsulated dry type with sound level of no more than 40 dB.
2. KVA rating shall be as denoted on the drawings.
3. 180 degrees C insulation system and rated at 115 degrees C temperature rise in a 40 degrees C maximum ambient, with a 30 degrees C average over 24 hours.
4. Provide two (2) 5% FCBN taps.
5. Cores shall be manufactured with non-ageing silicon steel with the core grounded to the enclosure.
6. The core and coil assembly shall be mounted on vibration pads and bolted to the enclosure.
7. Core and bus shall be aluminum.
8. The mini-power center shall include a primary main breaker with an interrupting rating of 14 kA at 480 volts single-phase; a secondary main breaker with an interrupting rating of 10kA at 120/240 volts single-phase, and a panelboard.
9. The secondary distribution section shall accommodate one-inch bolt-on breakers with 10 kA interrupting capacity.
10. The enclosure shall be N3R with locking.
11. Acceptable Manufacturers:
 - a. Eaton Cutler-Hammer Company.
 - b. General Electric Company.
 - c. Square D Company.
 - d. Or equal.

B. Circuit Breakers: Service-entrance approved, individually-enclosed molded case circuit breakers of trip rating and frame size as indicated on Drawings and of the following construction:

1. Circuit Breaker: Molded case type with overcenter, trip free, toggle type operating mechanism, quick-make and quick-break action, positive handle indication, two- and three-pole breakers of common trip type, operating handles assume center position when tripped.
 - a. Circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
 - b. Circuit breaker so constructed to accommodate supply connections at either end.
 - c. Circuit breaker calibrated for operation in an ambient temperature of 40°C.
 - d. Circuit breaker shall have a button on the cover for mechanically tripping the circuit breaker.
 - e. Circuit breakers UL-Listed.
 - f. Stand-alone circuit breakers rated for 480 volts shall have short circuit ratings of no less than 18,000 AIC.
2. NEMA 3R Enclosure: Fabricated from painted steel with threaded hubs sized for conduit indicated on Drawings and UL-Listed construction.
 - a. Enclosure equipped with provisions for up to three padlocks in OFF position.
 - b. Enclosure shall have an external operating handle with trip indication by assuming a position between ON and OFF position.

- c. Enclosure equipped with provisions for field installable, insulated, groundable neutral.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify other construction work is complete to the point of accepting electrical installation.
- B. Refer to wire and cable sizes on single line diagrams to determine size and configuration of lugs, compression terminal connectors, or pig-tail splices required.
- C. Obtain the full load running current and service factor for all motors and size the overload relays in accordance with this data.
- D. Verify direction of motor rotation in equipment before making final connections to electrically operated equipment.

3.02 INSTALLATION

- A. General: Install or mount the products of this Specifications Section, at locations indicated, square and plumb with respect to visible structures lines, with power connections made, and such products left in proper operating condition.
- B. Perform concrete work indicated for service and distribution equipment installation as specified in Division 3 – Concrete.
- C. Methods of Wiring: Perform wiring and grounding as specified in Section 16050.
- D. Cleaning: Clean installed products of this Specifications Section where deposits of oil, grease, dirt, dust, mud, or debris is present after installation. Use detergent-water solution, solvents where necessary, or other liquid cleaners not harmful to material and equipment finish.

3.03 SERVICE WIRING

- A. Service installation as indicated on the Drawings except that the entire installation shall conform to the latest rules and regulations of the serving Electric Utility Company.

3.04 FIELD QUALITY CONTROL

- A. Electrical Systems Test: As specified in Section 16010.

END OF SECTION

SECTION 16740
TELEPHONE SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Telephone Service.
- B. Modem

1.02 RELATED SECTIONS

- A. Division 2 - Site Work.
- B. Basic Electrical Requirements: Section 16010.
- C. Basic Electrical Materials and Methods: Section 16050.

1.03 SUBMITTALS

- A. Product Data: As specified in Section 16010, submittals required for the following items:
 - 1. Modem.
- B. Shop Drawings: As specified in Section 16010, submittals shall include required information for the items mentioned in this Section.
- C. Operation and Maintenance Manuals: Provide Operation and Maintenance Manuals as specified in Section 16010 for:
 - 1. Modem.

1.04 PROJECT CONDITIONS

- A. Telephone System Requirements:
 - 1. Perform the Telephone System work.
 - 2. Telephone service shall consist of a voice grade, dry pair, cable.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Telephone Materials and Equipment: Verizon shall provide interface terminal box and required appurtenances including cable from service termination to interface terminal box.
- B. Contractor Provided Materials and Equipment:
 - 1. Basic Electrical Materials: Conduit, electrical wire and cable, support devices, fasteners as required for Work of this Section are as specified in Section 16050.
 - 2. Telephone Outlet: Back box cover plate shall be stainless steel.
 - 3. Jack: USOC #RJ11C standard modular jack.
 - 4. Wire: Four-conductor, color-coded, insulated wire approved for telephone use.
- C. Modem:
 - 1. Stand-alone Bell 202 modem
 - 2. 0-1200 bps.
 - 3. Half or full duplex, 2 or 4-wire operating mode.
 - 4. Asynchronous, binary, serial format.
 - 5. V.23 modulation and carrier frequency.
 - 6. Output level of 0 dBm, switch selectable to -31 dBm in 1 dBm increments. RTS/CTS delay of 0 – 254 ms, switch selectable. 900 Hz soft carrier on time of 0 – 15 ms.
 - 7. Receiver operating range of 0 to -35 or -45 dBm. Receiver squelch of 0, or 156 ms for 2-wire. Carrier detect on delay of 2 to 30 ms. Hysteresis of 2 dB minimum.
 - 8. 12-160 VDC @ 100mA per card. 1800 VAC power supply isolation.
 - 9. Telco interface shall be RJ11 jack.
 - 10. User equipment interface shall be 25-pin EIA connector (RS232C Compatible).
 - 11. Manufacturers:
 - a. Applied Systems Engineering, Inc.
 - b. Control Microsystems.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Contractor shall perform trench work in accordance with Section 02221, with respect to excavating and backfilling for telephone system installation.
- B. Telephone Company Installations: Verizon provided materials and equipment will be installed by Telephone Company.
- C. Cables must be bonded and grounded.
- D. Ground any protective modules using the shortest possible path to ground.

- E. Install materials for Verizon as required for conduit sizing, backbox, cabinet sizing (if required), and location of such.
 - 1. Maintain telephone conduit system in good condition.
- F. Mount the modem within the control panel and connect to Verizon on the one end and the internal PLC on the other end.

3.02 TESTING

- A. All wiring shall be tested for continuity, shorts, and grounds before the system is activated.
- B. All test equipment, instruments, tools and labor required to conduct the tests shall be made available by the installing contractor.
- C. All alarm activation points shall be tested.

3.03 TRAINING

- A. The Contractor shall schedule a minimum of 1 hour of documented formalized instruction for the Owner, detailing the proper operation of the installed System.
- B. Instruction material shall be made available for up to three (3) plant personnel and one (1) for the Engineer.

END OF SECTION



JOHN D. HYNES & ASSOCIATES, INC.

*Geotechnical and Environmental Consultants
Monitoring Well Installation
Construction Inspection and Materials Testing*

June 28, 2012

Richard Parks
ARRO
1101 Opal Court, Suite 312
Hagerstown, Maryland 21740

Re: Report of Subsurface Exploration and Geotechnical
Engineering Recommendations
Hampshire Road Sewage Lift Station
Replacement and Upgrades
Salisbury, Maryland
Project No.: JDH-10/12/144

Dear Mr. Parks:

John D. Hynes & Associates, Inc. has completed the authorized subsurface exploration and geotechnical engineering evaluations for the proposed Hampshire Road Sewage Lift Station Replacement and Upgrades project in Salisbury, Maryland. Our evaluation was conducted, generally, in accordance with our subcontract agreement dated February 22, 2012.

This report describes the exploration methods employed, exhibits the data obtained and presents our geotechnical engineering evaluations and recommendations. We include recommendations for roadway subgrade preparation, pavement cross sections, fill and backfill construction, and recommended earth pressures and allowable bearing capacities for the lift station.

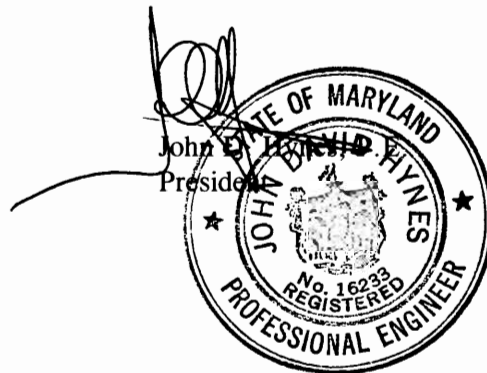
We appreciate the opportunity to be of service to you. If you have any questions regarding the contents of this report or if we may be of further assistance, please contact our office.

Respectfully,

JOHN D. HYNES & ASSOCIATES, INC.

Jeremy M. Boehm,
Project Engineer

JMB: JDH/jae





**REPORT OF
SUBSURFACE EXPLORATION
GEOTECHNICAL ENGINEERING RECOMMENDATIONS**

**HAMPSHIRE ROAD LIFT STATION
REPLACEMENT AND UPGRADES
SALISBURY, MARYLAND**

**PREPARED FOR
ARRO**

**JUNE 28, 2012
PROJECT NO.: JDH-10/12/144**



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PURPOSE AND SCOPE

The subsurface exploration study was performed to evaluate the subsurface conditions with respect to the following:

1. General site and subgrade preparation;
2. Fill and backfill construction;
3. Foundation recommendations for the proposed lift station;
4. Lateral earth pressures for the lift station;
5. Pavement subgrade preparation;
6. Recommended pavement cross section;
7. Groundwater and surface water considerations; and
8. Other aspects of the design and construction for the proposed structures indicated by the exploration.

An evaluation of the site, with respect to potential construction problems and recommendations dealing with earthwork and inspection during construction, is included. The inspection is considered necessary both to confirm the subsurface conditions and to verify that the soils related construction phases are performed properly.

EXISTING SITE CONDITIONS

As shown on our Project Location Map (Drawing No.: JDH-10/12/144-A) in the Appendix, the lift station is located at the intersection of Hampshire Road and Northgate Drive on the north side of Salisbury, Maryland. In addition to the lift station replacement, the project also includes the installation of 800 linear feet of force main south along Northgate Drive, the reconstruction of the segment of Northgate Drive, and the reconstruction of Hampshire Road 600 feet east to the Oasis Car Wash.

The existing Hampshire Road and Northgate Drive are two-lane, asphalt roads with concrete curb-and-gutter. Hampshire Road becomes an un-curbed gravel road west of the intersection. A Sam's Club occupies the north side of Hampshire Road within the project area. The existing lift station is directly adjacent to a parking area associated with the Sam's Club. The Oasis Car Wash and a vacant lot occupy the south side of Hampshire Road. The area to the northwest of the lift station is an agricultural field. The Northgate Drive segment is lined by vacant lots on both sides. Commercial building line Northgate Drive south of the project site.

FIELD EXPLORATION AND STUDY

In order to determine the nature of the subsurface conditions at the site, we drilled seven roadway/force main borings and one lift station boring at the locations shown on the Boring Location Plan (Drawing JDH-10/12/144) in the Appendix. The borings were drilled on May 29, 2012 using a Mobile B-47 HD trailer-mounted drill rig. The roadway/force main borings were drilled to depths of 10.5 feet. The lift station boring was drilled to a depth of 25.5 feet.

Our test drilling and sampling operations were conducted in accordance with ASTM Specification D-1586. A brief description of our field procedures is included in the Appendix. The results of all boring and sampling operations are shown on the boring logs in the Appendix. The surface elevations shown on the boring logs were taken from the Soil Boring Plan provided by ARRO.



Samples of the subsurface soils were examined by our engineering staff and were visually classified in accordance with the Unified Soil Classification System (USCS), ASTM Specification D-2488. The borings were also classified in accordance with the AASHTO Soil Classification System (AASHTO). The estimated USCS symbols appear on the boring logs and keys to the systems nomenclature is provided in the Appendix of this report. Also included are reference sheets which define the terms and symbols used on the boring logs and explains the Standard Penetration Test procedures.

We note that the test boring records represent our interpretation of the field data based on visual examination and selected soil classification tests. Indicated interfaces between materials may be gradual.

Our visual classifications were supplemented with laboratory testing. The laboratory at John D. Hynes & Associates, Inc. performed two Sieve Analysis tests and two Atterberg Limits (Liquid and Plastic) tests on the boring samples. The results of the tests are included on the boring logs in the Appendix. Also, bulk soil samples were taken at each boring location for CBR testing.

SUBSURFACE CONDITIONS

With the exception of boring B-7, the soil borings were conducted in the existing roadways. The following table shows the surficial materials encountered at each location. Other thicknesses of pavement or organic bearing soil and other surficial materials may be encountered at other locations on the project.

Boring	Location	Surficial Material
B-1	Northgate Dr.	3" asphalt, 4" stone
B-2	Northgate Dr.	7" asphalt, 8" stone
B-3	Northgate Dr.	7" asphalt, 4" stone
B-4	Hampshire Rd.	3" asphalt, 5" stone
B-5	Hampshire Rd.	2 ½" asphalt, 7" stone
B-6	Hampshire Rd.	2 ½" asphalt, 8" stone
B-7	Lift Station	16" organic bearing soil

The subsurface soils consist of interbedded Silty SANDs (SM, A-2-4) and SANDs (SP, A-3) with Silty CLAY (CL, A-7-6) layers at two locations. The Silty CLAYs were encountered from 3 to 5 feet below grade in borings B-5 and B-6.

The SANDs and Silty SANDs were characterized by Standard Penetration Test (SPT) values (N-values) of 5 to 39 blows per foot. This range of penetration resistance indicates in-place relative densities of very loose to dense. N-values of 14 to 18 blows per foot in the silts and clays indicate in-place consistencies of stiff to very stiff.

Groundwater was encountered at a depth of 20 feet during drilling in boring B-7, and at a depth of 19 feet immediately following boring completion. Groundwater was not encountered in borings B-1 through B-6. Groundwater elevations may vary depending on the time of the year and the extent of surface development.



PROJECT CHARACTERISTICS

The project includes constructing a replacement lift station, installing approximately 800 feet of force main, reconstructing approximately 800 feet of Northgate Drive, and reconstructing approximately 600 feet of Hampshire Road. The force main is a proposed replacement of an existing 4 inch diameter line. The existing lift station wet well is currently planned to be filled with #57 gravel and abandoned in place.

The new lift station consists of two below grade sections: a wet well for receiving and storing influent and a dry well housing the pumps. Both sections will have invert at Elevation 20 feet, which is approximately 24 feet below surface grade. The wet well will be a 7 foot diameter circular shaft. The dry well will be a 9 foot by 12 foot rectangle 14 feet in height, with a 4 foot diameter access tube extending to the surface. Both sections and the access risers will be constructed of precast concrete components supported on a cast-in-place concrete mat foundation 2 feet thick. The lift station facility also includes a davit crane supported on a 4 foot by 3 foot by 3 foot concrete foundation, an emergency connection vault, a pad mounted control panel, an emergency generator, and a paved driveway.

RECOMMENDATIONS

The following recommendations are based on our understanding of the proposed construction, the data obtained from the exploration, and our previous experience with similar subsurface conditions and projects. If there are any significant changes to the project characteristics, such as revised lift station plans, or force main locations, elevations, etc., we request that this office be advised so that the recommendations of this report can be re-evaluated.

A. Site Preparation

Prior to the construction of the lift station or pavements and the placement of fill in structural or pavement areas, existing organic materials, and frozen or wet, excessively soft or loose soils, pavement debris, concrete rubble and other deleterious materials should be removed and wasted. We note that demolition of existing pavements and associated site improvements will create demolition debris that will require removal. Site utility improvements may, also, result in the abandonment of some existing utilities. If so, they should be abandoned in place according to project plans or removed and their excavations should be backfilled in accordance with the recommendations of Section "B" of this report. Utilities or underground structures abandoned in place should be selectively removed to provide a minimum of 1 foot of clearance from any proposed structures and pavements.

After the stripping and demolition operations have been completed, the exposed subgrade soils should be inspected by the Geotechnical Engineer or his approved representative. The inspector should verify that organic matter and organic soils have been removed from structural subgrade areas. The inspector should require the exposed subgrade materials to be compacted to provide surficial densification. The inspector should require that the exposed pavement subgrade materials be proofrolled utilizing a heavily-loaded dump truck or other pneumatic tired vehicle of similar size and weight. The purpose of proofrolling would be to provide surficial densification and to locate any isolated areas of soft or loose soils requiring undercutting. Proofrolling is not advised in wet areas which may deteriorate under repeated vehicular loading. Wet areas should be drained and allowed to dry prior to proofrolling.



The SM and SP (A-2-4 and A-3) site soils are acceptable for use as structural fill (see Section 'B', Following). The SM soils will be sensitive to changes in moisture content. Silty CLAYs (CL, A-7-6) will be encountered in some excavations and should not be reused as structural fill.

Care should be exercised during the surface grading operations at the site. Shallow SM materials were identified at the pavement boring locations. These materials are moderately sensitive to changes in moisture conditions and should therefore be protected. If earthwork is conducted in the presence of moisture, the traffic of heavy equipment, including heavy compaction equipment, may create pumping and a general deterioration of the subgrade soils. Construction traffic should be minimized at pavement and building subgrade areas. If at all possible, the grading should be carried out during dry weather. This should minimize these potential problems, although they may not be eliminated. If such problems arise, the Geotechnical Engineer should be consulted for an evaluation of the conditions.

B. Fill Selection, Placement and Compaction

We recommend that all materials to be used as structural fill be inspected, tested and approved by the Geotechnical Engineer prior to use. The existing SM and SP (A-2-4 and A-3) soils may be approved for re-use as structural fill only if they are free of organic matter and debris and if they are not excessively wet. Structural fill includes fill materials placed below footings, slabs and pavement, and used as backfill against foundations, and retaining walls. The native CL (A-7-6) soils should not be reused as structural fill.

The native SM soils will be sensitive to alteration in moisture content and will become unworkable during and following periods of precipitation and when moisture contents are greater than 3 percentage points above optimum. The Contractor will have to dry these materials in order to use them as structural fill or set them aside for use in landscape areas. Sand, gravel or sand/gravel mixtures would be appropriate for wet weather placement.

Structural fill should be placed in lifts which are eight inches or less in loose thickness and should be compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557). Adjustments to the natural moisture content of the soils may be required in order to obtain specified compaction levels. These guidelines should be set for all structural fill at the site including but not limited to the ground slabs, force main backfill, and pavement fills.

For the proofrolling and fill compaction operations, fill limits should be extended at least 5 feet beyond the pavement boundaries where possible. A sufficient number of in place density tests should be performed by an engineering technician to verify that the proper degree of compaction is being obtained in all fill soils.

C. Lift Station Foundations

Considering current and proposed grade levels, the in-situ soil conditions and the proposed construction, mat foundations for the wet and dry wells can be dimensioned for maximum allowable bearing pressures of 4,000 psf. Shallow (less than 5 feet below grade) spread foundations for the davit crane, control panel, emergency generator, and miscellaneous equipment can be dimensioned for maximum allowable bearing pressures of 3,000 psf.



Some locations may be encountered where less than the required bearing is available. At those locations, compaction in the excavation subgrade may be necessary or minor overexcavation may yield greater soil support. For this reason, the inspection of the foundation excavations by the Geotechnical Engineer is advised.

The project shallow exterior footings in unheated areas should be located at a depth of at least 2 feet to bottom of footing below the outside finish grade to provide adequate frost cover protection. If the lift station structure is to be constructed during the winter months, then all shallow footings should be adequately protected during freezing periods. Otherwise, interior footings can be located on approved soils at nominal depths below the finished floor level.

The above described mats may be supported on firm natural soils or on a layer of controlled structural fill, or stone. The subgrade should be prepared in accordance with the procedures described in Sections "A" and "B" of this report. Prior to placing leveling or load distributing material, or casting the concrete mat, the mat subgrade should be free of standing water or mud. For native soil or fill material placed and compacted according to the procedures outlined in this report, we recommend using a value of modulus of subgrade reaction of 200 pounds per cubic inch.

Minimum dimensions of 30 inches should be used in isolated spread footing foundation design, and 18 inches should be used in linear or rectangular footing design to minimize the possibility of a local shear failure. All foundation excavations should be inspected by the Geotechnical Engineer or his approved representative prior to the placement of concrete. The purpose of the inspection would be to verify that the exposed bearing materials are suitable for the design soil bearing pressure and that loose, wet, frozen or compressible soils are not present.

Soils exposed at the bases of all satisfactory foundation excavations should be protected against any detrimental change in condition, such as disturbance from rain or frost. Surface runoff should be drained away from the excavations and not be allowed to pond.

D. Lateral Pressures for Below Grade Structures

Below grade walls for the project should be designed to resist an equivalent fluid weight of 65 pcf provided that the backfill meets the requirements specified in this report.

The lateral earth pressure intensity is based on long term soil loading conditions using an at-rest soil coefficient. On-site soils suitable for backfill around structures are SP sands. For these materials compacted in place, applicable engineering characteristics suitable for design are as follows:

Angle of Internal Friction, ϕ	30
Maximum moist density, compacted backfill	130 pcf
Cohesion	Zero

For walls designed for the undrained condition, where hydrostatic loading is applied, the equivalent fluid weight of the soil by be reduced to 34 pcf within the height of the hydrostatic load distribution.



A lateral surcharge loading should be applied in below grade wall designs to account for all construction and future traffic loading to be applied to the surface adjacent to the wall. Reference may be made to Drawing No.: JDH-10/12/144-C in the Appendix for load distribution recommendations.

Backfill immediately behind the wall should be relatively clean, granular material containing less than 10 percent passing the No. 200 sieve. In addition, the compaction within the active zone behind the walls should be 92 to 95 percent of the Modified Proctor maximum dry density in accordance with ASTM D-1557. Excessive compaction may cause yielding or damage to the walls. Hand operated equipment should be used near the wall. A vertical crushed stone drainage blanket or a drainage geosynthetic or other drains may used to allow the drainage of groundwater that may build up behind the wall.

E. California Bearing Ratio (CBR) Tests

Seven samples of representative subgrade soil were subjected to CBR tests. The CBR results are shown on the attached CBR summary sheets and in the chart below:

CBR Boring No.	USCS / AASHTO Classification	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Design CBR
B-1	SM / A-2-4	120.6	8.8	40.2
B-2	SM / A-2-4	128.6	8.8	25.8
B-3	SM / A-2-4	117.6	9.0	31.6
B-4	SM / A-2-4	120.5	9.4	36.1
B-5	SM / A-2-4	116.3	8.2	31.8
B-6	SM / A-2-4	119.9	9.5	18.6
B-7	SM / A-2-4	119.7	9.6	33.4

A summary of the CBR test procedures and methodology is provided in the APPENDIX of this report in "INVESTIGATIVE PROCEDURES".

John D. Hynes & Associates, Inc. has completed the requested pavement cross section design services for the referenced project. We used the following parameters for the pavement cross section designs:

Traffic: Approximately 200,000 ESALs per year
Design period: 20 years
Reliability: 80%
Standard deviation: 0.49
Design CBR: 21

Based on these design values, we recommend the following flexible pavement cross section for Hampshire Road and Northgate Drive:



Flexible Pavement

Asphalt Concrete Surface Course (Superpave 9.5 mm)	2 inches
Asphalt Concrete Base Course (Superpave 19.0 mm)	3 inches
Graded Aggregate Subbase	8 inches

We note that this pavement section should, also, be sufficient for the lift station driveway. The pavement materials and construction should be in general accordance with the Maryland State Highway Administration, *Standard Specifications for Construction and Materials* latest edition, and this report.

Pavement subgrades should be compacted to at least 95% of the Modified Proctor maximum dry density (ASTM-1557). The pavement subgrade and pavement layers should be graded such that surface water is carried off of the pavement areas and away from building areas. The surface water should not be allowed to pond. Runoff onto adjacent properties should be controlled properly.

G. Groundwater and Drainage

We encountered groundwater in boring B-7 during drilling operations at a depth of 20 feet below grade. The groundwater rose to 19 feet below grade by the completion of drilling. We did not encounter in borings B-1 through B-6. Precipitation may result in standing water accumulating in excavations. Efforts should be made to keep exposed subgrade areas dry during construction, primarily because the soils will be susceptible to deterioration and loss of strength in the presence of moisture. Adequate drainage should be provided at the site to minimize any increase in moisture content of the foundation and pavement subgrade soils. The final site drainage should also be designed such that run off onto adjacent properties is controlled properly.

ADDITIONAL SERVICES RECOMMENDED

Additional engineering, testing and consulting services recommended for this project are summarized below.

A. Site Preparation

The Geotechnical Engineer or experienced soils inspector should inspect the pavement subgrades after they have been stripped and excavated. The inspector should determine where undercutting, stabilization, or in-place densification are necessary to prepare a subgrade for fill placement support. The inspection should determine if the existing subgrade is adequate or if additional overexcavation is necessary.

B. Fill Placement and Compaction

The Geotechnical Engineer or experienced soils inspector should witness all fill and backfill operations and take sufficient in-place density tests to verify that the specified degree of fill compaction is achieved. The inspector should observe and approve fill materials used and should determine if their existing moisture contents are acceptable.



C. Foundation Excavation Inspections

The Geotechnical Engineer should inspect all foundation excavations for the structure. He should verify that the design bearing pressures are available and that no soft or loose soils exist beneath the bearing surfaces of the foundation excavations.

D. Pavement System Inspection

Pavement subgrade soils should be inspected prior to the placement materials to verify that proper compaction has been achieved and that project specifications are being followed. Compaction testing should be performed on pavement base and subbase stone layers to verify that the specified degree of compaction has been attained.

REMARKS

This report has been prepared solely and exclusively for ARRO to provide guidance to design professionals in developing plans for the Hampshire Road Sewage Lift Station Replacement and Upgrades project in Salisbury, Maryland. It has not been developed to meet the needs of others, and application of this report for other than its intended purpose could result in substantial difficulties. The Consulting Engineer cannot be held accountable for any problems which occur due to the application of this report to other than its intended purpose. Additional recommendations can be provided as necessary.

These analyses and recommendations are, of necessity, based on the concepts made available to us at the time of the writing of this report and on-site conditions, surface and subsurface that existed at the time the exploratory borings were drilled. Further assumption has been made that the limited exploratory borings, in relation both to the areal extent of the site and to depth, are representative of conditions across the site. If conditions are encountered during construction which differ significantly from those reported herein, our office should be notified so that our recommendations can be reviewed and revised as necessary. It is also recommended that we be given the opportunity to review the plans and specifications in order to comment on the interaction of soil conditions as described herein and the design requirements. This report, in its entirety, should be attached to the project specifications.

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted engineering principles and practices.



APPENDIX

1. Investigative Procedures
2. Project Location Map
3. Boring Location Plans
4. Boring Logs
5. Modified Proctor Tests and CBR Tests
6. Earth Pressure Requirements for Below Grade Walls
7. Unified Soil Classification Sheet
8. AASHTO Soil Classification Sheet
9. Field Classification Sheet
10. Information Sheet



INVESTIGATIVE PROCEDURES

SOIL TEST BORINGS

Soil drilling and sampling operations were conducted in accordance with ASTM Specification D-1586. The borings were advanced by mechanically turning continuous hollow stem auger flights into the ground. At regular intervals, samples were obtained with a standard 1.4 inch I.D., 2.0 inch O.D. splitspoon sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is the "Standard Penetration Resistance". The penetration resistance, when properly evaluated, is an index to the soil's strength, density and behavior under applied loads. The soil descriptions and penetration resistances for each boring are presented on the Test Boring Records in the Appendix.

SOIL CLASSIFICATION

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current problems. In our investigation, jar samples obtained during drilling operations are examined in our laboratory and visually classified by the geotechnical engineer in accordance with ASTM Specification D-2488. The soils are classified according to the USDA or Unified Classification System (ASTM D-2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior.

ATTERBERG LIMITS TEST

Portions from representative soil samples obtained during drilling operations were selected for Atterberg Limits tests. The Atterberg Limits are indicative of the soil's plasticity characteristics. The liquid limit is the moisture content at which the soil will flow as a heavy viscous fluid and is determined in accordance with ASTM Specification D-4318. The plastic limit is the moisture content at which the soil begins to lose its plasticity and is determined in accordance with ASTM Specification D-4318. The plastic limit is the moisture content at which the soil begins to lose its plasticity and is determined in accordance with ASTM Specification D-4318.

SIEVE ANALYSIS

Gradational analysis tests were performed to determine the particle size and distribution of the samples tested. The grain size distribution of soils coarser than a No. 200 sieve is determined by passing the sample through a standard set of nested sieves. The percentage of materials passing the No. 200 sieve is determined by washing the material over a No. 200 sieve. These tests are in accordance with ASTM D-421, D-422 and D-1140. The results are presented in the Appendix to our report.

NATURAL MOISTURE

Portions from representative soil samples obtained during drilling operations were selected for Natural Moisture Content tests. The Natural Moisture Content Test determines the water content of soils by drying into a oven with a standard drying temperature of 110 °C. The lost of mass drying the sample, determines the water content into the soil. The water content of the sample is calculated in percentage. The water content of soils (natural moisture) is determined in accordance with ASTM Specification D-2216.



INVESTIGATIVE PROCEDURES (CONTINUED)

MODIFIED PROCTOR

Bulk samples were obtained from the pavement area test borings. A Modified Proctor compaction test (ASTM D 1557) was performed on this soil to determine its compaction characteristics, including its maximum dry density and optimum moisture content.

CALIFORNIA BEARING RATIO

The results of the compaction testing described above were utilized in compacting samples for the laboratory California Bearing Ratio tests. The California Bearing Ratio, abbreviated as CBR, is a punching shear test. It provides data that are a semi-empirical index of the strength and deflection characteristics of a soil that has been correlated with pavement performance. This correlation has resulted in the establishment of design curves for pavement thickness.

The test is performed on a 6-inch diameter, 5-inch thick, disc of compacted soil which is confined in a steel cylinder. The specimens are first tested immediately after compaction and then soaked for four (4) days to simulate a saturated pavement subgrade.

A 1.95-inch diameter piston is forced into the soil at a standard rate and the resistance of the piston penetration is measured. The CBR is the ratio expressed as a percentage of the load at 1.0-inch piston penetration compared to the load required to produce the same penetration in a standard crushed stone.



JOHN D. HYNES & ASSOCIATES, INC.

32185 Beaver Run Drive • Salisbury, Maryland 21804

410-546-6462 / Fax: 410-548-5346

Date: May 29, 2012

Scale: Not To Scale

Drawn: ADC

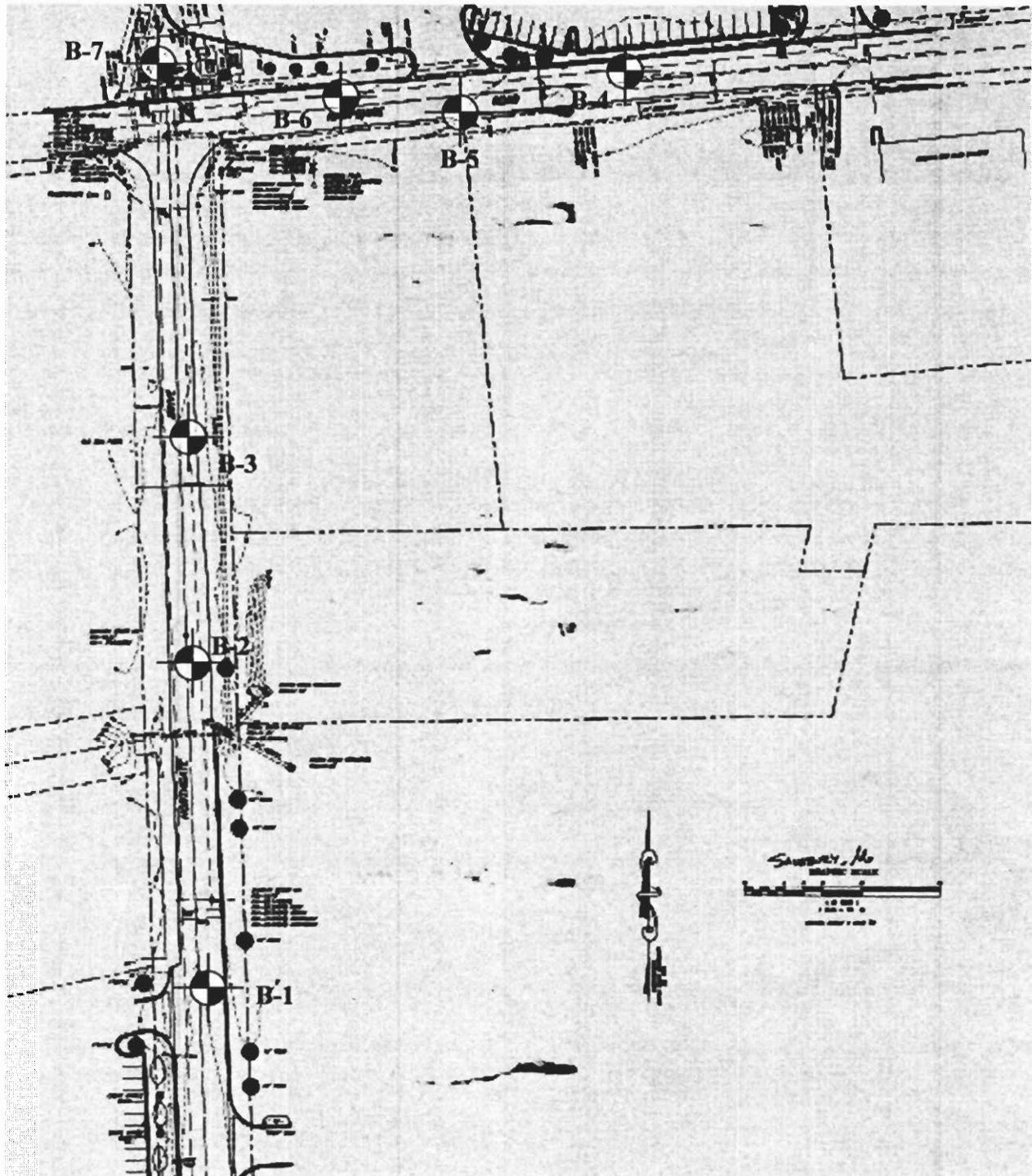
Project Location Map

Hampshire Road Sewage Lift Station Replacement and Upgrades

Salisbury, Maryland

DWG. No.

JDH-10/12/144-A



HYNES JOHN D. HYNES & ASSOCIATES, INC.
 32185 Beaver Run Drive • Salisbury, Maryland 21804
 410-546-6462 / Fax: 410-548-5346

Date: May 30, 2012

Scale: Not To Scale

Drawn: Unknown

Boring Location Plan
 Hampshire Road Sewage Lift Station Replacement and Upgrades
 Salisbury, Maryland

DWG. No.

JDH-10/12/144-B



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LOG OF BORING B-1

(Page 1 of 1)

ARRO
Hub Plaza 1101 Opal Court, Suite 312
Hagerstown, Maryland 21740

Hampshire Road Sewage Lift Station
Replacement and Upgrades

Project No.: : JDH-10/12/144
Date Completed: : May 29, 2012
Logged By: : P. Mauser

Drilled By: : B. Anderson
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 10.5 feet

Depth in Feet	Surf. Elev. 41	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0	41	Brown, wet, medium dense, fine to medium SAND, with little silt, trace fine to medium gravel (A-2-4)		SM	1	12-14-16	Scale 1" ~ 6 feet
2	39	Brown, wet, medium dense, fine to medium SAND, with little silt (A-2-4)		SM	2	16-12-14	Approximately 3 inches of asphalt and 4 inches of stone were encountered at the ground surface.
4	37	Light brown, wet, medium dense, fine to medium SAND, with little silt (A-2-4)		SM	3	7-9-11	Groundwater was not encountered during drilling operations.
6	35	Light brown, wet, loose, fine to coarse SAND, with trace fine gravel, trace silt (A-3)		SP	4	5-5-5	Boring caved in at 6.5 feet.
8	33	Boring was terminated at 10.5 feet.					
10	31						
12	29						
14	27						
16	25						
18	23						
20	21						
22	19						
24	17						
26	15						
28	13						
30	11						
32	9						
34	7						
36	5						
38	3						
40							



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LOG OF BORING B-2

(Page 1 of 1)


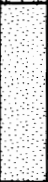
ARRO
Hub Plaza 1101 Opal Court, Suite 312
Hagerstown, Maryland 21740

Hampshire Road Sewage Lift Station

Replacement and Upgrades

Project No.: : JDH-10/12/144
Date Completed: : May 29, 2012
Logged By: : P. Mauser

Drilled By: : B. Anderson
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 10.5 feet

Depth in Feet	Surf. Elev. 41	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0	41	Brown, wet, medium dense, fine to medium SAND, with little silt (A-2-4)		SM	1	12-11-14	Scale 1" ~ 6 feet
2	39				2	7-8-8	Approximately 7 inches of asphalt and 8 inches of stone were encountered at the ground surface.
4	37	Light brown, wet, very loose to loose, fine to medium SAND, with trace silt (slightly mottled) (A-3)		SP	3	4-4-3	Groundwater was not encountered during drilling operations.
6	35				4	3-2-3	Boring caved in at 6 feet.
8	33						
10	31	Boring was terminated at 10.5 feet.					
12	29						
14	27						
16	25						
18	23						
20	21						
22	19						
24	17						
26	15						
28	13						
30	11						
32	9						
34	7						
36	5						
38	3						
40							



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LOG OF BORING B-3

(Page 1 of 1)

ARRO
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Hagerstown, Maryland 21740

Hampshire Road Sewage Lift Station
Replacement and Upgrades

Project No.: : JDH-10/12/144
Date Completed: : May 29, 2012
Logged By: : P. Mauser

Drilled By: : B. Anderson
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 10.5 feet

Depth in Feet	Surf. Elev. 41	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks	
0	41	Brown, wet, medium dense, fine to coarse SAND, with little silt (A-2-4)		SM	1	6-6-7	Scale 1" ~ 6 feet	
2	39				2	6-7-7	Approximately 7 inches of asphalt and 4 inches of stone were encountered at the ground surface.	
4	37	Light brown, wet, medium dense, fine to medium SAND, with trace silt (slightly mottled) (A-3)		SP	3	7-8-7	Groundwater was not encountered during drilling operations.	
6	35				4	8-8-8	Boring caved in at 6 feet.	
8	33	Boring was terminated at 10.5 feet.					Laboratory Test Results	
10	31						Sample No. 1	
12	29						From 0 to 2 feet	
14	27						Sieve Analysis	
16	25						Sieve Size	Passing %
18	23						No. 4	99.9
20	21						No. 10	99.1
22	19						No. 20	93.9
24	17						No. 40	65.0
26	15						No. 60	32.9
28	13						No. 100	21.2
30	11						No. 200	13.8
32	9	Natural Moisture = 10.5%						
34	7							
36	5							
38	3							
40								



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LOG OF BORING B-4

(Page 1 of 1)

ARRO
Hub Plaza 1101 Opal Court, Suite 312
Hagerstown, Maryland 21740

Hampshire Road Sewage Lift Station
Replacement and Upgrades

Project No.: : JDH-10/12/144
Date Completed: : May 29, 2012
Logged By: : P. Mauser

Drilled By: : B. Anderson
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 10.5 feet

Depth in Feet	Surf. Elev. 44	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0	44	Dark brown, wet, dense, fine to coarse SAND, with some pavement aggregate, little silt (A-2-4)		SM	1	19-20-19	Scale 1" ~ 6 feet
2	42	Dark brown, wet, medium dense, fine to medium SAND, with little pavement aggregate (A-2-4)		SM	2	7-10-10	Approximately 3 inches of asphalt and 5 inches of stone were encountered at the ground surface.
4	40	Light brown, wet, medium dense, fine to medium SAND, with trace silt (slightly mottled) (A-3)		SP	3	6-7-8	Groundwater was not encountered during drilling operations.
6	38				4	7-9-11	Boring caved in at 6.5 feet.
8	36	Boring was terminated at 10.5 feet.					
10	34						
12	32						
14	30						
16	28						
18	26						
20	24						
22	22						
24	20						
26	18						
28	16						
30	14						
32	12						
34	10						
36	8						
38	6						
40							



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LOG OF BORING B-5

(Page 1 of 1)

ARRO
Hub Plaza 1101 Opal Court, Suite 312
Hagerstown, Maryland 21740

Hampshire Road Sewage Lift Station
Replacement and Upgrades

Project No.: : JDH-10/12/144
Date Completed: : May 29, 2012
Logged By: : P. Mauser

Drilled By: : B. Anderson
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 10.5 feet

Depth in Feet	Surf. Elev. 44	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0 - 44		Dark brown, wet, medium dense, fine to coarse SAND, with some pavement aggregate, little silt (A-2-4)		SM	1	4-8-12	Scale 1" ~ 6 feet
2 - 42		Brown, wet, very stiff, silty CLAY, with some fine to medium sand (mottled) (A-7-6)		CL	2	7-8-10	Approximately 2.5 inches of asphalt and 7 inches of stone were encountered at the ground surface.
4 - 40		Light brown, wet, medium dense, fine to medium SAND, with little silt, little medium to coarse gravel, trace clay (A-2-4)		SM	3	6-8-9	Groundwater was not encountered during drilling operations.
6 - 38		Light brown, wet, medium dense, fine to medium SAND, with trace silt (A-3)		SP	4	12-12-8	Boring caved in at 6.5 feet.
8 - 36		Boring was terminated at 10.5 feet.					Laboratory Test Results
10 - 34							Sample No. 2 From 3 to 4.5 feet
12 - 32							Atterberg Limits
14 - 30							Liquid Limit = 46
16 - 28							Plasticity Index = 25
18 - 26							Natural Moisture = 20.1%
20 - 24							
22 - 22							
24 - 20							
26 - 18							
28 - 16							
30 - 14							
32 - 12							
34 - 10							
36 - 8							
38 - 6							
40							



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LOG OF BORING B-6

(Page 1 of 1)

ARRO
Hub Plaza 1101 Opal Court, Suite 312
Hagerstown, Maryland 21740

Hampshire Road Sewage Lift Station

Replacement and Upgrades

Project No.: : JDH-10/12/144
Date Completed: : May 29, 2012
Logged By: : P. Mauser

Drilled By: : B. Anderson
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 10.5 feet

Depth in Feet	Surf. Elev. 43	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0	43	Dark brown, wet, medium dense, fine to medium SAND, with little silt, trace fine gravel (mottled) (A-2-4)		SM	1	6-7-6	Scale 1" ~ 6 feet
2	41	Brown, wet, stiff, silty CLAY, with little fine to medium sand (mottled) (A-7-6)		CL	2	4-7-7	Approximately 2.5 inches of asphalt and 8 inches of stone were encountered at the ground surface.
4	39	Brown, wet, medium dense, fine to medium SAND, with little silt (A-2-4)		SM	3	8-8-10	Groundwater was not encountered during drilling operations.
6	37	Light brown, wet, medium dense, fine to coarse SAND, with trace silt (mottled) (A-3)		SP	4	7-8-12	Boring caved in at 6 feet.
8	35						Laboratory Test Results
10	33	Boring was terminated at 10.5 feet.					Sample No. 2 From 3 to 4.5 feet
12	31						Atterberg Limits
14	29						Liquid Limit = 47 Plasticity Index = 26 Natural Moisture = 20.0%
16	27						
18	25						
20	23						
22	21						
24	19						
26	17						
28	15						
30	13						
32	11						
34	9						
36	7						
38	5						
40							



**HYNES
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LOG OF BORING B-7

(Page 1 of 1)

ARRO
Hub Plaza 1101 Opal Court, Suite 312
Hagerstown, Maryland 21740

Hampshire Road Sewage Lift Station
Replacement and Upgrades

Project No.: : JDH-10/12/144
Date Completed: : May 29, 2012
Logged By: : P. Mauser

Drilled By: : B. Anderson
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 30.5 feet

Depth in Feet	Surf. Elev. 43	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0	43	Brown, wet, loose, fine to coarse SAND, with some silt (A-2-4)			1	-	Scale 1" ~ 6 feet
2	41			SM	2	3-3-4	Approximately 16 inches of organic bearing soil was encountered at the ground surface.
4	39				3	7-10-8	Groundwater was encountered at 20 feet during drilling operations. At completion water was at 19 feet.
6	37	Brown, wet, medium dense, fine to medium SAND, with trace silt (A-3)			4	6-7-9	Boring caved in at 19.5 feet.
8	35			SP			Laboratory Test Results
10	33				5	8-9-10	Sample No. 2 From 3 to 4.5 feet
12	31	Brown, wet, medium dense, fine to coarse SAND, with trace fine gravel, trace silt (A-3)			6	9-8-8	Sieve Analysis
14	29			SP			Sieve Size Passing %
16	27				7	5-6-6	No. 4 99.8
18	25	Brown, wet to saturated, medium dense, fine to coarse SAND, with little silt (mottled) (A-2-4)			8	4-8-10	No. 10 96.5
20	23			SM			No. 20 79.8
22	21						No. 40 51.1
24	19	Light brown, saturated, medium dense, fine to coarse SAND, with trace silt (A-3)					No. 60 33.8
26	17			SP			No. 100 21.5
28	15						No. 200
30	13	Light brown, saturated, medium dense, fine to medium SAND, with little silt (A-2-4)					Natural Moisture = 12.2%
32	11			SM			
34	9						
36	7						
38	5						
40		Boring was terminated at 30.5 feet.					



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Monitoring Well Installation
Construction Inspection and Materials Testing

RECORD No: 10807

TEST TYPE: California Bearing Ratio (CBR) Test

MADE FOR: ARRO

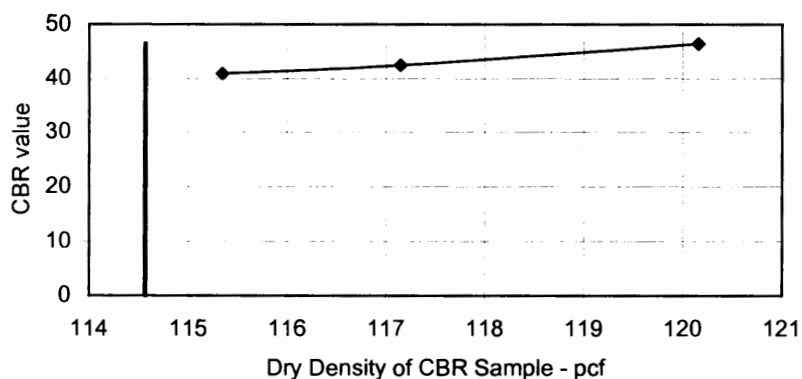
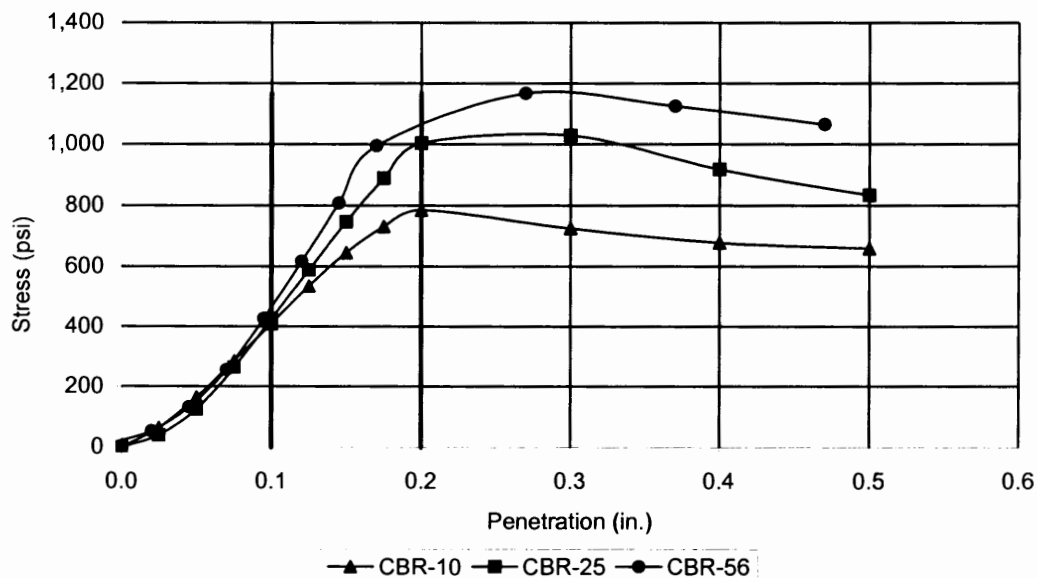
TEST DATE: June 6, 2012

PROJECT: Hampshire Road Sewage Lift Station Replacement and Upgrades

LOCATION: B-1

TEST METHOD: ASTM D-1883

DESCRIPTION: Brown, fine to coarse SAND, with some silt (SM)



Sample Condition:

Soaked

Number of Blows	10	25	56
Dry Density (pcf)	115.3	117.1	120.2
Moisture Content Before Soak (%)	10.8	10.8	10.8
CBR Value:	40.9	42.5	46.4

**Design CBR
@ 95%
40.2**

Maximum Dry Density: 120.6 pcf
Optimum Moisture Content: 8.8 %
Dry Density at 95% compaction = 114.6 pcf

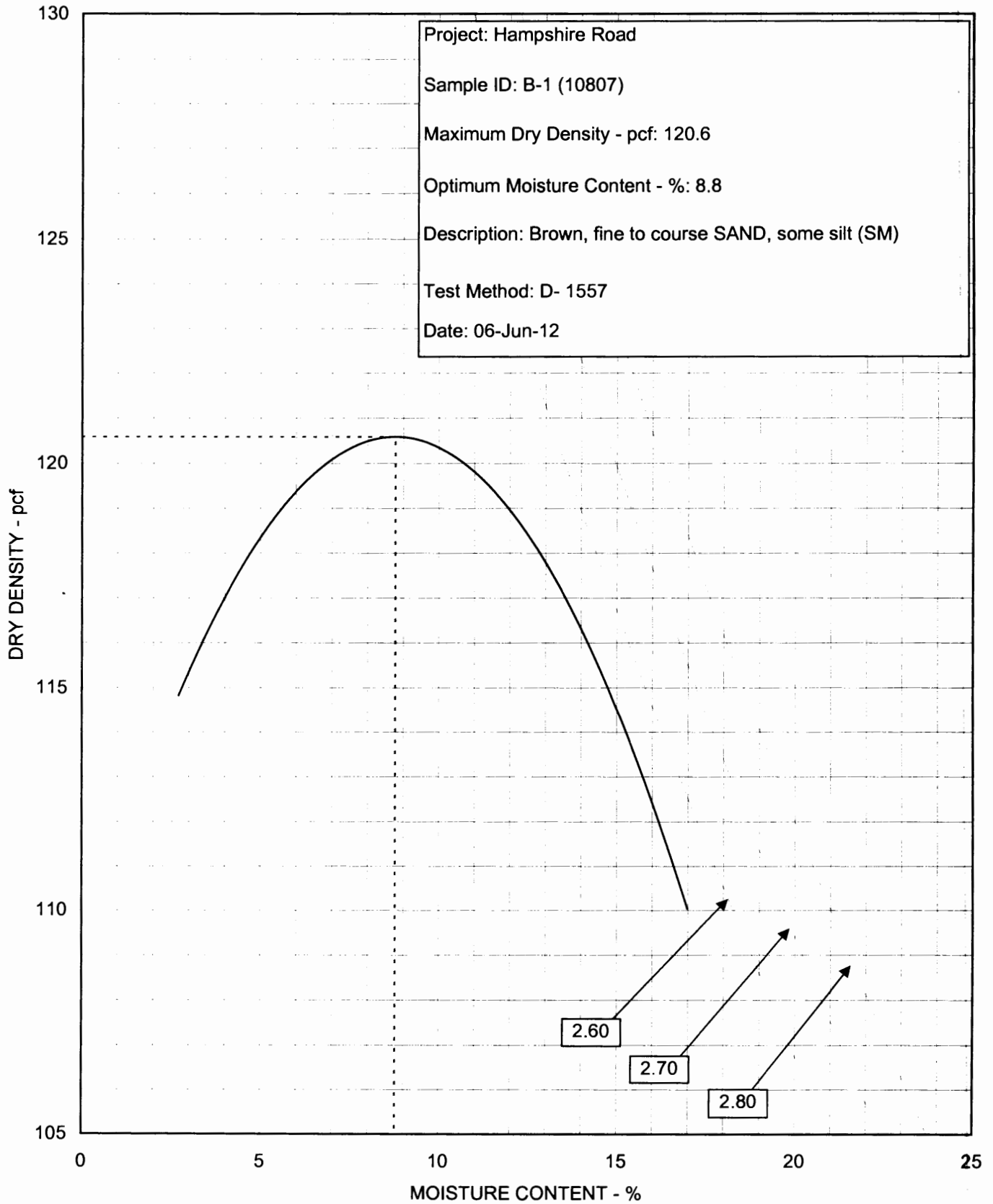
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By: Paul Mauser

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RECORD No: 10810

TEST TYPE: California Bearing Ratio (CBR) Test

MADE FOR: ARRO

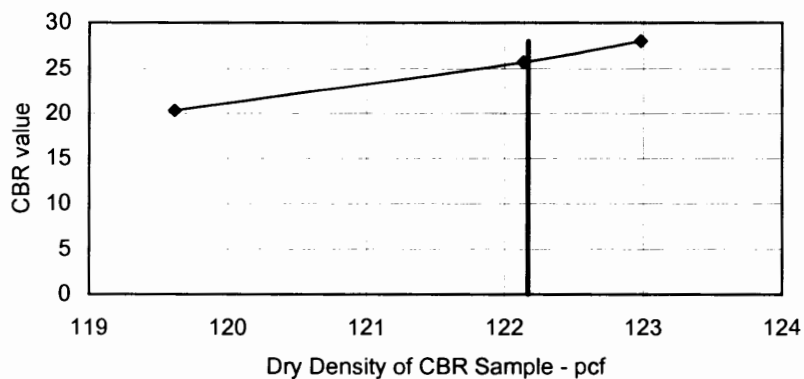
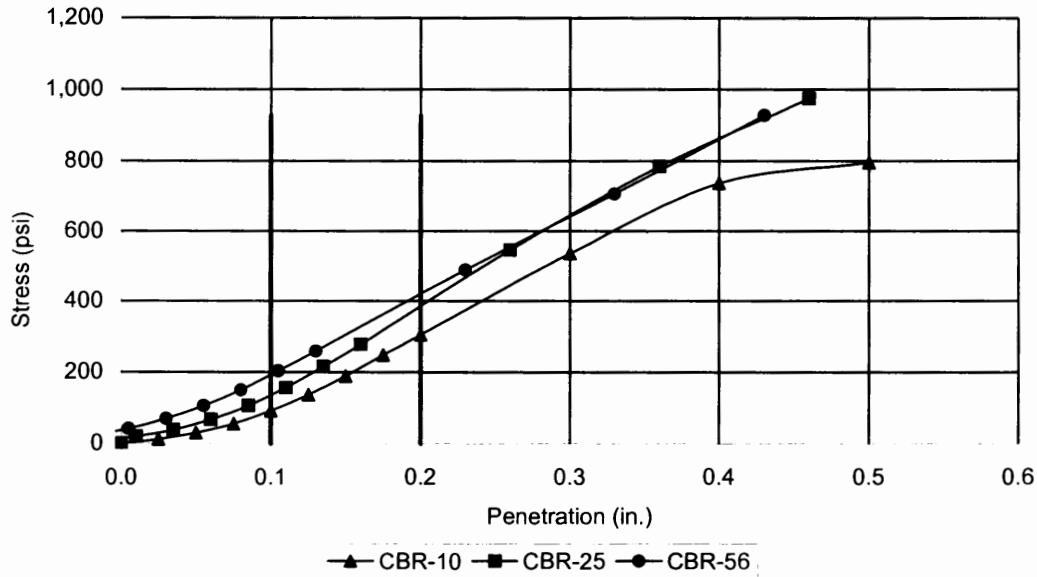
TEST DATE: June 15, 2012

PROJECT: Hampshire Road Sewage Lift Station Replacement and Upgrades

LOCATION: B-2

TEST METHOD: ASTM D-1883

DESCRIPTION: Brown, fine to coarse SAND, with little silt, trace fine gravel (SM)



Sample Condition:

Soaked

Number of Blows	10	25	56
Dry Density (pcf)	119.6	122.1	123.0
Moisture Content Before Soak (%)	10.9	10.9	10.9
CBR Value:	20.3	25.7	28.0

**Design CBR
@ 95%
25.8**

Maximum Dry Density: 128.6 pcf
Optimum Moisture Content: 8.8 %
Dry Density at 95% compaction = 122.2 pcf

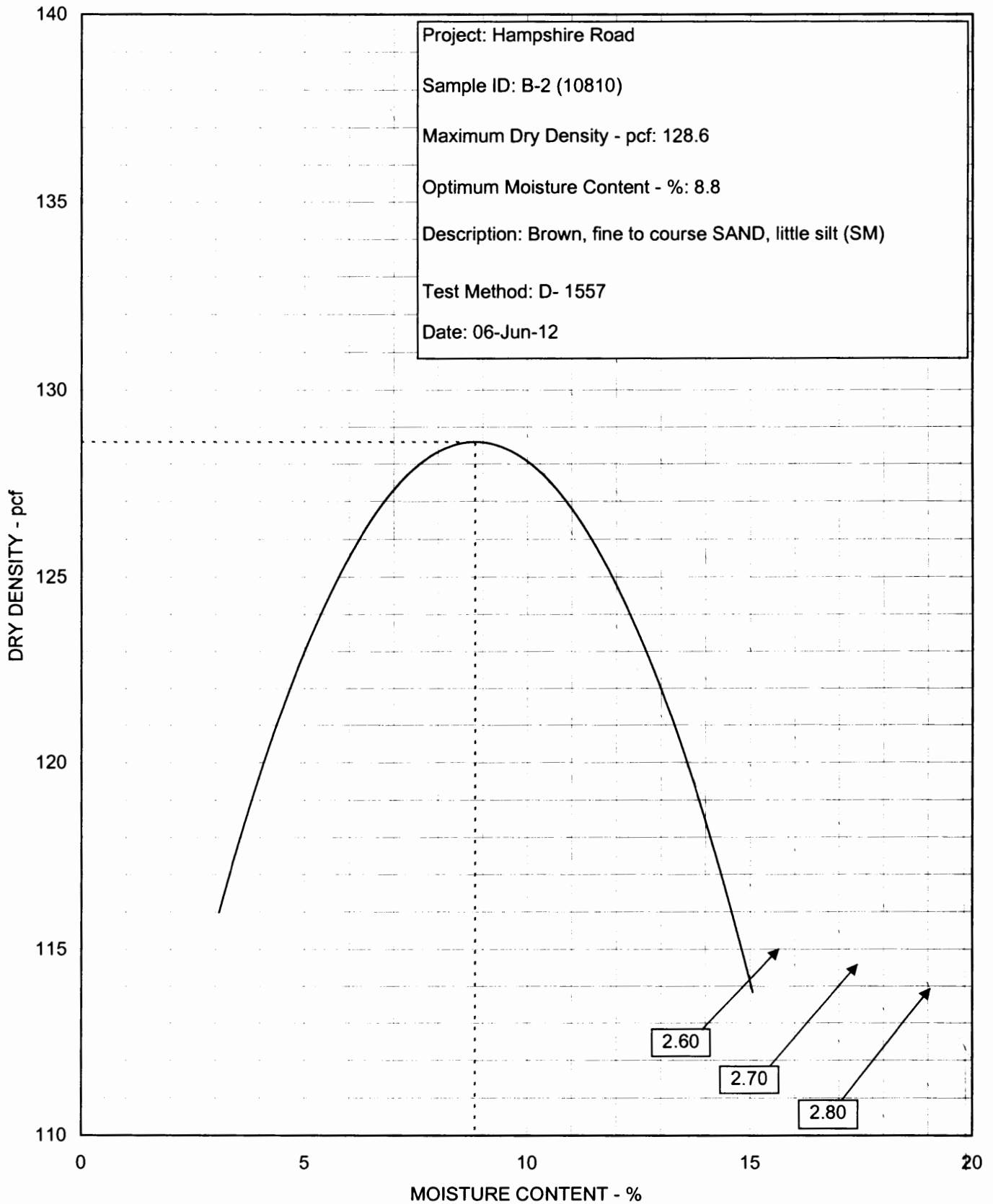
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RECORD No: 10812

TEST TYPE: California Bearing Ratio (CBR) Test

MADE FOR: ARRO

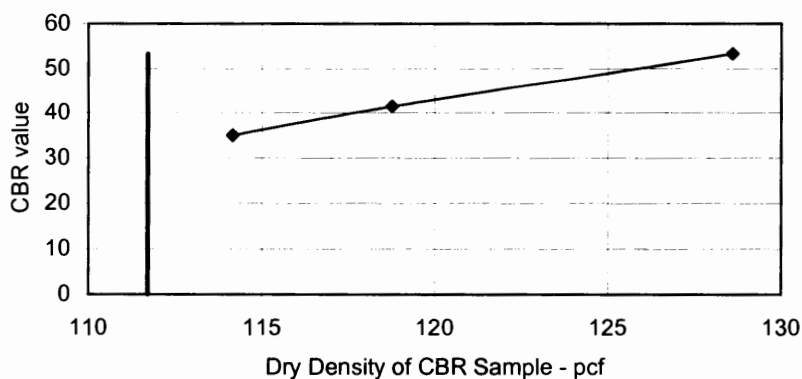
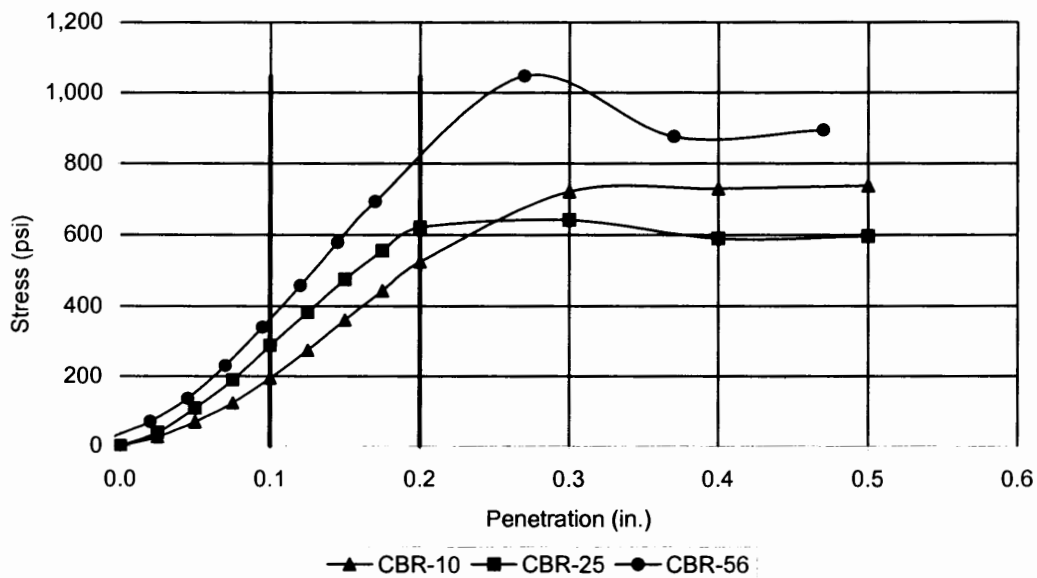
TEST DATE: June 19, 2012

PROJECT: Hampshire Road Sewage Lift Station Replacement

LOCATION: B-3

TEST METHOD: ASTM D-1883

DESCRIPTION: Brown, fine to coarse SAND, with little silt (SM)



Sample Condition:

Soaked

Number of Blows	10	25	56
Dry Density (pcf)	114.2	118.8	128.6
Moisture Content Before Soak (%)	11.2	9.0	9.0
CBR Value:	35.0	41.4	53.3

**Design CBR
@ 95%
31.6**

Maximum Dry Density: 117.6 pcf
Optimum Moisture Content: 9.0 %
Dry Density at 95% compaction = 111.7 pcf

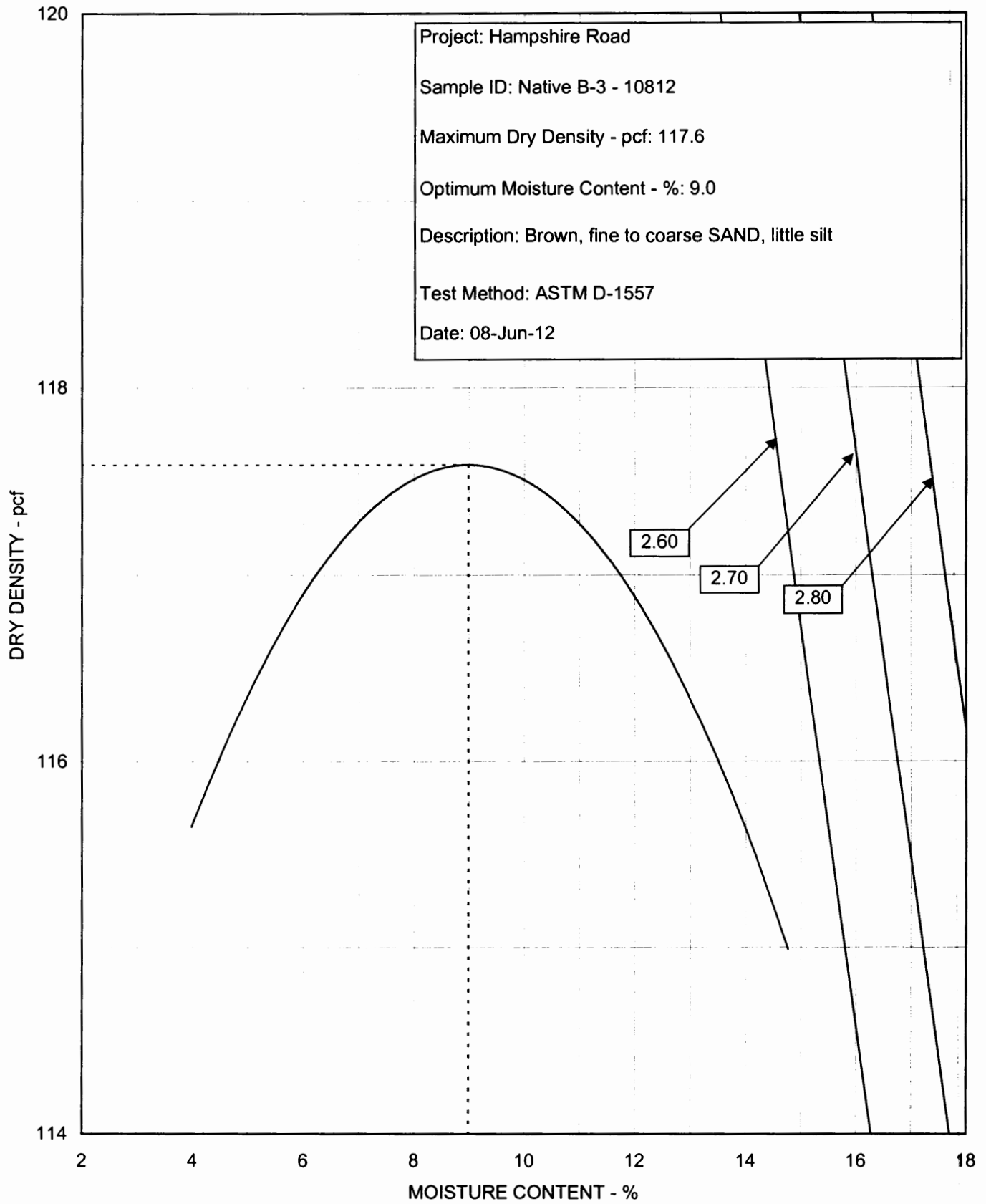
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RECORD No: 10806

TEST TYPE: California Bearing Ratio (CBR) Test

MADE FOR: ARRO

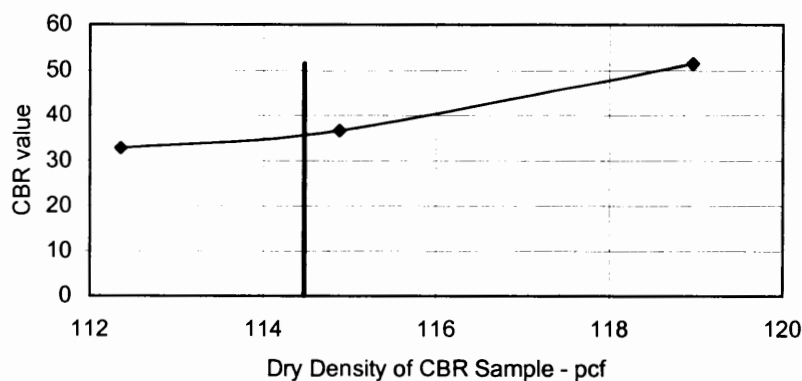
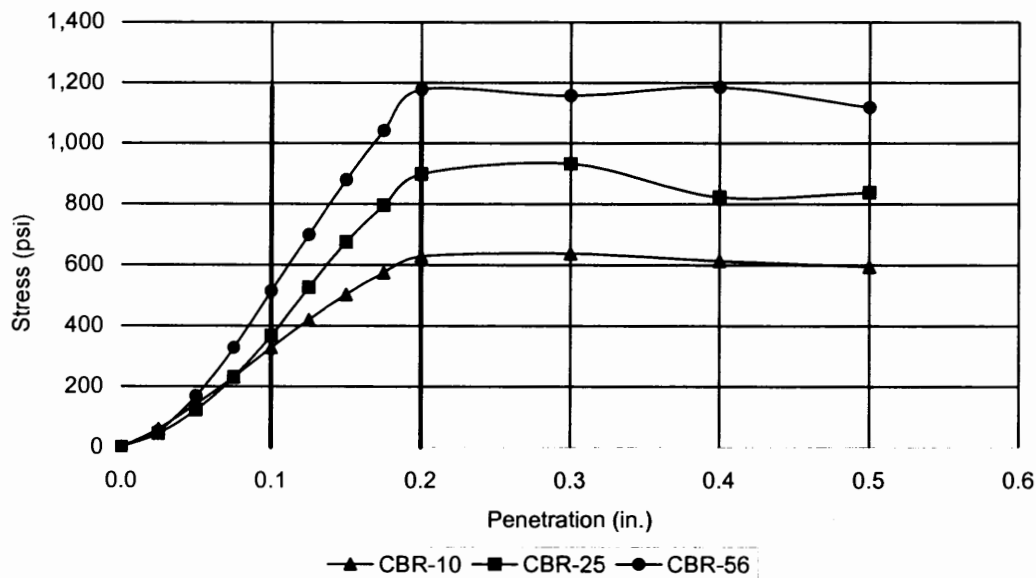
TEST DATE: June 6, 2012

PROJECT: Hampshire Road Sewage Lift Station Replacement and Upgrades

LOCATION: B-4

TEST METHOD: ASTM D-1883

DESCRIPTION: Brown, fine to coarse SAND, with little silt, trace fine gravel (SM)



Sample Condition:

Soaked

	10	25	56
Number of Blows	10	25	56
Dry Density (pcf)	112.4	114.9	119.0
Moisture Content Before Soak (%)	11.0	11.0	11.0
CBR Value:	32.8	36.7	51.5

**Design CBR
@ 95%
36.1**

Maximum Dry Density: 120.5 pcf
Optimum Moisture Content: 9.4 %
Dry Density at 95% compaction = 114.5 pcf

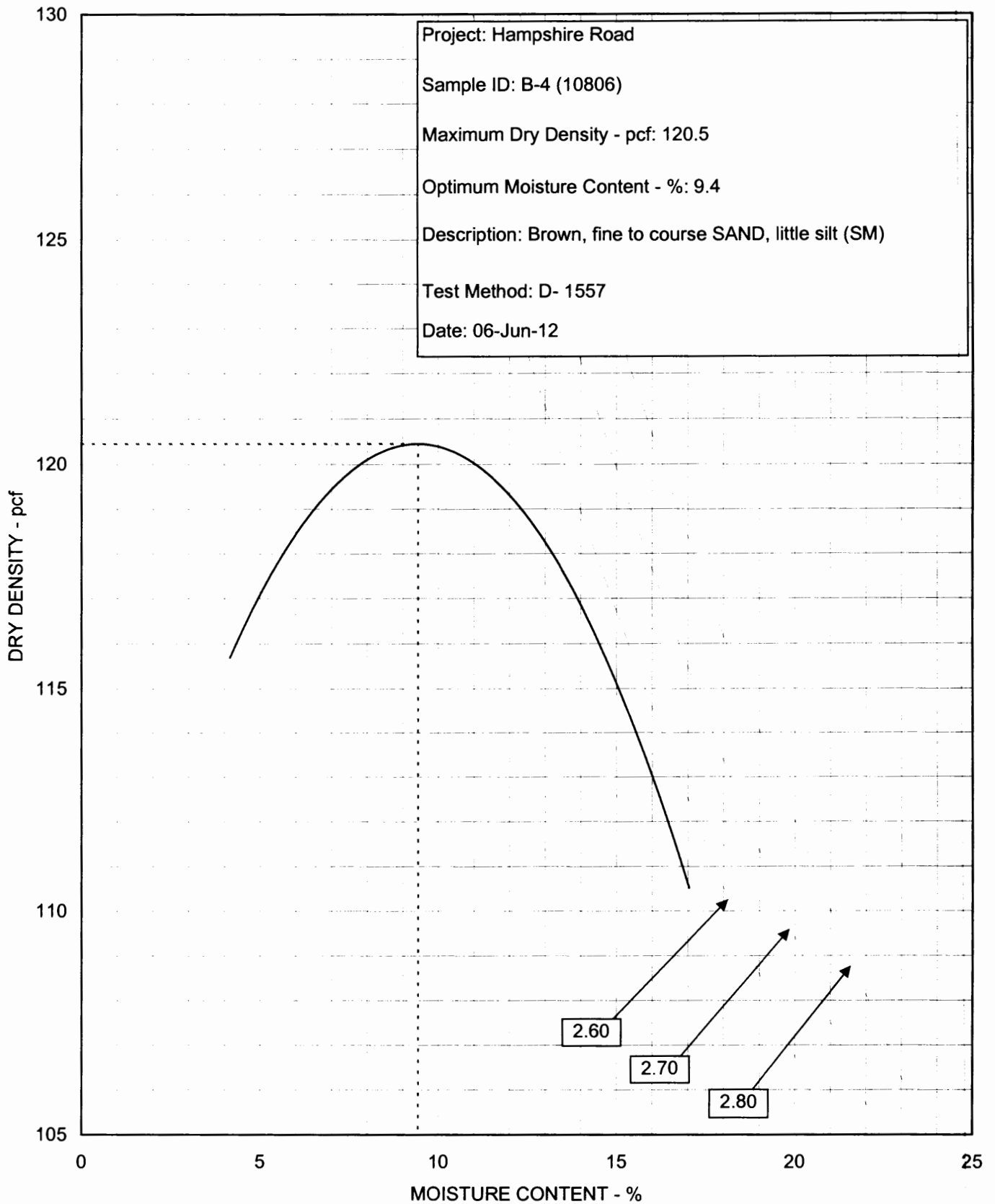
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RECORD No: 10811

TEST TYPE: California Bearing Ratio (CBR) Test

MADE FOR: ARRO

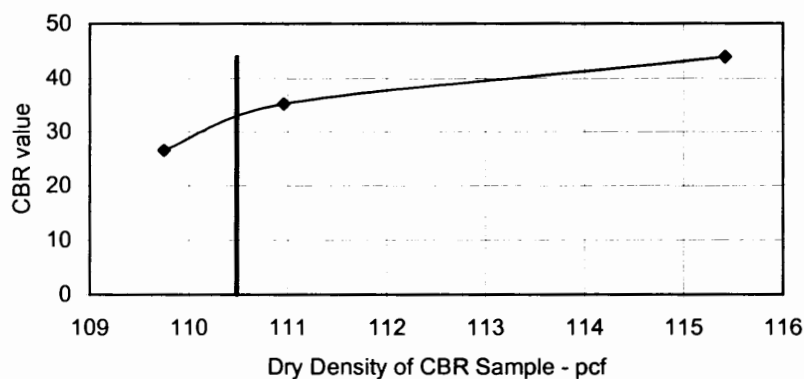
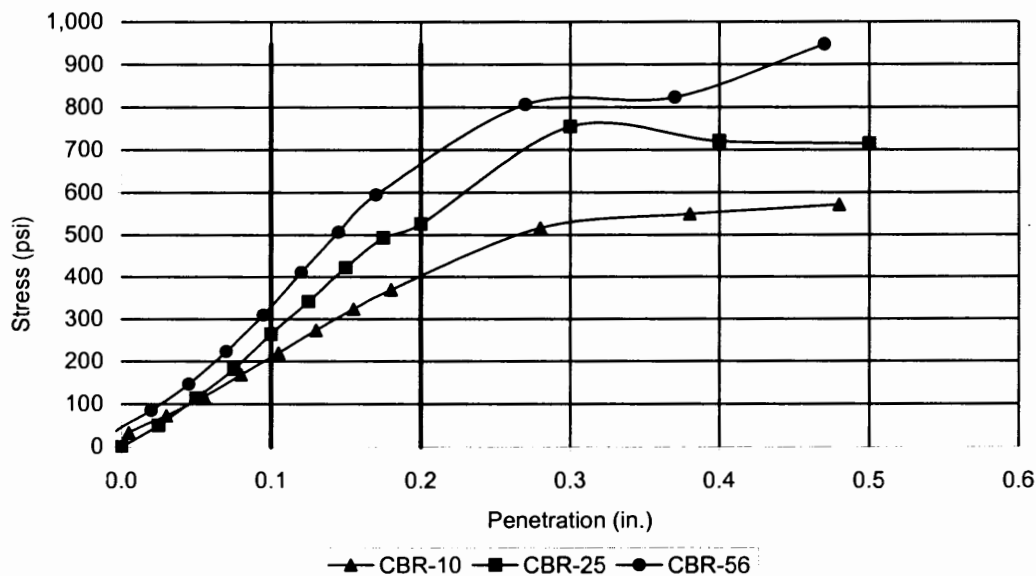
TEST DATE: June 15, 2012

PROJECT: Hampshire Road Sewage Lift Station Replacement and Upgrades

LOCATION: B-5

TEST METHOD: ASTM D-1883

DESCRIPTION: Brown, fine to coarse SAND, with little silt (SM)



Sample Condition:

Soaked

Number of Blows	10	25	56
Dry Density (pcf)	109.8	111.0	115.4
Moisture Content Before Soak (%)	10.5	10.5	10.5
CBR Value:	26.6	35.1	43.9

**Design CBR
@ 95%
31.8**

Maximum Dry Density: 116.3 pcf
Optimum Moisture Content: 8.2 %
Dry Density at 95% compaction = 110.5 pcf

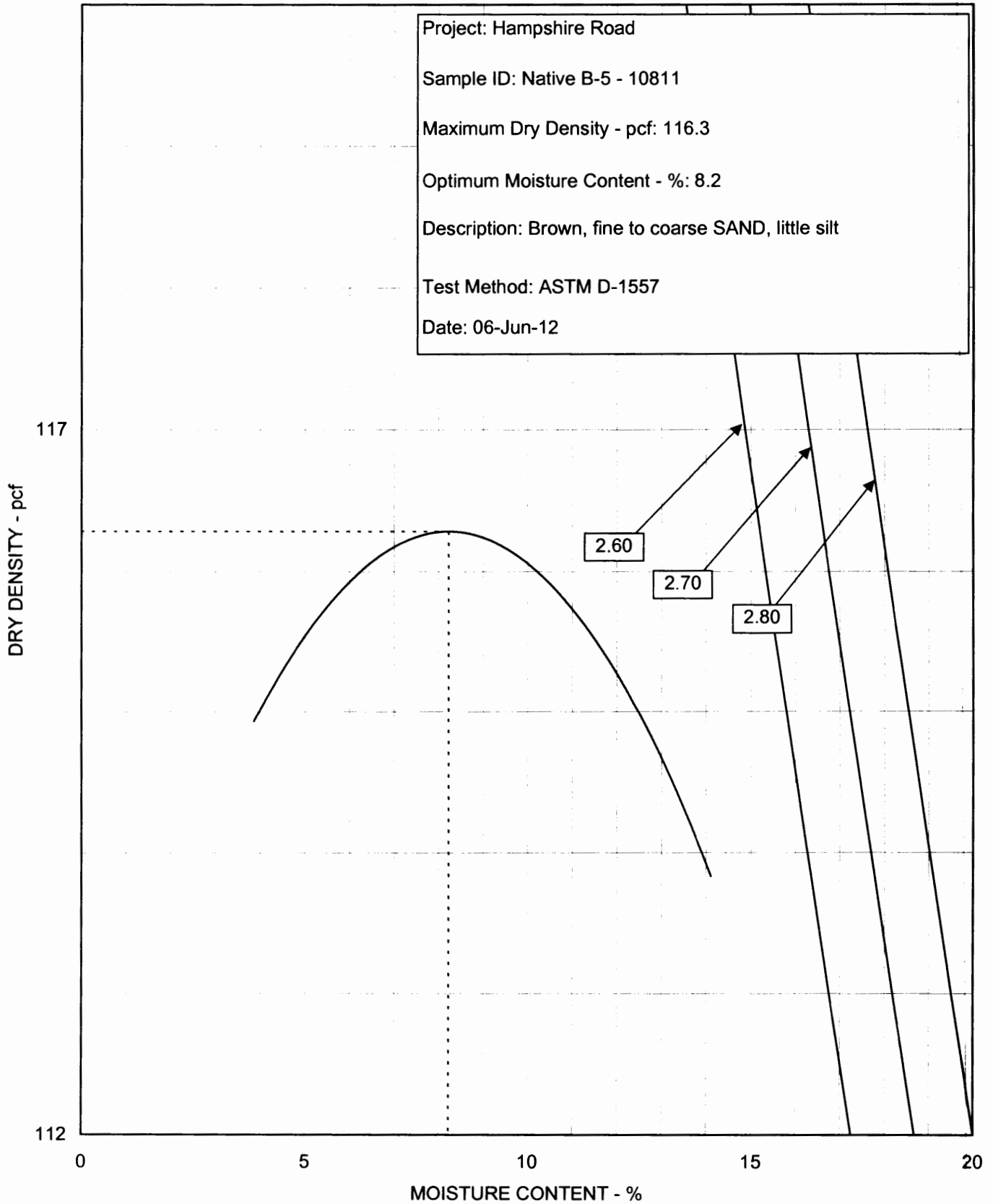
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RECORD No: 10809

TEST TYPE: California Bearing Ratio (CBR) Test

MADE FOR: ARRO

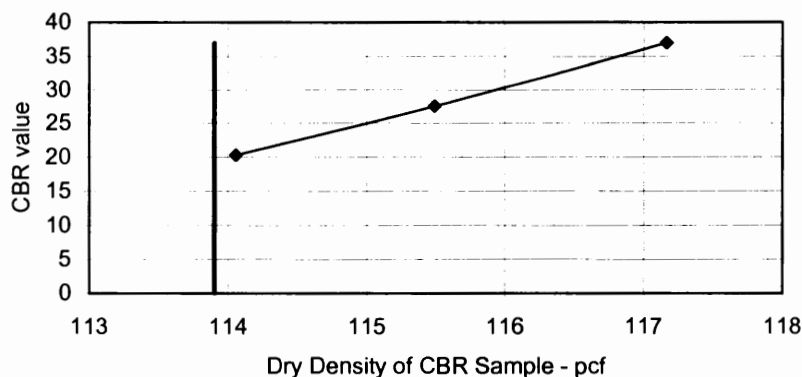
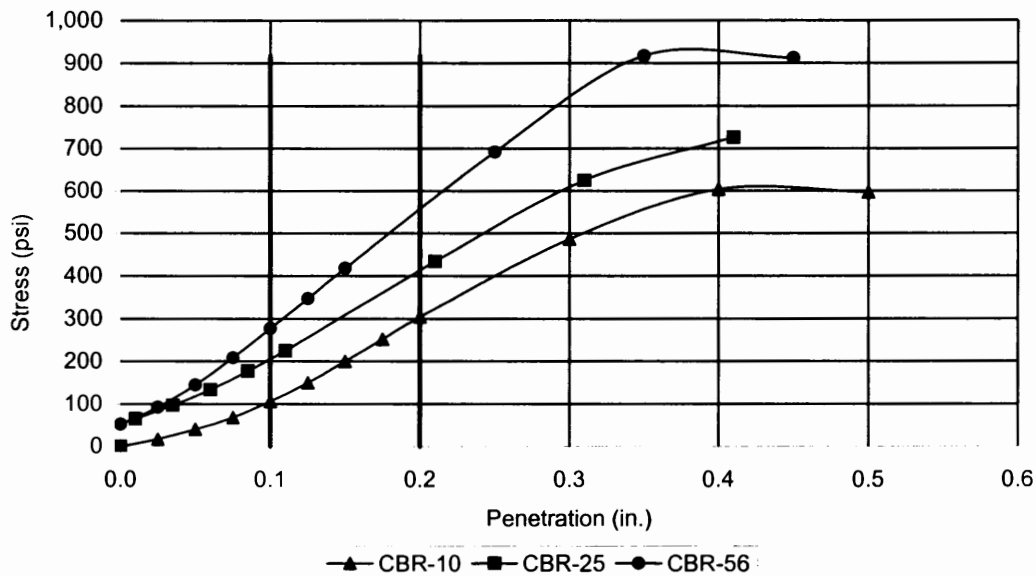
TEST DATE: June 7, 2012

PROJECT: Hampshire Road Sewage Lift Station Replacement and Upgrades

LOCATION: B-6

TEST METHOD: ASTM D-1883

DESCRIPTION: Brown, fine to coarse SAND, with little silt, trace fine gravel (SM)



Sample Condition:

Soaked

Number of Blows	10	25	56
Dry Density (pcf)	114.1	115.5	117.2
Moisture Content Before Soak (%)	11.5	11.5	11.5
CBR Value:	20.3	27.5	37.0

**Design CBR
@ 95%
18.6**

Maximum Dry Density: 119.9 pcf
Optimum Moisture Content: 9.5 %
Dry Density at 95% compaction = 113.9 pcf

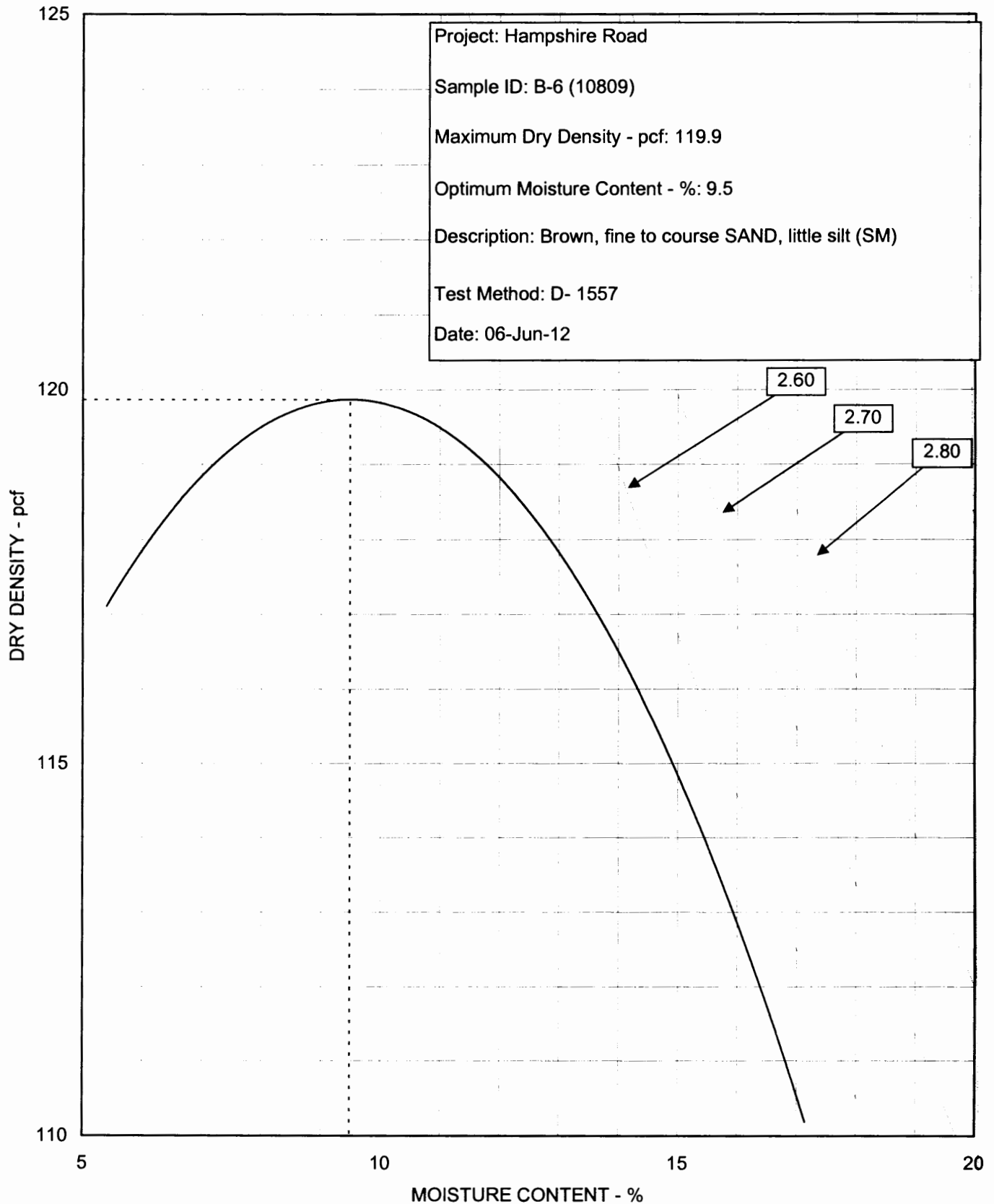
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By: Paul Mauser

32185 Beaver Run Drive, Salisbury, Maryland 21804
302-678-9718 • Fax 302-678-9733



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RECORD No: 10805

TEST TYPE: California Bearing Ratio (CBR) Test

MADE FOR: ARRO

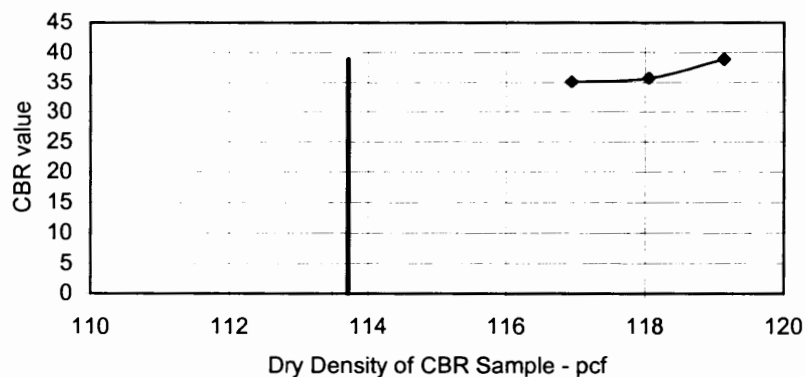
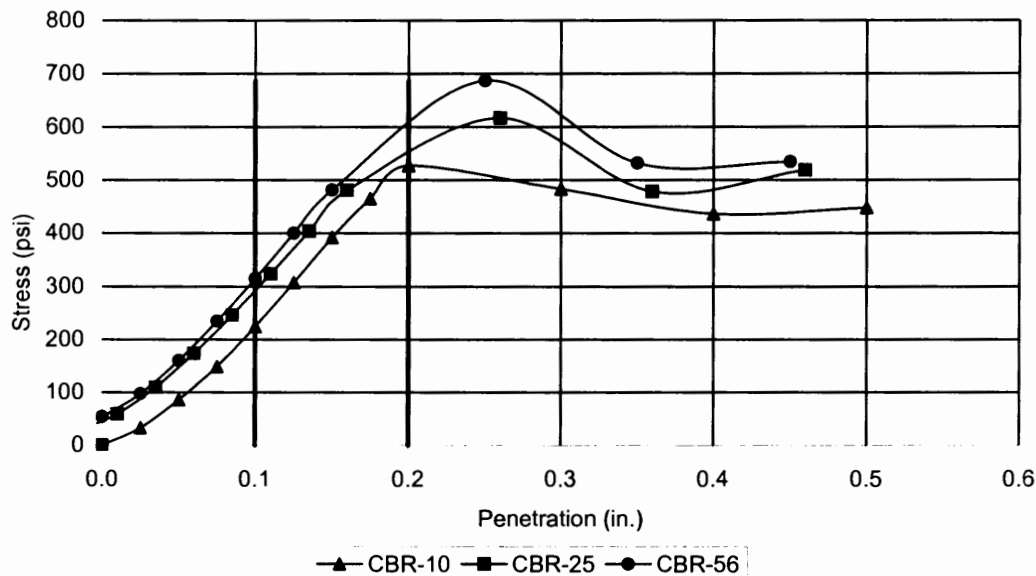
TEST DATE: June 15, 2012

PROJECT: Hampshire Road Sewage Lift Station Replacement and Upgrades

LOCATION: B-7

TEST METHOD: ASTM D-1883

DESCRIPTION: Brown, fine to coarse SAND, with some silt, trace fine gravel (SM)



Sample Condition:	Soaked		
Number of Blows	10	25	56
Dry Density (pcf)	116.9	118.1	119.1
Moisture Content Before Soak (%)	11.4	11.4	11.4
CBR Value:	35.1	35.7	38.9

**Design CBR
@ 95%
33.4**

Maximum Dry Density: 119.7 pcf
Optimum Moisture Content: 9.6 %
Dry Density at 95% compaction = 113.7 pcf

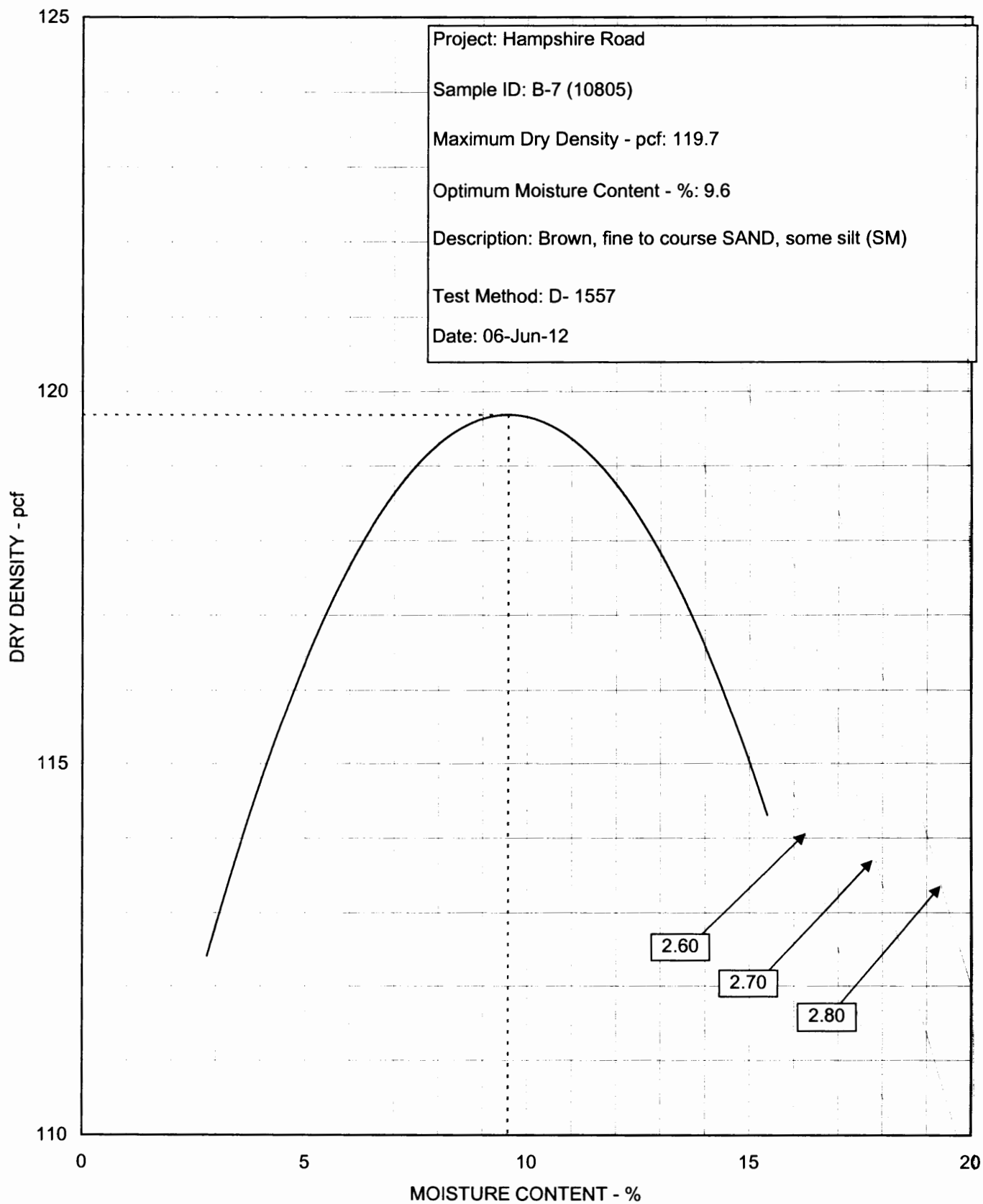
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By: Paul Mauser

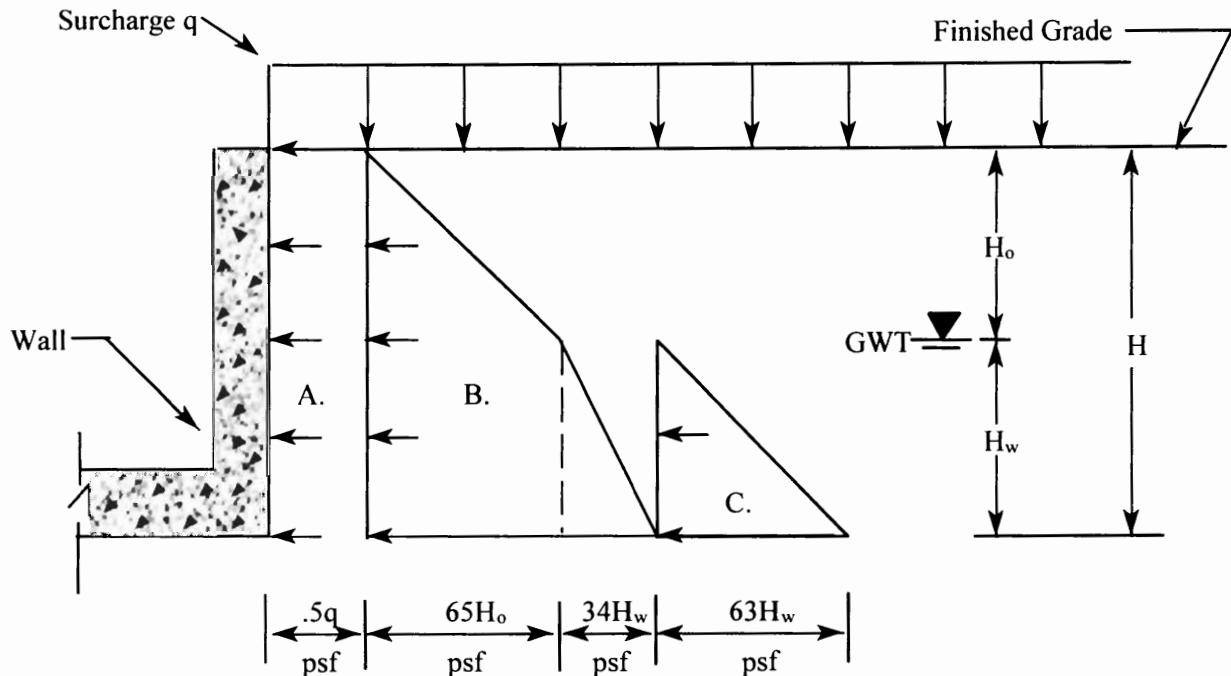
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EARTH PRESSURE REQUIREMENTS FOR BELOW GRADE WALLS (UNDRAINED)



A. Lateral Surcharge
B. Lateral Soil Pressure
C. Hydrostatic Pressure

1. Pressure diagram assumes undrained soil conditions.
2. Pressure diagram assumes at rest soil pressures on cantilevered walls or walls with one support level.
3. For backfill, use non-plastic SP or better quality material (ASTM D-2487).
4. Compact backfill in maximum 8-inch loose lifts to 92 to 95 percent maximum dry density (ASTM D-1557).
5. Use only light-duty hand operated compaction equipment within 10 feet of walls.
6. For surcharge q , consider the greater of the maximum expected construction equipment live loads or permanent structure dead and live loads.
7. For temporary retaining walls used for excavation support, use 2/3 of the above values for lateral surcharge and soil pressures. This reflects the active soil pressure condition.



JOHN D. HYNES & ASSOCIATES, INC.

32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

Date: June 27, 2012

Scale: Not to Scale

DRAWN: WCP

Earth Pressure Requirements for Below Grade Walls (Undrained)
Hampshire Road Sewage Lift Station Replacement and Upgrades
Salisbury, Maryland

DWG. No.

JDH-10/12/144-C



FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON-COHESIVE SOILS

(Silt, Sand, Gravel and Combinations)

DENSITY

Very Loose	- 5 blows/ft. or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

PARTICLE SIZE IDENTIFICATION

Boulders	- 8 inch diameter or more
Cobbles	- 3 to 8 inch diameter
Gravel	- Coarse - 1 to 3 inch - Medium - 1/2 to 1 inch - Fine - 4.75 mm to 1/2 inch
Sand	- Coarse - 2.0 mm to 4.75 mm - Medium - 0.425 mm to 2.0 mm - Fine - 0.075 mm to 0.425 mm
Silt	- 0.075 mm to 0.002 mm

RELATIVE PROPORTIONS

Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

COHESIVE SOILS

(Clay, Silt and Combinations)

CONSISTENCY

Very Soft	- 3 blows/ft. or less
Soft	- 4 to 5 blows/ft.
Medium Stiff	- 6 to 10 blows/ft.
Stiff	- 11 to 15 blows/ft.
Very Stiff	- 16 to 30 blows/ft.
Hard	- 31 blows/ft. or more

PLASTICITY

Degree of Plasticity	Plasticity Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	over 22

Classification on logs are made by visual inspection of samples unless a sample has been subjected to laboratory classification testing.

Standard Penetration Test - Driving a 2.0" O.D., 1-3/8" I.D., splitspoon sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary to drive the spoon 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the test are recorded for each 6 inches of penetration on the drill log (Example - 6/8/9). The standard penetration test value (N - value) can be obtained by adding the last two figures (i.e. 8 + 9 = 17 blows/ft.). (ASTM D-1586)

Strata Changes - In the column "Soil Descriptions," on the drill log, the horizontal lines represent strata changes. A solid line (—) represents an actually observed change, a dashed line (---) represents an estimated change.

Groundwater - Observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc. may cause changes in the water levels indicated on the logs.



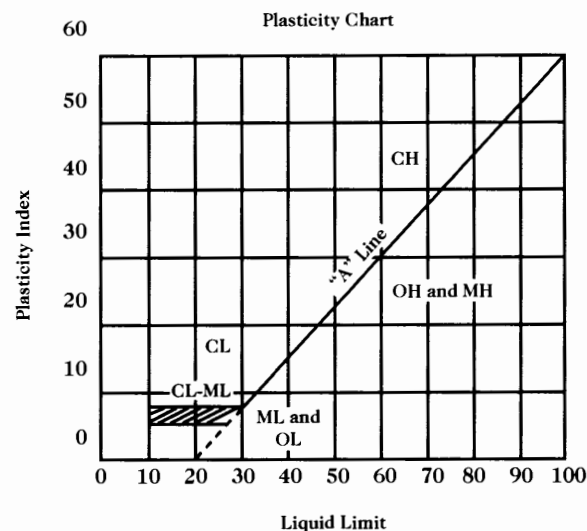
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UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria					
Coarse-grained soils (More than half of material is larger than No 200 sieve size)	Gravels (More than half of coarse fraction is larger than No 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No 200 sieve size), coarse grained soils are classified as follows: Less than 5 percent More than 12 percent 5 to 12 percent	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3				
			GP	Poorly graded gravels, gravel sand mixtures, little or no fines		Not meeting all gradation requirements for GW				
		Gravels with fines (Appreciable amount of fines)	GM ^a d u	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4		Above "A" line with P.I. between 4 and 7 are <i>borderline</i> cases requiring use of dual symbols		
						GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands,		GW, GP, SW, SP GM, GC, SM, SC <i>Borderline cases requiring dual symbols^a</i>	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3			
			SP	Poorly graded sands, gravelly sands, little or no fines			Not meeting all gradation requirements for SW			
		Sands with fines (Appreciable amount of fines)	SM ^a d u	Silty sands, sand-silt mixtures			Atterberg limits below "A" line or P.I. less than 4		Above "A" line with P.I. between 4 and 7 are <i>borderline</i> cases requiring use of dual symbols.	
							SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7

Fine-grained soils (More than half material is smaller than No 200 sieve)	Silts and clays (Liquid limit less than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity		
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
		OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
		CH	Inorganic clays of high plasticity, fat clays		
		OH	Organic clays of medium to high plasticity, organic silts		
	Highly organic soils	Pt	Peat and other highly organic soils		





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*Geotechnical and Environmental Consultants
Monitoring Well Installation
Construction Inspection and Materials Testing*

AASHTO SOIL CLASSIFICATION SYSTEM

General classification	Granular materials (35% or less of total sample passing No. 200 sieve)						
Group classification	A-1		A-3	A-2			
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7
Sieve analysis (% passing) No. 10 sieve No. 40 sieve No. 200 sieve	50 max 30 max 15 max	50 max 25 max	51 min 10 max	35 max	35 max	35 max	35 max
For fraction passing No. 40 sieve Liquid limit (<i>LL</i>) Plasticity index (<i>PI</i>)	6 max		Non-plastic	40 max 10 max	41 min 10 max	40 max 11 min	41 min 11 min
Usual types of material	Stone fragments, gravel, and sand		Fine sand	Silty or clayey gravel and sand			
Subgrade rating	Excellent to good						

General classification	Silt-clay materials (More than 35% of total sample passing No. 200 sieve)			
Group classification	A-4	A-5	A-6	A-7 A-7-5 ^a A-7-6 ^b
Sieve analysis (% passing) No. 10 sieve No. 40 sieve No. 200 sieve	36 min	36 min	36 min	36 min
For fraction passing No. 40 sieve Liquid limit (<i>LL</i>) Plasticity index (<i>PI</i>)	40 max 10 max	41 min 10 max	40 max 11 min	41 min 11 min
Usual types of material	Mostly silty soils		Mostly clayey soils	
Subgrade rating	Fair to poor			

^aIf $PI \leq LL - 30$, it is A-7-5

^bIf $PI > LL - 30$, it is A-7-6

☐ **Main Office** - 32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346

☐ **Dover Office** - 1039 Fowler Court • Dover, Delaware 19901 • 302-678-9718 • Fax 302-678-9733

E-mail - Salisbury jdhyne@aol.com

Important Information About Your Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one—not even you*—should apply the report for any purpose or project except the one originally contemplated.

Read the full report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when

it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions *only* at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an *opinion* about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject To Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the

report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time to perform additional study.* Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations", many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Rely on Your Geotechnical Engineer for Additional Assistance

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.



8811 Colesville Road Suite G106 Silver Spring, MD 20910

Telephone: 301-565-2733 Facsimile: 301-589-2017

email: info@asfe.org www.asfe.org

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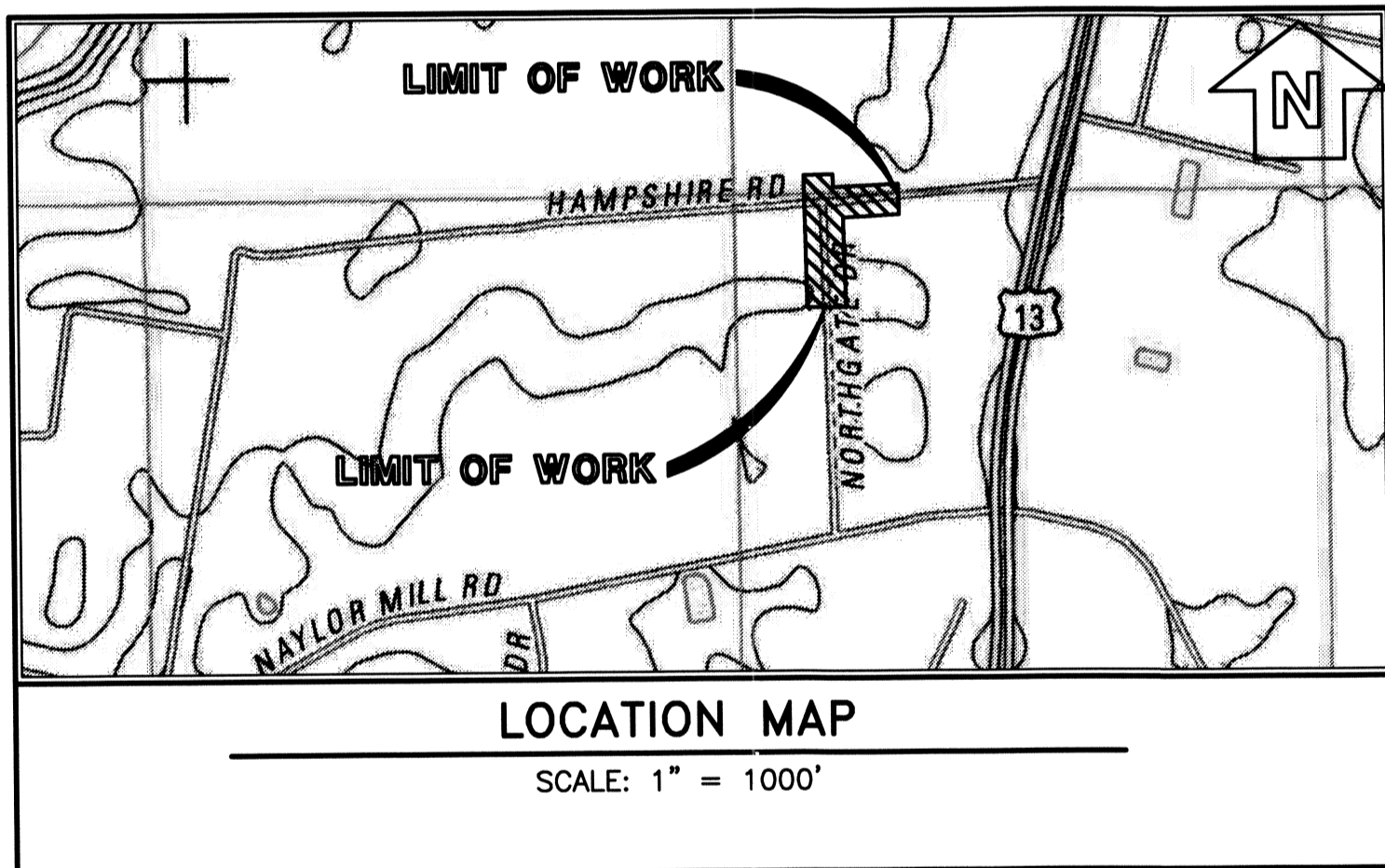
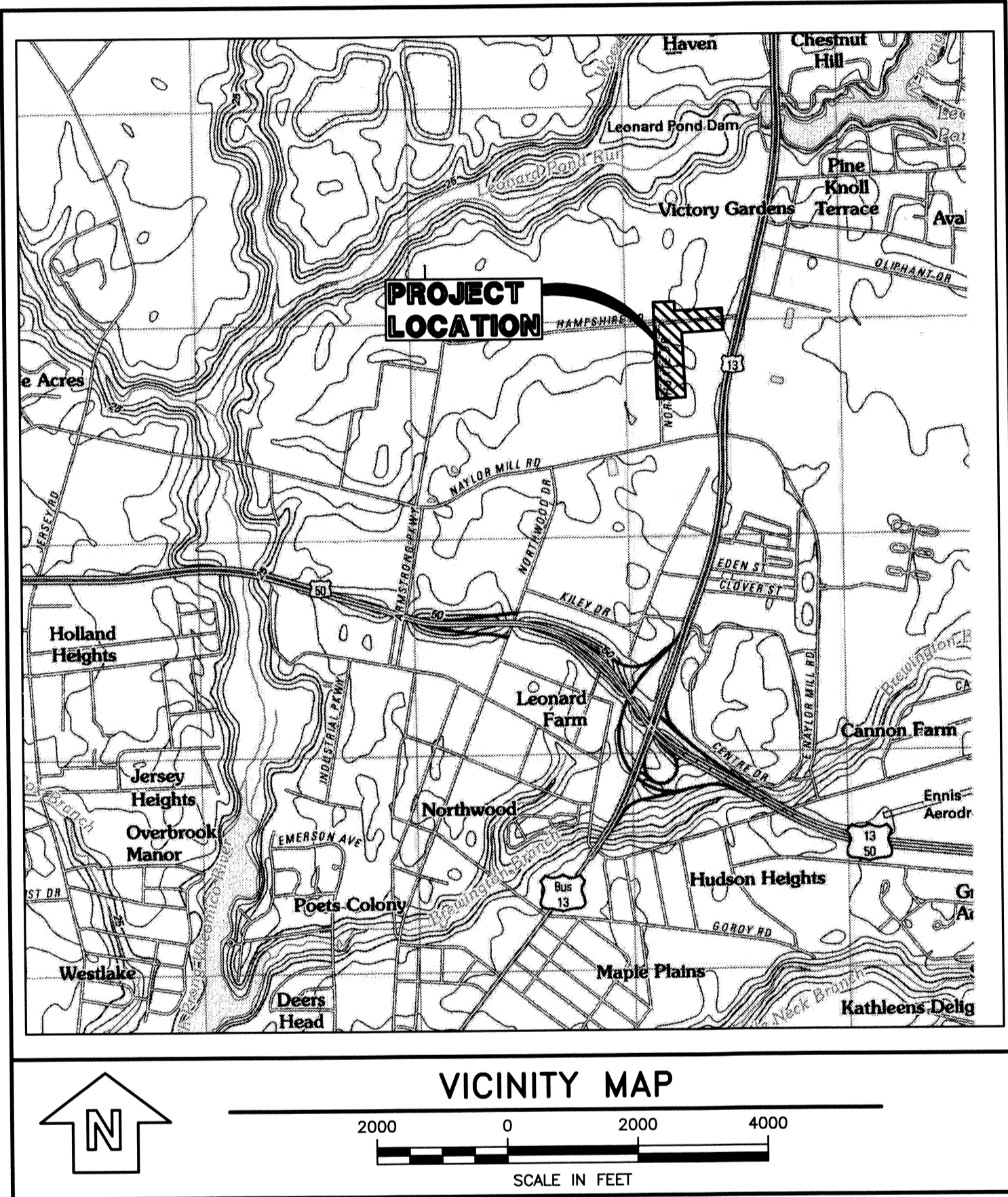
GENERAL NOTES

1. THE APPROVED UTILITY CONTRACTOR'S FIELD REPRESENTATIVE SHALL BE REQUIRED TO FOLLOW AND HAVE AN APPROVED, SIGNED COPY OF THE CONTRACT DRAWINGS, THE LATEST REVISION OF THE CITY OF SALISBURY CONSTRUCTION AND MATERIAL SPECIFICATION FOR UTILITY AND ROADWAY CONSTRUCTION AND THE CONSTRUCTION STANDARDS, (STANDARD DETAILS) MANUALS AT THE CONSTRUCTION AREA DURING WORKING HOURS.
2. ALL CONSTRUCTION WITHIN CITY RIGHT OF WAYS AND EASEMENTS SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF SPW CONSTRUCTION AND MATERIAL SPECIFICATIONS FOR UTILITY AND ROADWAY CONSTRUCTION.
3. ALL PUBLIC INFRASTRUCTURE IMPROVEMENTS, INCLUDING GRAVITY SEWER, SANITARY FORCE MAIN, CURB, GUTTER, AND PAVING FOR THIS PROJECT IN ITS ENTIRETY MUST BE ACCEPTED IN WRITING BY THE CITY PRIOR TO FINAL ACCEPTANCE. REDUCTIONS IN PROJECT SURETY WILL NOT BE APPROVED PRIOR TO FINAL WRITTEN ACCEPTANCE BY THE CITY OF ALL PUBLIC INFRASTRUCTURE IMPROVEMENTS. SUB-PHASING OF THIS PROJECT SHALL NOT BE PERMITTED.
4. A WRITTEN "NOTICE TO PROCEED" MUST BE OBTAINED FROM AND A PRE-CONSTRUCTION MEETING SCHEDULED WITH SPW, BEFORE BEGINNING CONSTRUCTION IN CITY PUBLIC R/W'S, EASEMENTS AND/OR CITY MAINTAINED UTILITIES OR ROADWAYS. CONTACT RON WELLS, ACTING TECHNICAL SERVICE MANAGER, 125 N. DIVISION ST., SALISBURY, MARYLAND, 21801-4940, TELEPHONE 410-251-0799, E-MAIL: RWELLS@C1.SALISBURY.MD.US, TO SCHEDULE A PRE-CONSTRUCTION MEETING AND OBTAIN A WRITTEN "NOTICE TO PROCEED". 48 HOURS NOTICE IS REQUIRED.
5. CONTRACTOR TO VERIFY ALL ELEVATIONS AGAINST A PREVIOUSLY CONSTRUCTED POINT OF KNOWN ELEVATION BEFORE BEGINNING CONSTRUCTION.
6. THE CITY RESERVES THE RIGHT TO REQUIRE STRUCTURAL MODIFICATIONS TO THE SITE WORK FOLLOWING PERMIT ISSUANCE IF SUCH MODIFICATIONS ARE NECESSARY.
7. MILLING AND REPAVING SHALL BE PER RESOLUTION 2298.
8. THE CONTRACTOR SHALL NOTIFY "MISS UTILITY" AT 1-800-257-7777, THREE (3) DAYS PRIOR TO BEGINNING ANY WORK IN THE VICINITY OF EXISTING UTILITIES.
9. DURING THE PROGRESS OF THE JOB, THE CONTRACTOR SHALL KEEP A CAREFUL RECORD AT THE JOB SITE OF ALL CHANGES AND CORRECTIONS TO THE INFORMATION SHOWN ON THE CONTRACT DRAWING(S) AND THE STORMWATER MANAGEMENT PLAN DRAWING(S). PRIOR TO BACKFILL, THE CONTRACTOR SHALL ENTER SUCH CHANGES AND CORRECTIONS ON ONE SET OF RED LINE AS BUILT DRAWINGS. THE RED LINE AS BUILT DRAWINGS SHALL INDICATE, IN ADDITION TO ALL CHANGES AND CORRECTIONS, ALL SUBSURFACE STRUCTURES/UTILITIES INSTALLED OR UNCOVERED, REFERENCED TO TWO PERMANENTLY FIXED SURFACE STRUCTURES. PRIOR TO TESTING OF THE UTILITY/UTILITIES AND ACCEPTANCE OF THE SWM FACILITIES INVOLVED UNDER THE CONTRACT, THE CONTRACTOR SHALL SUBMIT, CONCURRENTLY, TO THE OWNER ONE SET OF RED LINE AS BUILT DRAWINGS SHOWING THE AFOREMENTIONED DATA AND ONE COPY OF THE RED LINE AS BUILT DRAWINGS TO SALISBURY PUBLIC WORKS. SHOULD THE CONTRACTOR FAIL TO MAINTAIN RED LINE AS BUILT DRAWING(S), THE OWNER MAY BE REQUIRED TO HIRE A PRIVATE LOCATOR AND MAY BE REQUIRED TO TEST PIT THE MAINS AT THE DISCRETION OF THE CITY ENGINEER. PARTIAL ACCEPTANCE OF THE PUBLIC UTILITIES AND ACCEPTANCE OF THE STORMWATER MANAGEMENT FACILITY MAY BE DELAYED PENDING RECEIPT OF THIS INFORMATION.
- DISCREPANCIES
- A. THE CONTRACTOR SHALL IMMEDIATELY STOP WORK AND NOTIFY THE CITY REPRESENTATIVE OR THE CONSULTANT OF ANY DISCREPANCIES DISCOVERED BETWEEN THE DRAWINGS AND EXISTING CONDITIONS.
- B. ERRORS OR OMISSIONS IN DRAWINGS OR LAYOUT SHALL BE TREATED AS A DISCREPANCY.
- C. THE CITY REPRESENTATIVE OR THE CONSULTANT WILL REVIEW THE CONTRACTOR'S FINDING TO CONFIRM THE DISCREPANCY.
- D. THE CITY REPRESENTATIVE OR THE CONSULTANT WITH SALISBURY PUBLIC WORKS APPROVAL, WILL ISSUE NEW INSTRUCTIONS AS SOON AS POSSIBLE TO RELIEVE THE DISCREPANCY.
- E. THE CONTRACTOR SHALL RESOLVE ANY DISCREPANCY BEFORE START OF WORK OR CONTINUATION AFTER THE DISCREPANCY ARISES.
10. APPROVAL OF THE SITE PLAN AND THE CONTRACT DRAWINGS EXPIRES TWO (2) YEARS FROM THE FINAL APPROVAL DATE. CONSTRUCTION OF THE PROJECT MUST HAVE BEEN STARTED PRIOR TO THE EXPIRATION DATE. THE CITY RESERVES THE RIGHT TO EXTEND THE EXPIRATION DATE UPON WRITTEN REQUEST AND WRITTEN CONFIRMATION.
11. FOLLOWING COMPLETION OF CONSTRUCTION, THE DEVELOPER SHALL BE RESPONSIBLE FOR SUBMISSION OF PRE-FINAL AS-BUILT DRAWINGS OF THE PUBLIC WATER, SEWER, AND STORM DRAINS AS WELL AS PRIVATE STORMWATER MANAGEMENT CONSTRUCTION, TO ENSURE COMPLIANCE WITH THE APPROVED IMPROVEMENTS CONSTRUCTION PLAN. ALL APPLICABLE AS-BUILTS MUST BE SUBMITTED AT THE SAME TIME UNLESS OTHERWISE APPROVED BY SPW. PARTIAL SUBMITTALS WILL BE REJECTED. THE AS-BUILTS SHALL ALSO SHOW THE LOCATION OF ALL NEW CITY UTILITIES SUCH AS BUT NOT LIMITED TO ELECTRIC, TELEPHONE, GAS, AND C.A.T.V. THE AS-BUILT DRAWINGS MUST BE SEALED BY A PROFESSIONAL LAND SURVEYOR, PROPERTY LINE SURVEYOR, OR ENGINEER, CURRENTLY REGISTERED IN MARYLAND. THE INITIAL PRE-FINAL SUBMITTAL SHALL BE PAPER ONLY, FIVE (5) COPIES AND LABELED "AS BUILTS". ONCE THE PRE-FINAL SUBMITTAL HAS BEEN APPROVED, REMOVE "AS BUILTS" AND THE FINAL STAMPED AS-BUILTS MUST BE SUBMITTED TO SPW ON MYLAR, PAPER, AND AUTO-CAD 2005 OR AN EARLIER VERSION OF AUTO-CAD, ONE (1) EACH. ALL COMPACT DISCS (CD) MUST BE IN A PLASTIC PROTECTIVE CASE. PROJECT SURETY WILL BE WITHHELD UNTIL THIS AS-BUILT INFORMATION IS SUBMITTED TO AND APPROVED BY SPW IN WRITING. REQUIREMENTS ARE AVAILABLE IN THE SPW OFFICE.
12. ALL CONSTRUCTION SHALL BE DONE IN ACCORDANCE WITH CITY OF SALISBURY DEPARTMENT OF PUBLIC WORKS STANDARD DETAILS AND SPECIFICATIONS UNLESS OTHERWISE NOTED.
13. THE EXISTING UTILITIES ARE SHOWN FROM THE BEST AVAILABLE RECORDS AND SHALL BE VERIFIED BY THE CONTRACTOR TO HIS SATISFACTION PRIOR TO CONSTRUCTION. NECESSARY PRECAUTIONS SHALL BE TAKEN BY THE CONTRACTOR TO PROTECT EXISTING SERVICES AND MAINS AND ANY DAMAGE DONE TO THEM DUE TO HIS OPERATION SHALL BE REPAIRED IMMEDIATELY AT HIS OWN EXPENSE.
14. THE CONTRACTOR SHALL TEST PIT USING "SOFT DIG METHOD" TO LOCATE EXISTING UTILITY LINES IF THE TEST PIT IS OUTSIDE OF REQUIRED PIPE TRENCHING.
15. THE CONTRACTOR SHALL NOTIFY MISS UTILITY 800-257-7777 FIVE DAYS PRIOR TO START OF WORK SHOWN ON THESE DRAWINGS.
16. THE CONTRACTOR SHALL NOTIFY THE DEPARTMENT OF PUBLIC WORKS AT 410-548-3170 FIVE DAYS PRIOR TO START OF WORK SHOWN ON THESE DRAWINGS.
17. THE CONTRACTOR SHALL BE RESPONSIBLE FOR AVOIDING AND/OR CLEANING UP DUST AND MUD ON ALL ROADS DUE TO VEHICLES ARRIVING AND LEAVING THE JOB SITE AS PART OF THIS WORK.
18. ALL FORCE MAIN AND FITTINGS TO BE PVC C-900 (DR-18). ALL PVC PIPE SHALL INCLUDE #12 COPPER TRACING WIRE.
19. TRENCHES, BEDDING AND BACKFILL SHALL BE IN ACCORDANCE WITH THE CITY OF SALISBURY STANDARDS, SPECIFICATIONS AND DETAILS.
20. ALL SEDIMENT AND EROSION WORK SHALL COMPLY WITH ALL APPLICABLE PROVISIONS OF THE MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL ISSUED BY THE MARYLAND DEPARTMENT OF THE ENVIRONMENT, DATED DEC 2011 OR LATEST EDITION.
21. IT SHALL BE DISTINCTLY UNDERSTOOD THAT FAILURE TO MENTION SPECIFICALLY ANY WORK WHICH WOULD NORMALLY BE REQUIRED TO COMPLETE THE PROJECT SHALL NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY TO COMPLETE SUCH WORK.
22. TRENCHES SHALL BE PAVED IN ACCORDANCE WITH THE STANDARD DETAILS AND SPECIFICATIONS IMMEDIATELY AFTER ALL UTILITY WORK IS COMPLETED AND TESTED.
23. EXISTING SITE IS LOCATED OUTSIDE THE 100 YEAR FLOODPLAIN.
24. ALL PLUGS, CAPS, VALVES, TEES, AND BENDS SHALL BE PROVIDED WITH ANCHORAGE AS SHOWN IN STANDARD DETAILS.
25. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR LOCATING AND PAYING ALL PERMIT FEES AND TEMPORARY LAND ACQUISITION COSTS FOR A TRAILER AND STORAGE SITE. THE CONTRACTOR SHALL PROTECT THE TEMPORARY TRAILER AND STORAGE SITE(S) FROM EROSION BY INSTALLING SILT FENCE AT THE LOWER ELEVATIONS. PLACEMENT OF SILT FENCE WILL BE AT THE DISCRETION OF SCs.
26. CONTRACTOR SHALL REPLACE ANY DAMAGED WIRING, CONDUIT, HANDBOX, GAS LINES AND VALVES, OR OTHER UTILITIES WITHOUT COST TO OWNER OR ENGINEER.
27. CONTRACTOR SHALL RESTRIPE ALL DISTURBED LANE MARKINGS AND RESTORE ANY DISTURBED CURB, DRIVEWAYS, SIGNS, GUARDRAILS OR OTHER EXISTING FEATURES UPON COMPLETION.
28. CONTRACTOR SHALL COORDINATE WITH DELMARVA POWER TO BRACE ALL EXISTING POLES WITHIN 10' OF THE PROPOSED FORCEMAIN.
29. ALL EXCAVATION FOR PIPE LINE INSTALLATION SHALL BE BACKFILLED AND STABILIZED DURING THE SAME WORK DAY, OR COVERED WITH STEEL PLATES AT THE END OF EACH WORK DAY.
30. CONTRACTOR SHALL TEST PIT ALL CROSSINGS OF EXISTING GAS LINES AND OTHER UTILITIES. THE CONTRACTOR WILL BE RESPONSIBLE FOR ADJUSTING FRAMES AND COVERS OF ALL GAS, SEWER AND OTHER UTILITIES.

CITY OF SALISBURY
WICOMICO COUNTY, MARYLAND

HAMPSHIRE ROAD SEWAGE
PUMP STATION REPLACEMENT
AND UPGRADES

CONTRACT NO. 03-12-INF
NOVEMBER 2015



CURRENT WICOMICO COUNTY WATER/SEWER PLAN CATEGORY W-1/S-1

DRAWING INDEX

SHT. NO.	DESCRIPTION	DWG. NO.
1	TITLE SHEET, VICINITY MAP, NOTES, LEGEND, INDEX	G-1
2	NORTHGATE DRIVE - PLAN AND PROFILE	PP-1
3	HAMPSHIRE ROAD - PLAN AND PROFILE	PP-2
4	PUMP STATION - SITE PLAN AND DETAILS	P-1
5	PUMP STATION - MECHANICAL PLAN AND SECTIONS	M-1
6	PUMP STATION - MECHANICAL PLAN AND SECTIONS	M-2
7	PUMP STATION - DETAILS	D-1
8	MISCELLANEOUS DETAILS	D-2
9	MISCELLANEOUS DETAILS	D-3
10	STRUCTURAL NOTES AND DETAILS	S-1
11	SEDIMENT AND EROSION CONTROL - PLAN	SC-1
12	SEDIMENT AND EROSION CONTROL - NOTES	SC-2
13	SEDIMENT AND EROSION CONTROL - DETAILS	SC-3
14	PUMP STATION - ELECTRICAL PLAN, SCHEMATICS, DETAILS	E-1
15	TRAFFIC CONTROL PLAN COVER SHEET	
16	TRAFFIC CONTROL PLAN	TP-1
17	TRAFFIC CONTROL PLAN	TP-2
18	TRAFFIC CONTROL PLAN	TP-3
19	TRAFFIC CONTROL PLAN	TP-4
20	TRAFFIC CONTROL PLAN	TP-5

LEGEND

• CD	EX. SAN. CLEANOUT	Ø	EX. UTILITY POLE
OMH	EX. MANHOLE	—	EX. SIGN
—H—	EX. FIRE HYDRANT	⊕	BENCHMARK
⊕ WV	EX. VALVE (GV, WV)	Δ	EX. TRAVERSE PT.
☆	EX. STREET LIGHT	----- 102 -----	EX. CONTOUR AND ELEVATION
● WM	EX. WATER METER	— 102 —	PROP. CONTOUR AND ELEVATION
-----	EX. RIGHT-OF-WAY	— LOD —	LIMITS OF DISTURBANCE
— G —	EX. GAS LINE	[]	CURB INLET PROTECTION
— W —	EX. WATER LINE	(NIC)	NOT IN CONTRACT
— SAN —	EX. SANITARY LINE	— 4" M —	EX. FORCE MAIN
— CATV —	EX. TV LINE	— 4" FM —	PROP. FORCE MAIN
— OEL —	EX. OVERHEAD ELEC. LINE	---	EX. EASEMENT
-x-x-x-	EX. FENCE		

CONSULTANT'S CERTIFICATION

THE DEVELOPERS' PLAN TO CONTROL SILT AND EROSION IS ADEQUATE TO CONTAIN THE SILT AND EROSION ON THE PROPERTY COVERED BY THE PLAN. I CERTIFY THAT THIS PLAN OF SEDIMENT AND EROSION CONTROL REPRESENTS A PRACTICAL AND WORKABLE PLAN BASED ON MY PERSONAL KNOWLEDGE OF THE SITE AND WAS PREPARED IN ACCORDANCE WITH THE REQUIREMENTS OF THE WICOMICO COUNTY SOIL CONSERVATION DISTRICT PLAN SUBMITTAL GUIDELINES AND THE CURRENT MARYLAND STANDARDS AND SPECIFICATIONS FOR SEDIMENT AND EROSION CONTROL. I HAVE REVIEWED THIS EROSION AND SEDIMENT CONTROL PLAN WITH THE OWNER/DEVELOPER.

RICHARD D. PARKS, P.E. MD. P.E. LIC. #11697 DATE 6/20/16
ARRC CONSULTING, INC.
1101 OPAL COURT, SUITE 312
HAGERSTOWN, MD 21740



DISTURBED AREA QUANTITY

THE AREA OF THE TOTAL SITE IS 54,000 SQ. FEET (1.24 ACRES- ROAD R/W). THE TOTAL AREA TO BE DISTURBED SHOWN ON THESE PLANS HAS BEEN DETERMINED TO BE APPROXIMATELY 48,000 SQUARE FEET (1.1 ACRES) AND THE TOTAL AMOUNT OF EXCAVATION AND FILL AS SHOWN ON THESE PLANS HAS BEEN COMPUTED TO BE APPROX. 1596 CU. YDS. OF EXCAVATION AND APPROXIMATELY 1479 CUBIC YARDS OF FILL. THE TOTAL SURFACE AREA TO BE VEGETATIVELY STABILIZED IS APPROXIMATELY 500 SQUARE FEET (0.01 ACRES) ** (UTILITY TRENCH EXCAVATION AND FILL QUANTITIES ONLY. NOT FOR BID PURPOSES)**

SIGNATURE [Signature] DATE 6/20/16

NO	REVISION	DATE	BY	APP.	NO	REVISION	DATE	BY	APP.
1	ISSUED FOR CONSTRUCTION								
0	ISSUED FOR BID								
D	AGENCY COMMENTS	6/13/13	ACM	RDP					
C	CLIENT COMMENTS	4/01/13	ACM	RDP					
B	CLIENT COMMENTS	12/19/12	ACM	RDP					
A	ISSUED TO CLIENT	6/12/12	ACM	RDP					

RICHARD D. PARKS, P.E.	DESIGN	CHECKED
R. D. PARKS, P.E.	DRAWN	CHECKED
	CADD	
DATE	SURVEY DATE	FIELD BOOK
APRIL 2013		

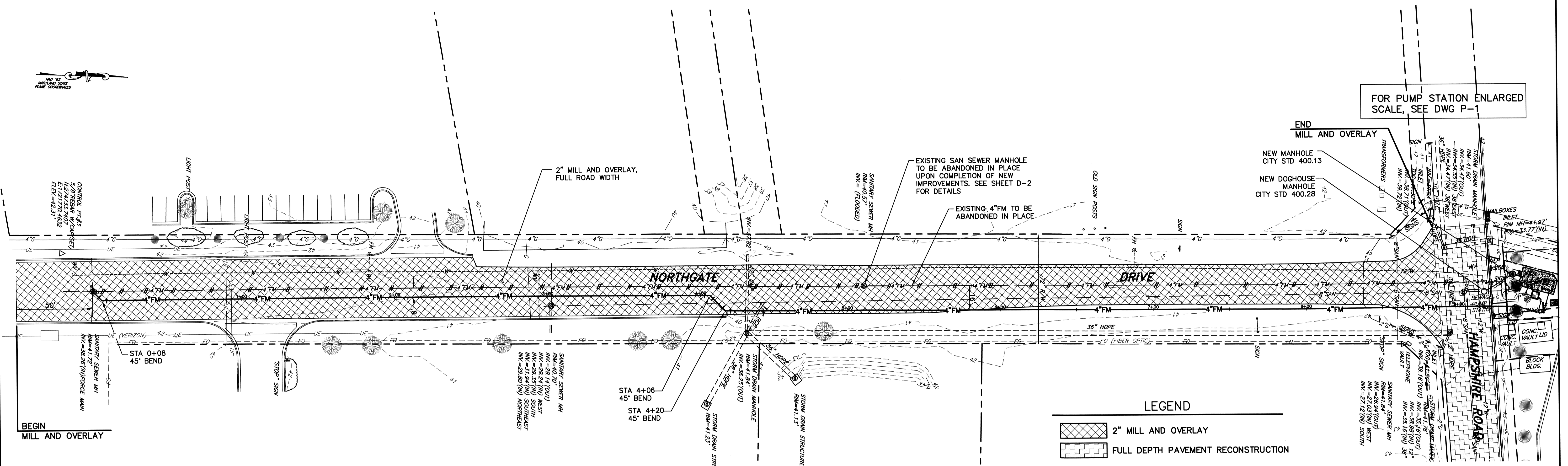


PROFESSIONAL CERTIFICATION
I RICHARD D. PARKS, P.E. hereby certify that these documents were prepared and approved by me and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 11697, expiration date 11-1-2017.

CLIENT & PROJECT
CITY OF SALISBURY
125 NORTH DIVISION STREET
SALISBURY, MARYLAND 21801-4940
HAMPSHIRE ROAD SEWAGE PUMP STATION
REPLACEMENT AND UPGRADES
SALISBURY, WICOMICO COUNTY, MARYLAND

ARRC
ENGINEERING & ENVIRONMENTAL CONSULTANTS
1101 Opal Court, Third Floor
Hagerstown, Maryland 21740
Tel 301.791.1100

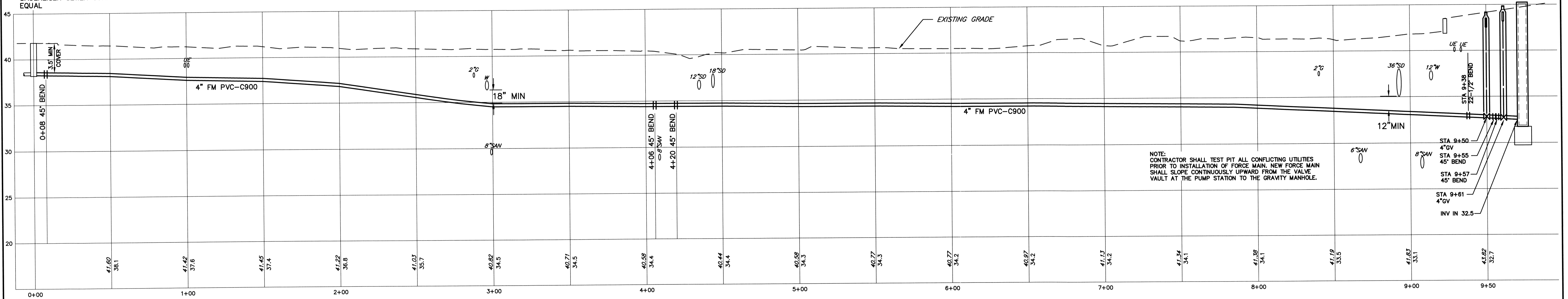
CITY OF SALISBURY DEPARTMENT OF PUBLIC WORKS	
MICHAEL S. MOULDS DIRECTOR OF PUBLIC WORKS	DATE
TITLE TITLE SHEET, VICINITY MAP, GENERAL NOTES	
SCALE AS NOTED	DWG. NO. G-1
PROJECT NO. 10518.00	SHEET NO. 1 OF 20
REV.	



PLAN - NORTHGATE DRIVE
SCALE: 1" = 30'

EX. MH. TR=41.72
MODIFY MH INVERT CHANNEL TO
ACCOMMODATE NEW 4"FM. PLUG EX. 4"FM
AT MH AFTER NEW FM IS ACTIVATED.
COAT INSIDE OF MANHOLE WITH
SAUERREISEN SEWER GUARD 210S OR
EQUAL

NOTE:
MAINTAIN A MINIMUM HORIZONTAL SEPARATION OF 10'
BETWEEN WATER & SEWER LINES.

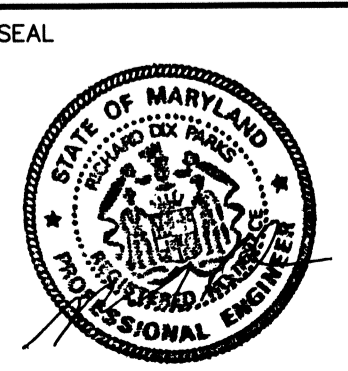


PROFILE - NORTHGATE DRIVE
SCALE: H:1" = 30', V:1" = 5'

CITY OF SALISBURY DEPARTMENT OF PUBLIC WORKS	
MICHAEL S. MOULDS DIRECTOR OF PUBLIC WORKS	DATE
TITLE NORTHGATE DRIVE PLAN AND PROFILE	
SCALE H:1" = 30', V:1" = 5'	DWG. NO. PP-1
PROJECT NO. 10518.01	SHEET NO. 2 OF 20
REV.	

NO	REVISION	DATE	BY	APP.	NO	REVISION	DATE	BY	APP.
1	ISSUED FOR CONSTRUCTION								
0	ISSUED FOR BID								
D	AGENCY COMMENTS	6/13/13	AM						
C	CLIENT COMMENTS	4/03/13	AM	RDP					
B	CLIENT COMMENTS	12/19/12	AM	RDP					
A	ISSUED TO CLIENT	6/12/12	AM	RDP					

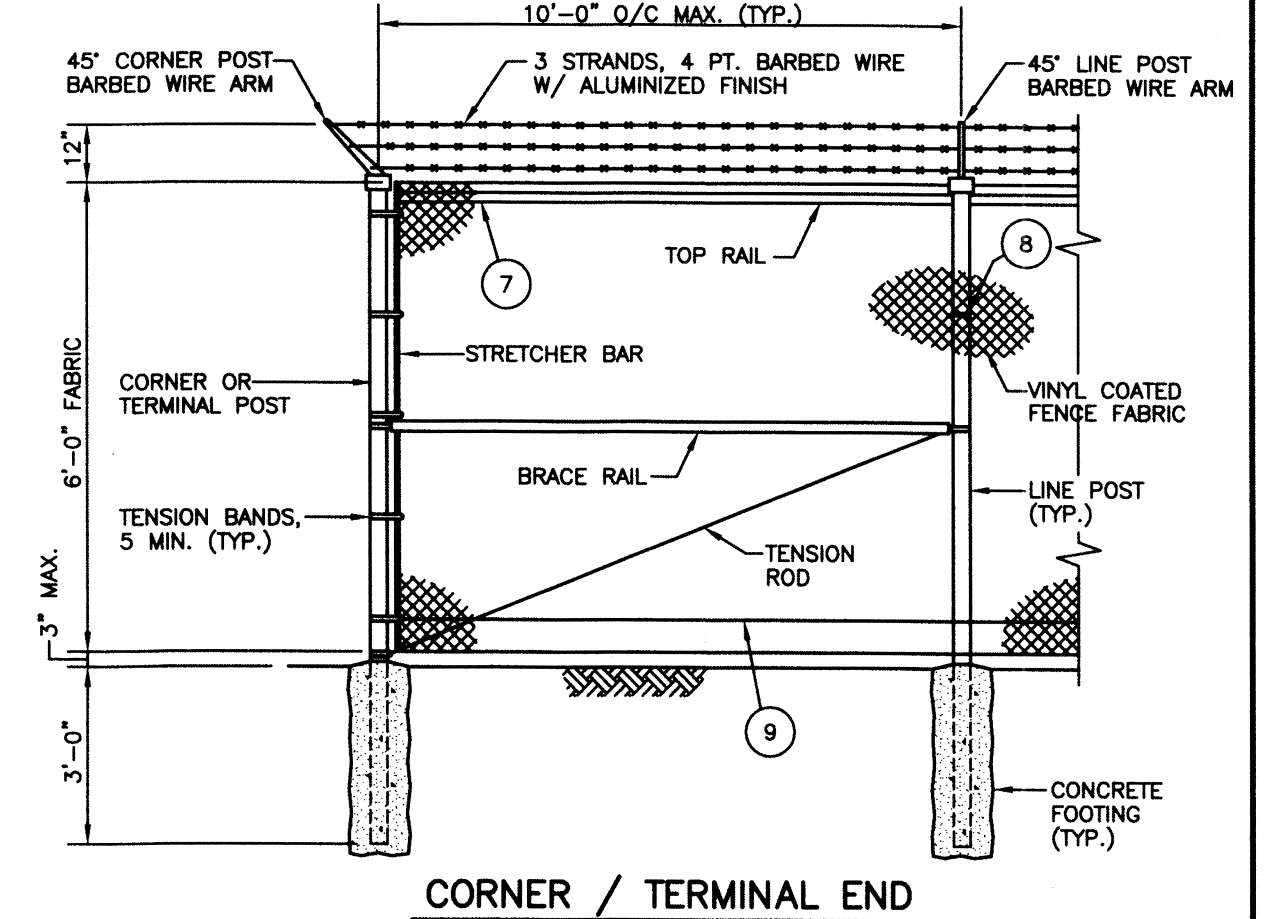
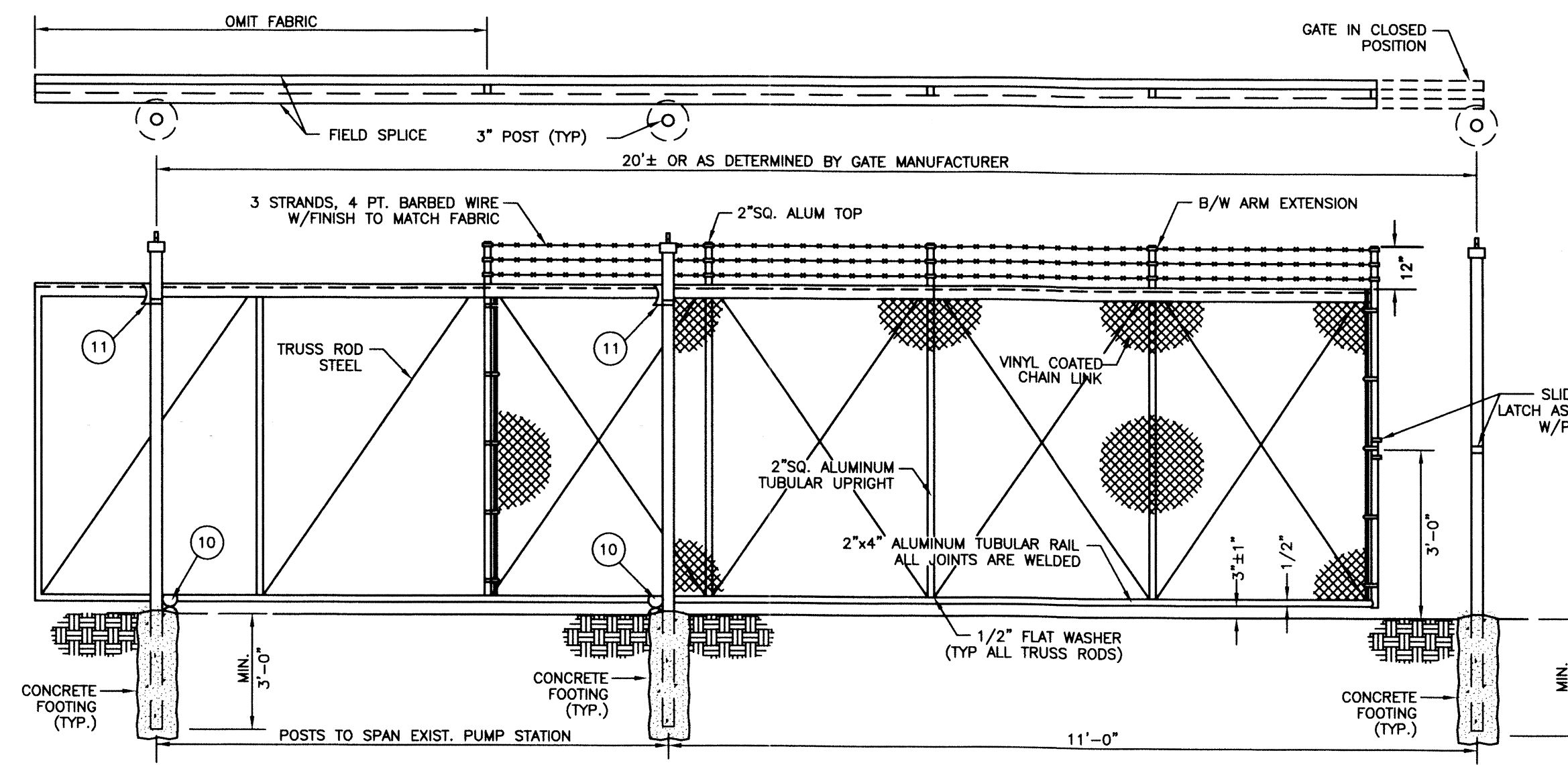
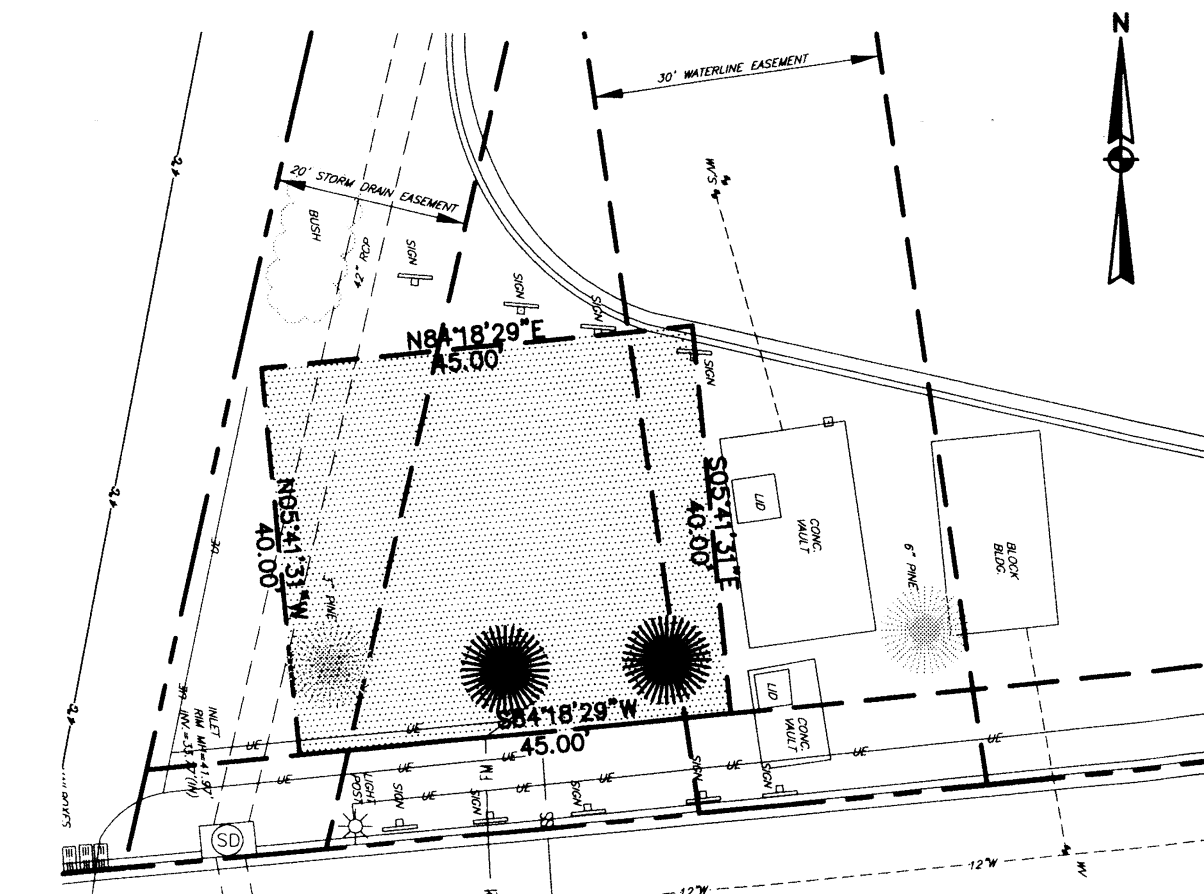
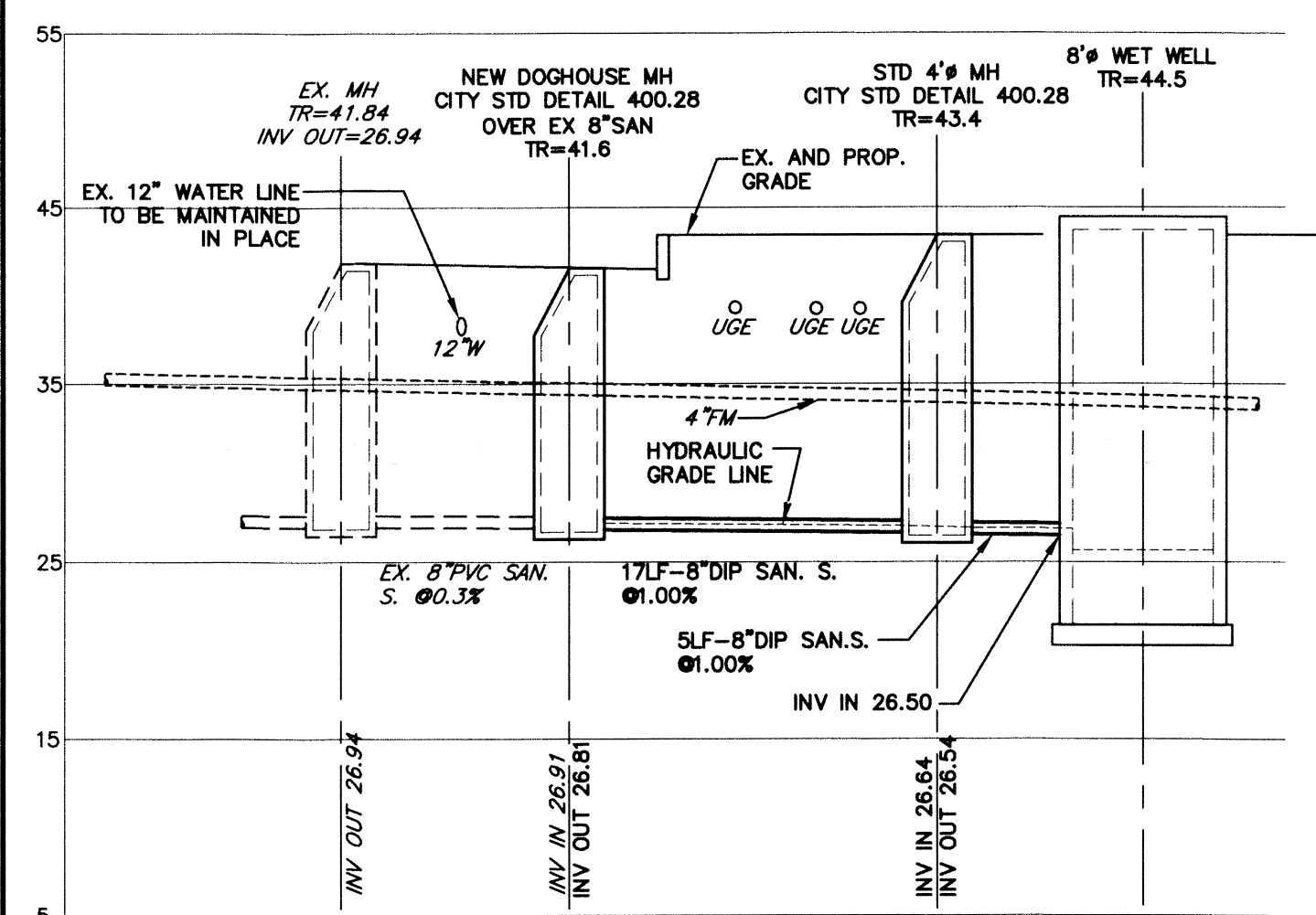
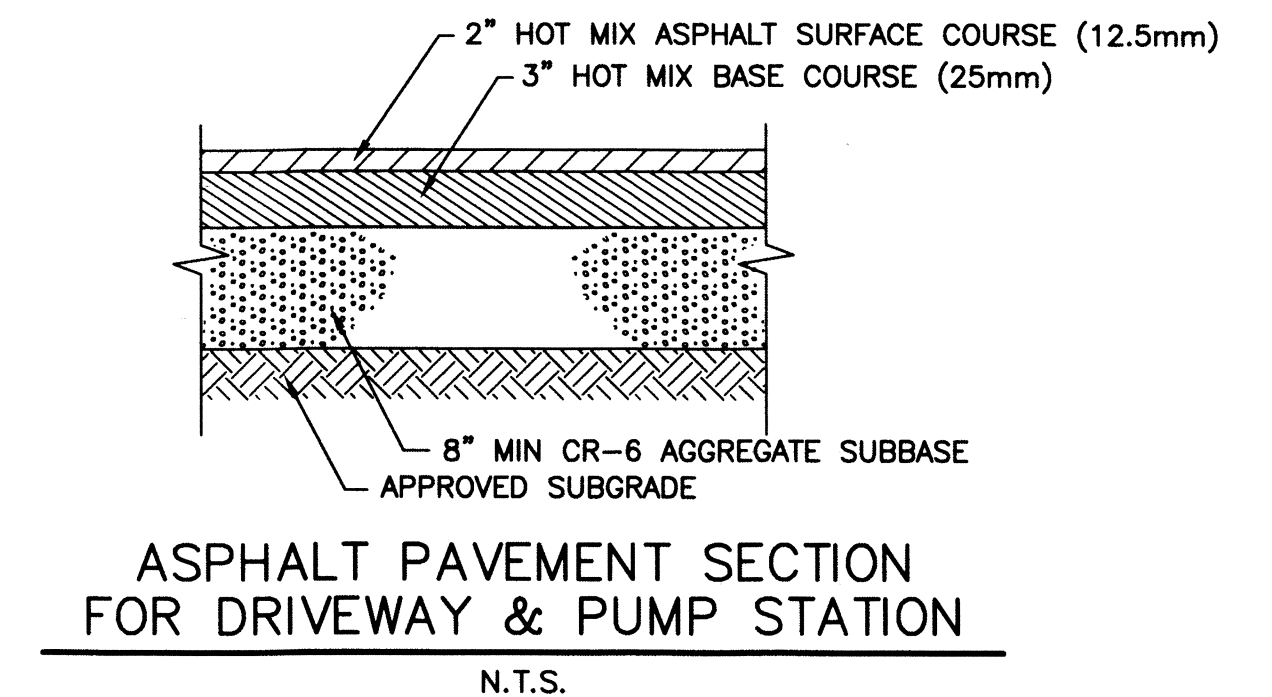
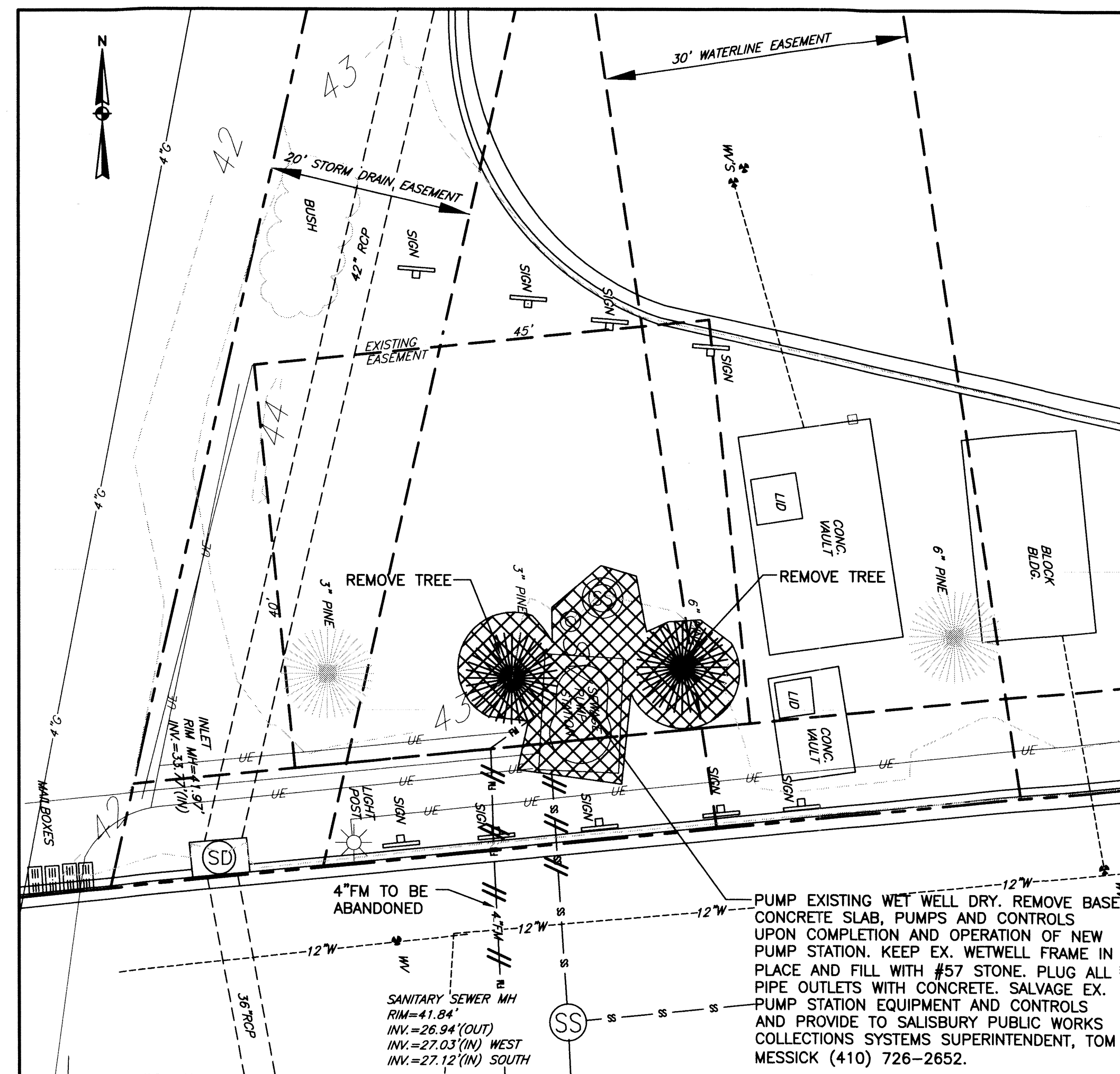
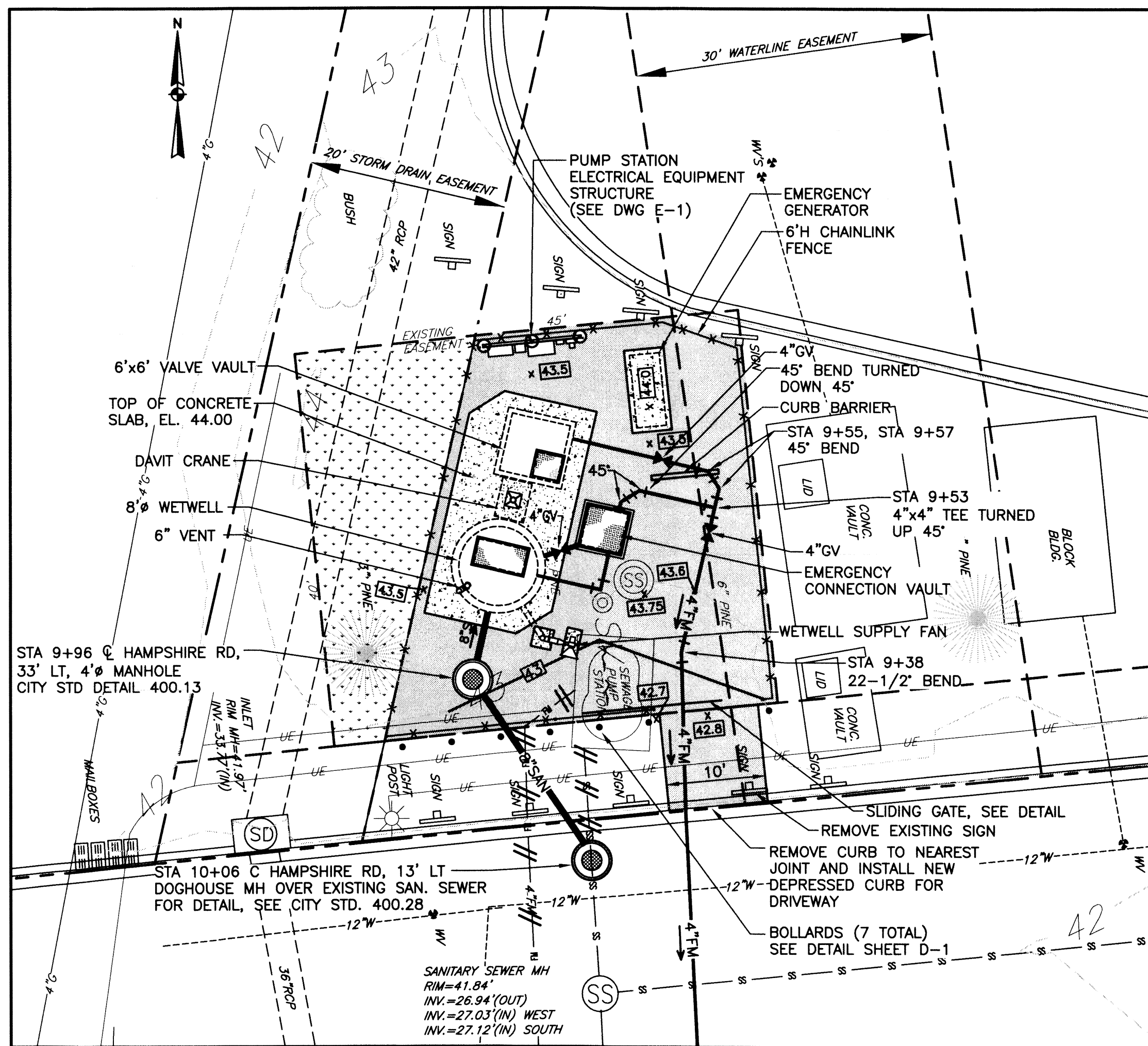
RICHARD D. PARKS, P.E.	
RELEASED BY	CHECKED
DESIGN R.D.PARKS, P.E.	
DRAWN	CHECKED
CAD	
DATE	SURVEY DATE
MAY 2012	FIELD BOOK



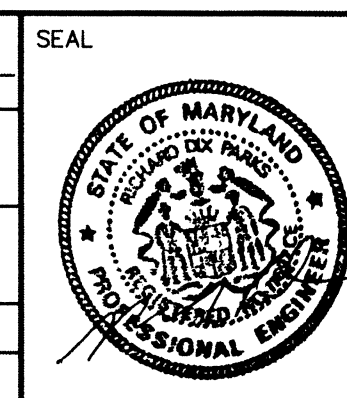
PROFESSIONAL CERTIFICATION
I, RICHARD D. PARKS, P.E.,
hereby certify that these
documents were prepared and
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the laws of the State of
Maryland, License No. 11697,
expiration date 11-1-2017.

CLIENT & PROJECT
CITY OF SALISBURY
125 NORTH DIVISION STREET
SALISBURY, MARYLAND 21801-4940
HAMPSHIRE ROAD SEWAGE PUMP STATION
REPLACEMENT AND UPGRADES
SALISBURY, WICOMICO COUNTY, MARYLAND





NO	REVISION	DATE	BY	APP.	NO	REVISION	DATE	BY	APP.
1	ISSUED FOR CONSTRUCTION				1	ISSUED FOR CONSTRUCTION			
2	ISSUED FOR BID				2	ISSUED FOR BID			
3	AGENCY COMMENTS	6/13/13	AM	ROP	3	AGENCY COMMENTS	6/13/13	AM	ROP
4	CLIENT COMMENTS	4/03/13	AM	ROP	4	CLIENT COMMENTS	4/03/13	AM	ROP
5	CLIENT COMMENTS	12/19/12	AM	ROP	5	CLIENT COMMENTS	12/19/12	AM	ROP
6	CLIENT COMMENTS	11/19/12	AM	ROP	6	CLIENT COMMENTS	11/19/12	AM	ROP
7	ISSUED TO CLIENT	6/12/12	AM	ROP	7	ISSUED TO CLIENT	6/12/12	AM	ROP
8					8				
9					9				
10					10				



PROFESSIONAL CERTIFICATION

I, RICHARD D. PARKS, P.E., hereby certify that these documents were prepared and approved by me and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 11897, expiration date 11-1-2017.

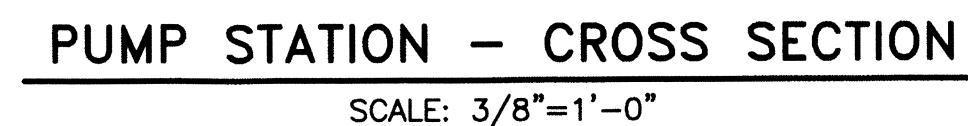
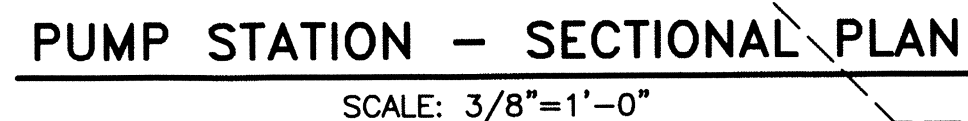
CLIENT & PROJECT

CITY OF SALISBURY
125 NORTH DIVISION STREET
SALISBURY, MARYLAND 21801-4940

HAMPSHIRE ROAD SEWAGE PUMP STATION
REPLACEMENT AND UPGRADES
SALISBURY, WCOMICO COUNTY, MARYLAND



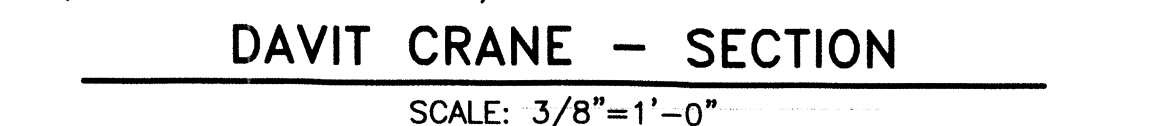
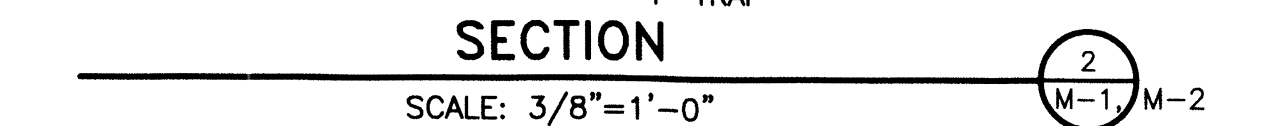
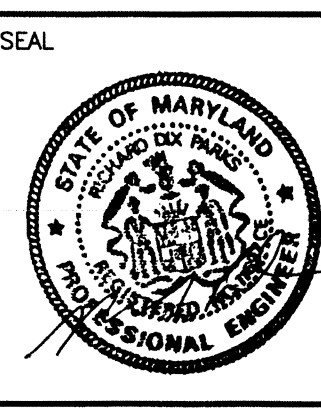
CITY OF SALISBURY DEPARTMENT OF PUBLIC WORKS			
MICHAEL S. MOULDS DIRECTOR OF PUBLIC WORKS		DATE	
TITLE PUMP STATION SITE PLAN AND DETAILS			
SCALE 1" = 10' OR AS SHOWN		DWG. NO. P-1	
PROJECT NO. 10515.00	SHEET NO. 4 OF 20	REV.	



5. ALL INTERIOR SURFACES OF THE WET WELL, THE MANHOLE IMMEDIATELY UP STREAM OF THE WET WELL AND THE FORCE MAIN DISCHARGE MANHOLE SHALL BE COATED WITH SAUERISEN SEWER GUARD 210S OR EQUAL.

DESIGN SCHEDULE		
A	INFLUENT SEWER SIZE & INVERT	8", 26.50
B	PUMP DISCHARGE	4" CL 53 DIP
C	IRON CHECK VALVE (SPRING & LEVER TYPE)	4" FLG
D	IRON PLUG VALVE W/LEVER	4" FLG
E	MIN. INSIDE DIA. OF WET WELL	8'-0"
F	MIN. INSIDE DIM. OF VALVE PIT	6'-0"x6'-0"
G	WET WELL PROJECTION	6"±
H	VALVE PIT PROJECTION	6"±
I	FIN. GRADE	44.00±
J	HIGH WATER ALARM LEVEL	25.25
K	LAG PUMP ON LEVEL	24.75
L	LEAD PUMP ON LEVEL (HIGH WATER LEVEL)	24.25
M	BOTH PUMPS OFF LEVEL (LOW WATER LEVEL)	22.75
N	TOP OF CONCRETE SLAB ELEV.	44.50
O	WET WELL INVERT	19.75
P	VALVE VAULT INVERT	31.50
R	LOW LEVEL ALARM	22.25

- ### KEY NOTES
-
- (1) PRECAST CONCRETE WET WELL
 - (2) PRECAST CONCRETE VALVE VAULT (6'-0"x6'-0" MIN)
 - (3) REINFORCED CONCRETE TOP SLAB, 8" THICK, PLACED MONOLITHICALLY (SEE DETAIL, DWG. NO. S-1)
 - (4) CONCRETE FOUNDATION SLAB - CAST IN PLACE W/#5 AT 12" E.W.
 - (5) TYPE B SELECT MATERIAL (AASHTO NO. 57) MIN DEPTH 6" BELOW STRUCTURES
 - (6) PUMP NO. 1 (5 HP FLYGT N-PUMP SERIES)
 - (7) PUMP NO. 2 (5 HP FLYGT N-PUMP SERIES)
 - (8) PUMP GUIDE RAIL (STAINLESS STEEL) W/QUICK DISCONNECT BASE BY PUMP MANUFACTURER
 - (9) STAINLESS STEEL LIFTING CHAIN (IN ADDITION, SUPPLY 30FT S.S. LIFTING CABLE TO ATTACH TO CRANE)
 - (10) (NOT USED)
 - (11) 4" FLAP VALVE & DRAIN
 - (12) VENTILATION BLOWER UNIT, MODEL 6-4A SFD DIRECT DRIVE CENTRIFUGAL BLOWER WITH WEATHERPROOF HOOD, 1/4 HP, 541 CFM @ 0.5" S.P., ON CONCRETE PAD (SEE DETAIL, DWG. NO. D-1)
 - (13) NON-SHRINK GROUT OR CONCRETE FILL W/ MIN. 2" NON-SHRINK GROUT TOPPING ON FLOOR
 - (14) PUMP POWER & CONTROL (SEE PUMP STATION WIRING DIAGRAM, DWG. NO. E-1)
 - (15) PUMP JUNCTION BOX (SEE DETAIL, DWG. NO. E-1)
 - (16) SEALED MERCURY-FREE FLOAT SWITCH & WATERPROOF CABLE ASSEMBLY FOR HIGH & LOW LEVEL REDUNDANT CONTROL
 - (17) SST BRACKET W/ ADJUSTABLE CABLE CONNECTORS. MOUNT BRACKET ACCESSIBLE FROM HATCH OPENING.
 - (18) 30"x60" DOUBLE LEAF AL. HATCH W/ FLUSH TYPE HANDLE & LOCK. (HALLIDY PRODUCTS OR EQUAL)
 - (19) 6" SCH 80 PVC AIR SUPPLY PIPE FROM VENTILATION BLOWER; BOTTOM ELEV. = 28.25
 - (20) 2'-6" SQ. AL. HATCH W/ FLUSH TYPE HANDLE & LOCK (HALLIDY PRODUCTS OR EQUAL)
 - (21) SUBMERSIBLE PRESSURE TRANSDUCER, SUSPENDED W/STAINLESS STEEL CABLE TO 6" A.F.F., INSIDE PERFORATED 6" SCH 80 PVC STILLING WELL
 - (22) FIXED SERIES 572E3 DAVIT CRANE WITH ELECTRIC WINCH AND RATCHET STYLE SCREW JACK FROM THERN OR EQUAL
 - (23) DIMENSION VARIES, SEE SITE GRADING
 - (24) PIPE SUPPORT AT EACH CHECK VALVE
 - (25) CONC. REACTION BLOCKING TO BE CONSTRUCTED ALLOWING ENOUGH CLEARANCE FOR BOLT REMOVAL FROM PIPE FLANGES (3000 PSI)
 - (26) FLOAT JUNCTION BOX (SEE DETAIL, DWG. NO. E-1)
 - (27) TRANSDUCER/FLOAT CONTROL WIRING (SEE PUMP STATION WIRING DIAGRAM, DWG. NO. E-1)
 - (28) (NOT USED)
 - (29) (NOT USED)
 - (30) (NOT USED)
 - (31) UNDISTURBED EARTH OR STRUCTURAL BACKFILL AT 95% MAX DRY DENSITY
 - (32) PIPE OPENING SEAL (WATER TIGHT MECH. SEAL)
 - (33) 6" DIA. SCH 80 PVC VENT W/BIRD SCREEN
 - (35) 3/4" TAP & PETCOCK
 - (36) PRESSURE GAUGE W/BALL VALVE, 3 1/2" DIA.

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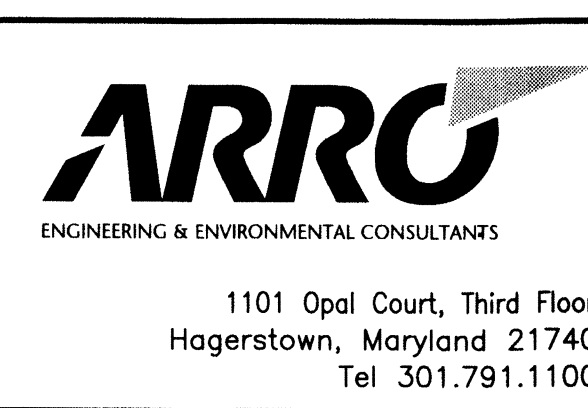
PROFESSIONAL CERTIFICATION

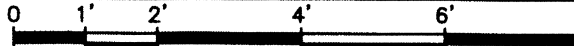
I RICHARD D. PARKS, P.E.
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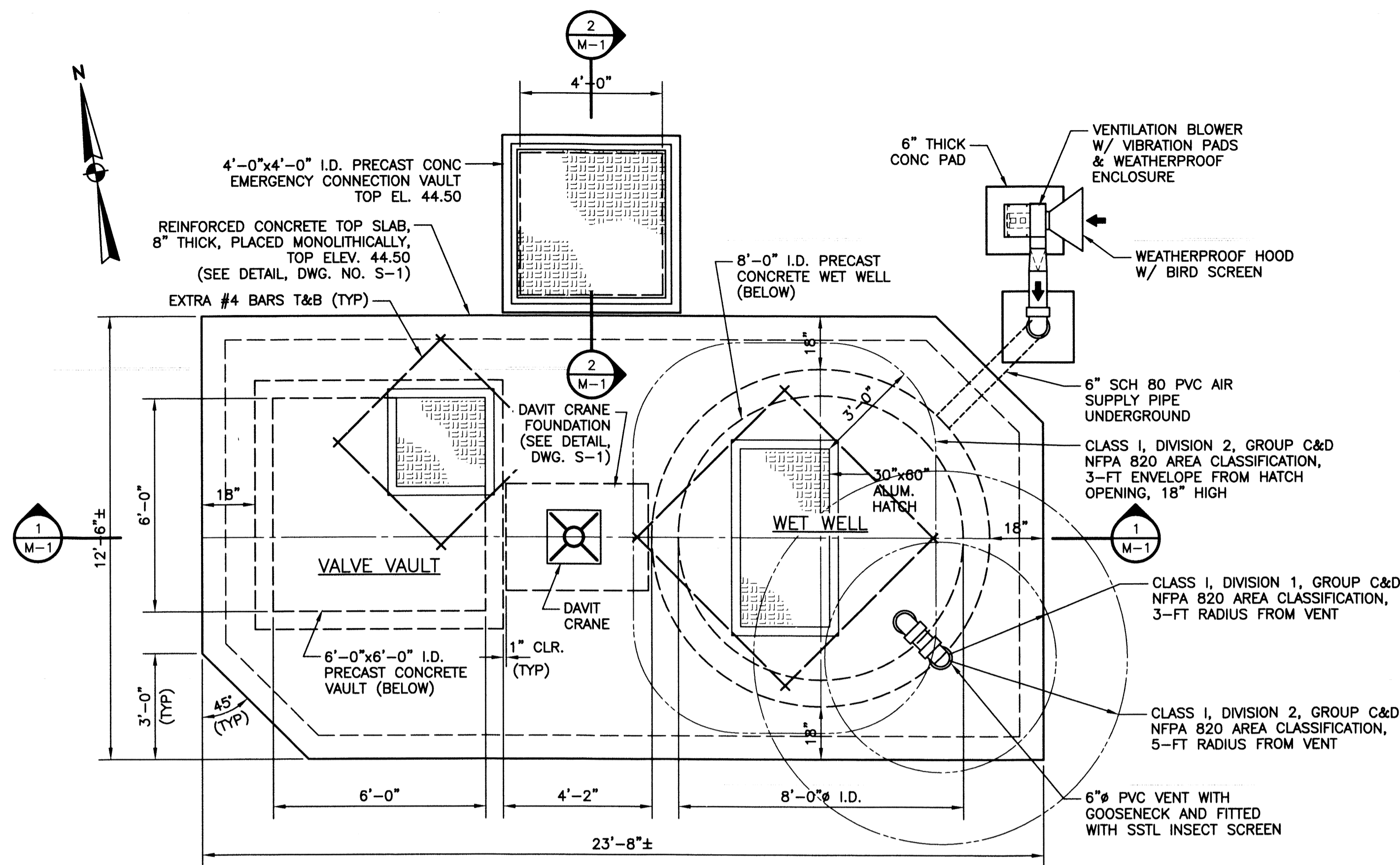
CLIENT & PROJECT

CITY OF SALISBURY
125 NORTH DIVISION STREET
SALISBURY, MATYLAND 21801-4940

HAMPSHIRE ROAD SEWAGE PUMP STATION
REPLACEMENT AND UPGRADES
CITY OF SALISBURY, WICOMICO COUNTY, MARYLAND

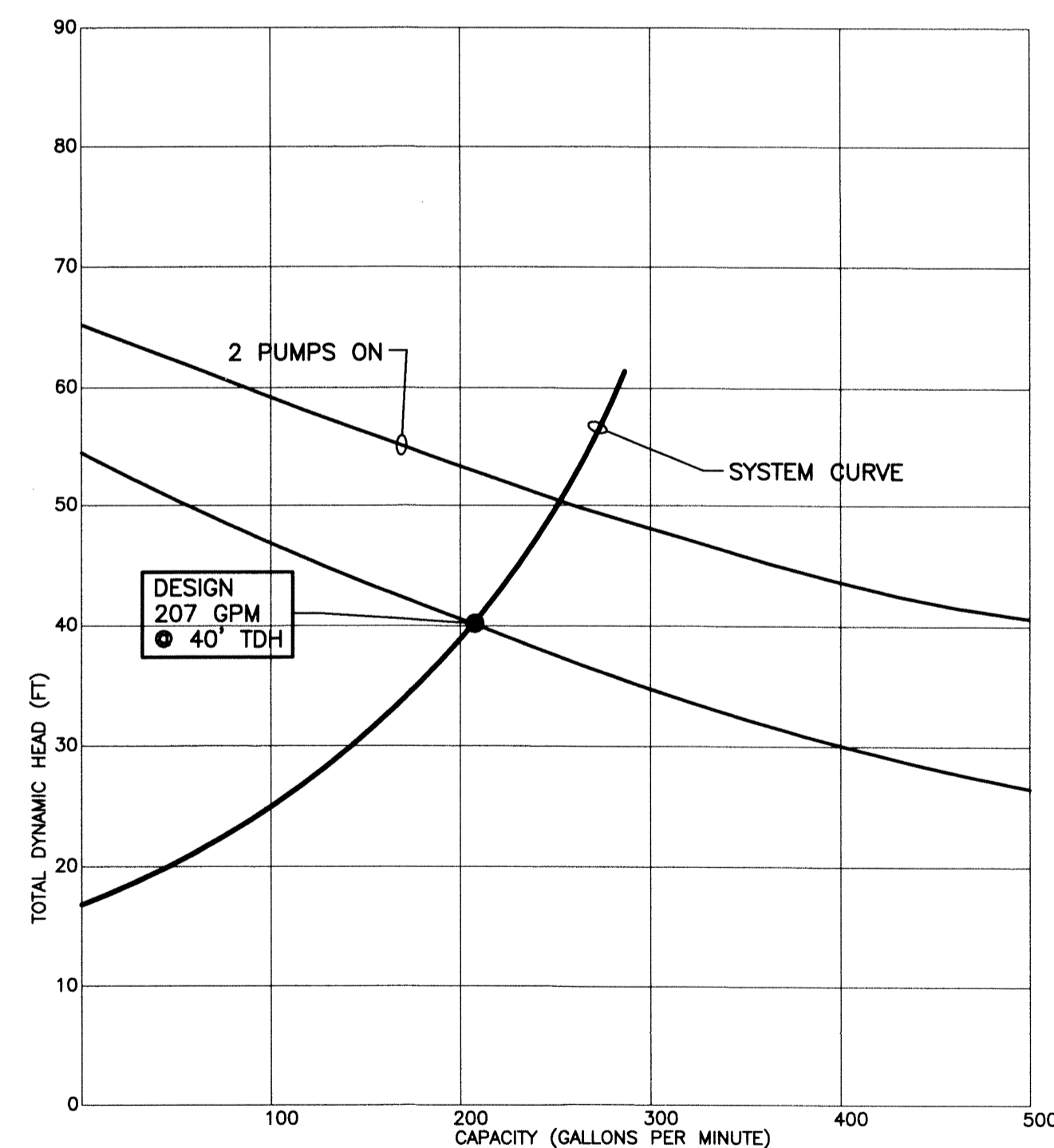


CITY OF SALISBURY DEPARTMENT OF PUBLIC WORKS			
MICHAEL S. MOULDS DIRECTOR OF PUBLIC WORKS			DATE
TITLE HAMPSHIRE ROAD SEWAGE PUMP STATION MECHANICAL PLANS AND SECTIONS			
SCALE  $SCALE: \frac{3}{8}" = 1'-0"$			DWG. NO.
PROJECT NO. 10518.01	SHEET NO. 5 OF 20	REV.	M-1



TOP PLAN OF PUMPING STATION

SCALE: 3/8"=1'-0"



FLYGT NP 3102 MT 3Ø 460 (5HP)

N.T.S.

SERVICE AREA DESIGN FLOWS

	PRESENT	ULTIMATE
POPULATION	100	200
AVG. DOMESTIC FLOW, GPD	0	0
AVG. DOMESTIC FLOW, GPCD	0	0
AVG. COMMERCIAL FLOW, GPM	22	65
AVG. INSTITUTIONAL FLOW, GPM	0	0
AVG. TOTAL FLOW, GPM	22	65
PEAK DOMESTIC COMMERCIAL FLOW, GPM	66	195
INFILTRATION AT 200 GPD/ACRE	5	12
DESIGN FLOW GPM	71	207

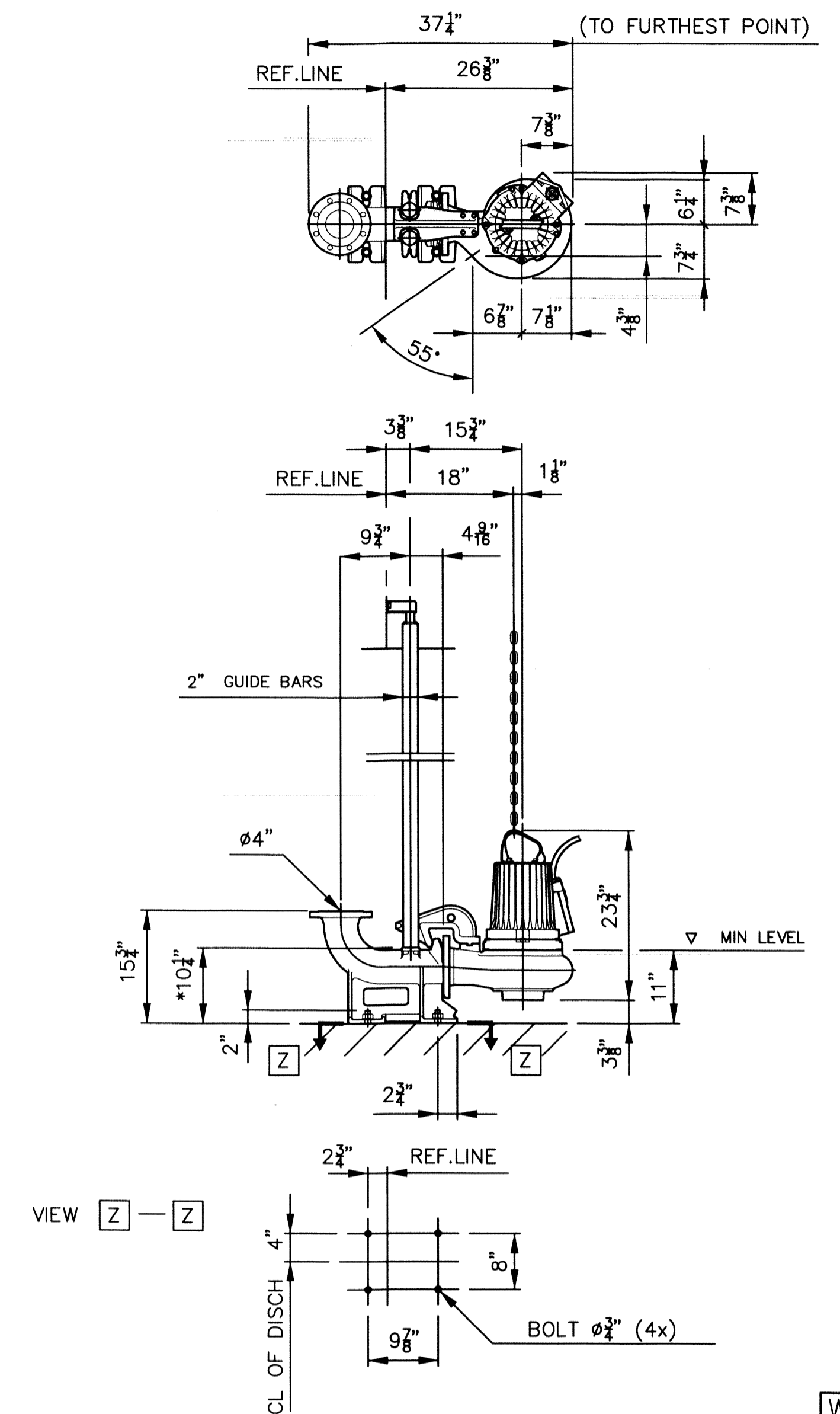
EMERGENCY STORAGE

PER SECTION 47.3 OF CHAPTER 40 OF THE RECOMMENDED 10-STATE STANDARDS FOR POTENTIAL OVERFLOWS:

- THE FOUR (4) ESSENTIAL ELEMENTS ARE PROVIDED WHICH ARE:
- A TELEMETRY ALARM SYSTEM
 - A STANDBY PUMP UNIT
 - A STATIONARY AUXILIARY POWER SOURCE
 - A PUMP-AROUND CONNECTION

IN ADDITION, 2-HOURS OF EMERGENCY STORAGE IS BEING PROVIDED AS DEMONSTRATED BELOW:

AVERAGE DAILY FLOW (ULTIMATE)	65 GPM
EMERGENCY STORAGE REQUIRED	7800 GALLONS
EMERGENCY STORAGE IN 8' DIA WET WELL FROM HIGH WATER ALARM (25.25) TO LOWEST GROUND ELEVATION SERVED (40.25)	5637 GALLONS
EMERGENCY STORAGE IN 8" GRAVITY SEWER TO LOWEST GROUND ELEVATION (2100 LF)	5371 GALLONS
TOTAL EMERGENCY STORAGE PROVIDED (5637+5371)	= 11,008 GALLONS
STORAGE PROVIDED (11,008 GALLONS) ≥ STORAGE REQUIRED (7800 GALLONS)	



* DIMENSION TO ENDS OF GUIDE BARS

		Weight (lbs)	
		Pump	Disch
		240	80
1	Correct insertion point for Secad	080813	NK
Rev. No.	Revision	Date	Checked
		Dimensional dwg	Drawn by NK
		NP 3102 MT	Checked by
		φ 4"	Date 080813
			Rev no 5399
			6602300
			1

PUMP DIMENSIONAL DRAWING

SCALE: 3/4"=1'-0"

CITY OF SALISBURY
DEPARTMENT OF PUBLIC WORKS

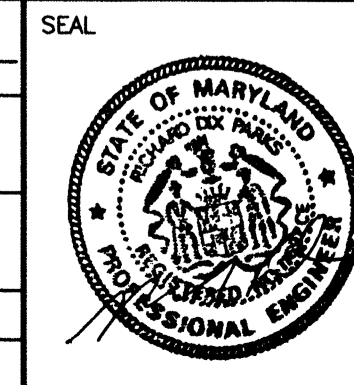
MICHAEL S. MOULDS
DIRECTOR OF PUBLIC WORKS

TITLE HAMPSHIRE ROAD SEWAGE PUMP STATION
MECHANICAL
PLANS AND SECTIONS

SCALE	0 1' 2' 4' 6' 8'	DWG. NO.	M-2
PROJECT NO.	10518.01	SHEET NO.	6 OF 20
REV.			

NO	REVISION	DATE	BY	APP.
1	ISSUED FOR CONSTRUCTION			
0	ISSUED FOR BID			
C	AGENCY COMMENTS	6/13/13	AM	RDP
B	AGENCY COMMENTS	4/03/13	AM	RDP
A	ISSUED TO CLIENT	6/12/12	AM	RDP
NO	REVISION	DATE	BY	APP.

RICHARD D. PARKS, P.E.	
RELEASED BY	
DESIGN	CHECKED
R.D. PARKS	
DRAWN	CHECKED
CADD	
DATE	SURVEY DATE
MAY 2012	
	FIELD BOOK



PROFESSIONAL CERTIFICATION

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CLIENT & PROJECT

CITY OF SALISBURY
125 NORTH DIVISION STREET
SALISBURY, MARYLAND 21801-4940

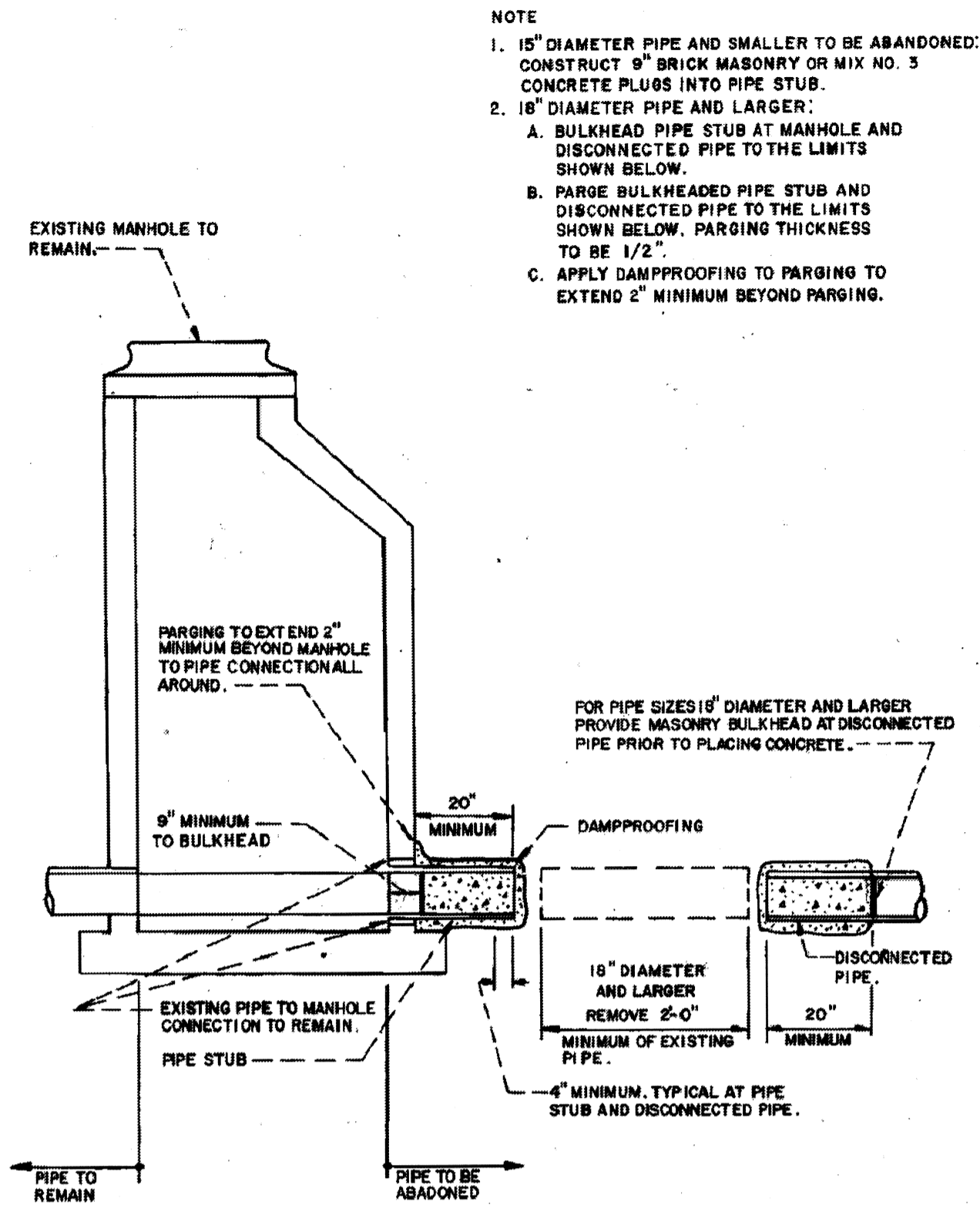
HAMPSHIRE ROAD SEWAGE PUMP STATION
REPLACEMENT AND UPGRADES
CITY OF SALISBURY, WICOMICO COUNTY, MARYLAND



1101 Opal Court, Third Floor
Hagerstown, Maryland 21740
Tel 301.791.1100

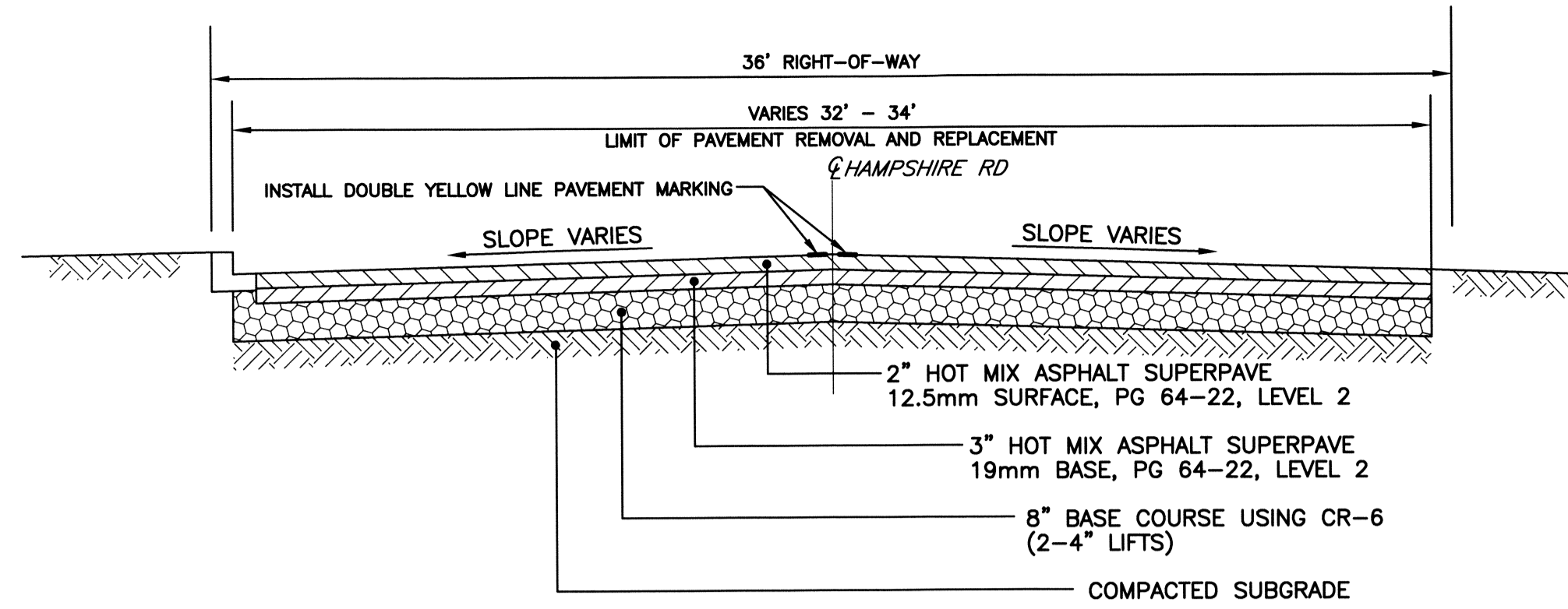


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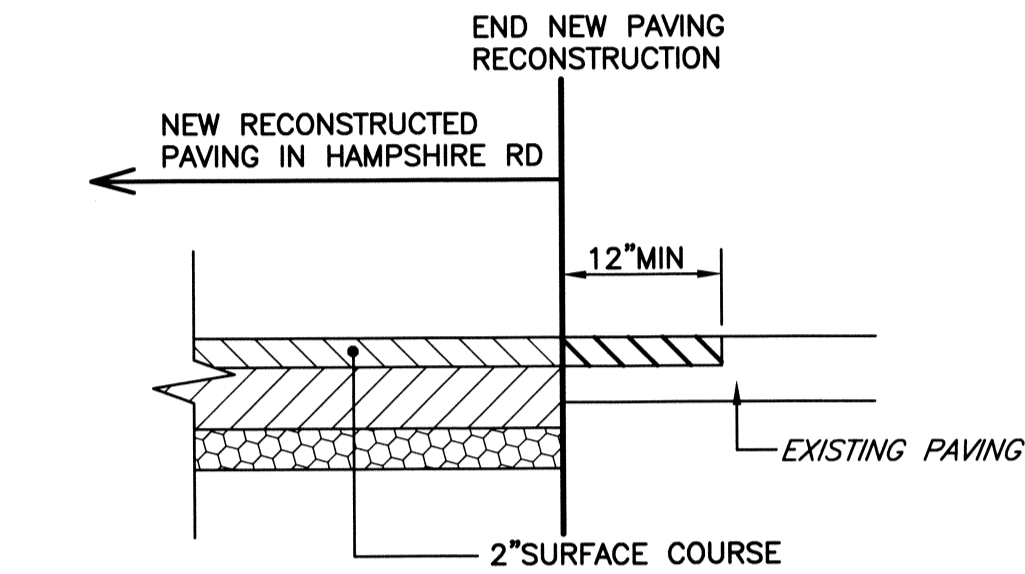
ABANDONMENT OF PIPE AT MANHOLE

N.T.S.



TYPICAL SECTION HAMPSHIRE ROAD RECONSTRUCTION

N.T.S.

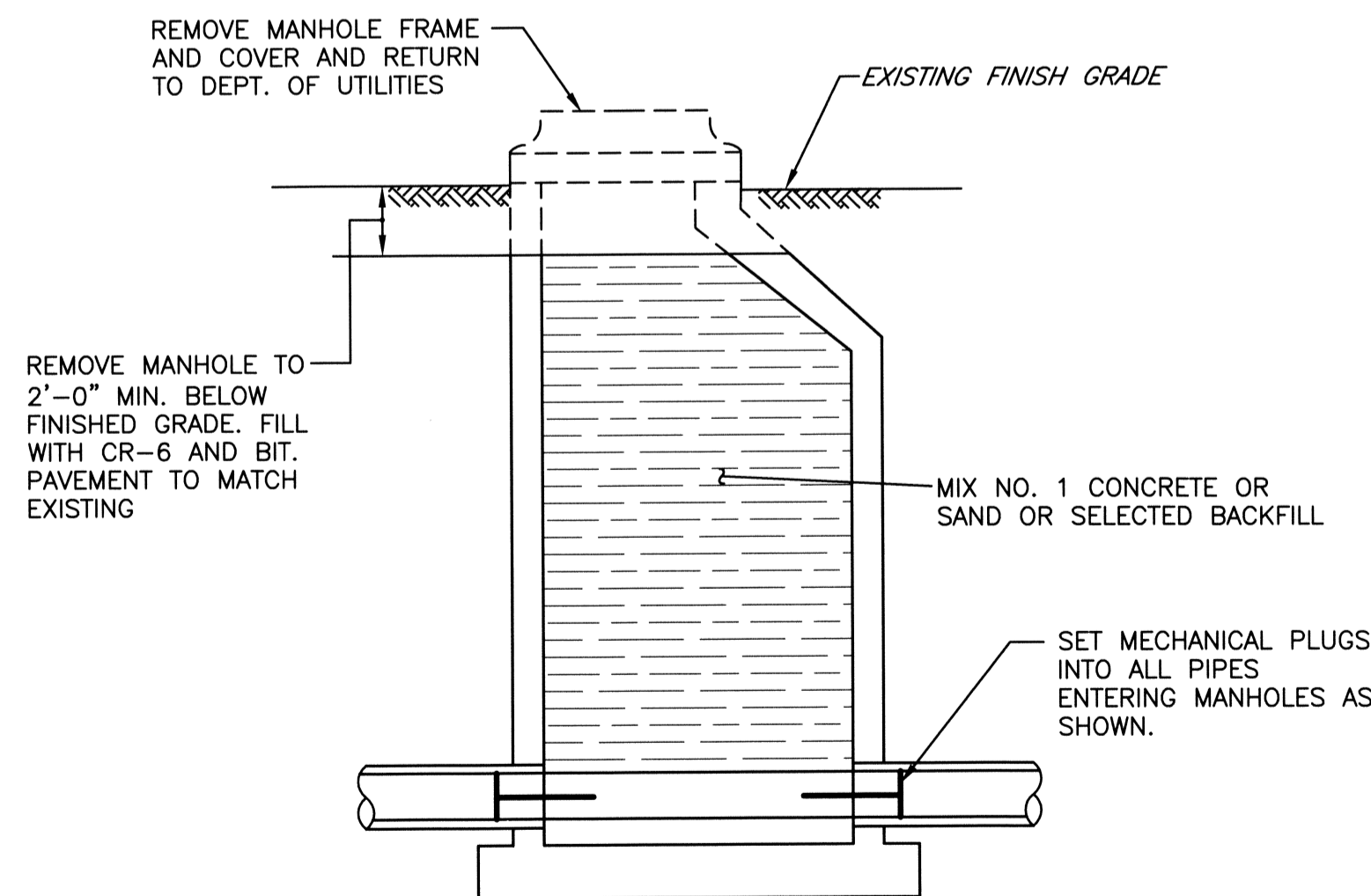


DETAIL - TIE INTO EXISTING PAVING HAMPSHIRE ROAD

N.T.S.

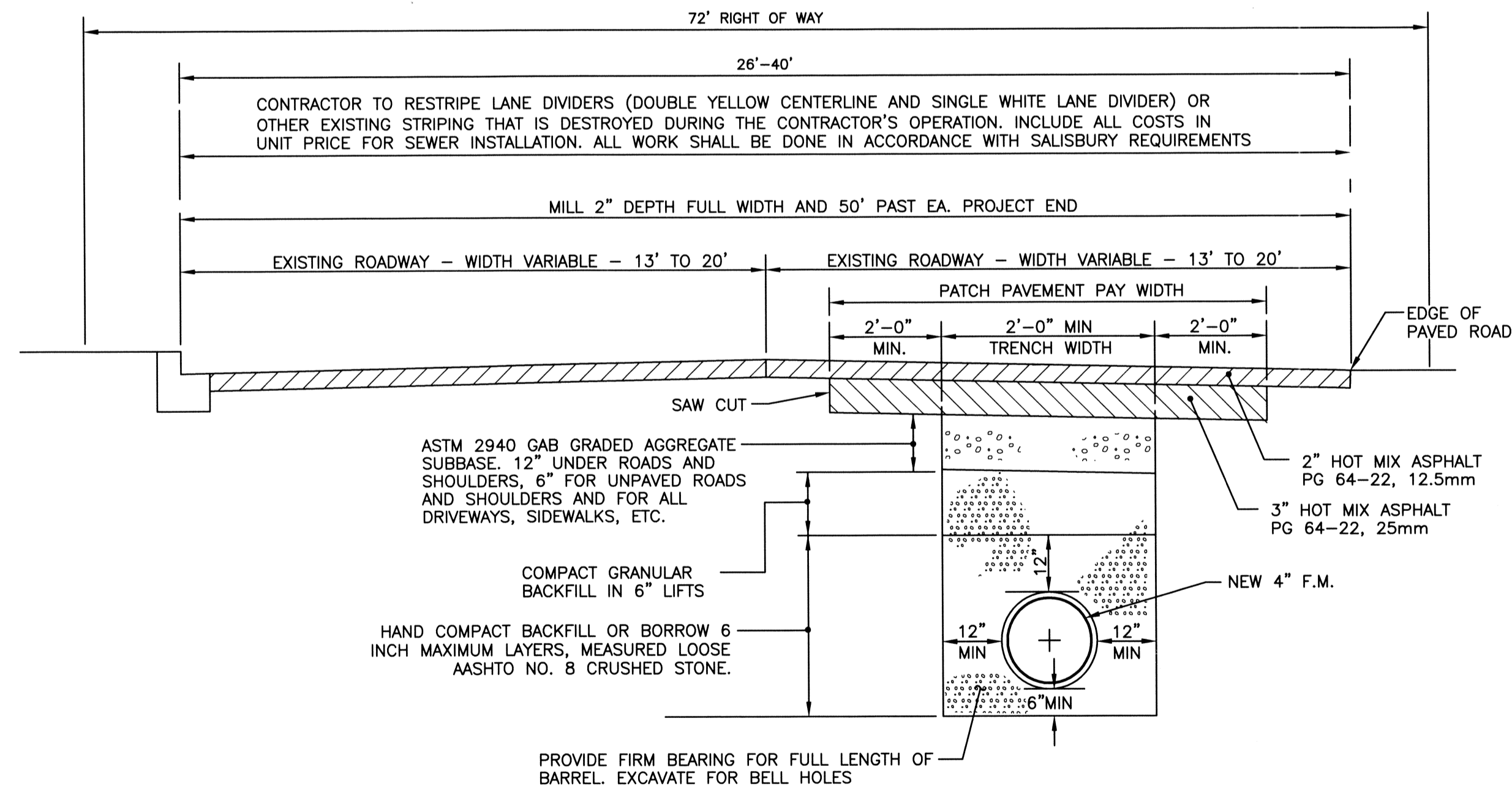
PROPOSED ROAD ELEVATIONS FOR HAMPSHIRE ROAD PAVEMENT RECONSTRUCTION

STATION	LT. EDGE ELEV.	ELEVATION	RT. EDGE ELEV.	
10+00	41.53	41.80	41.47	EXISTING
	41.53	41.80	41.47	PROPOSED
10+50	41.88	42.01	41.81	EXISTING
	41.88	42.14	41.81	PROPOSED
11+00	42.39	42.53	42.43	EXISTING
	42.39	42.72	42.43	PROPOSED
11+50	42.82	43.13	42.96	EXISTING
	42.82	43.22	42.96	PROPOSED
12+00	43.17	43.64	43.53	EXISTING
	43.17	43.69	43.53	PROPOSED
12+50	43.79	44.10	44.26	EXISTING
	43.79	44.34	44.26	PROPOSED
13+00	44.43	44.61	44.59	EXISTING
	44.43	44.75	44.59	PROPOSED
13+50	44.78	45.04	44.95	EXISTING
	44.78	45.11	44.95	PROPOSED
14+00	44.80	45.04	44.97	EXISTING
	44.80	45.15	44.97	PROPOSED
14+50	44.42	44.67	44.46	EXISTING
	44.42	44.74	44.46	PROPOSED
14+75	44.16	44.50	44.26	EXISTING
	44.16	44.50	44.26	PROPOSED



ABANDONMENT OF EXISTING MANHOLE IN NORTHGATE DRIVE

N.T.S.

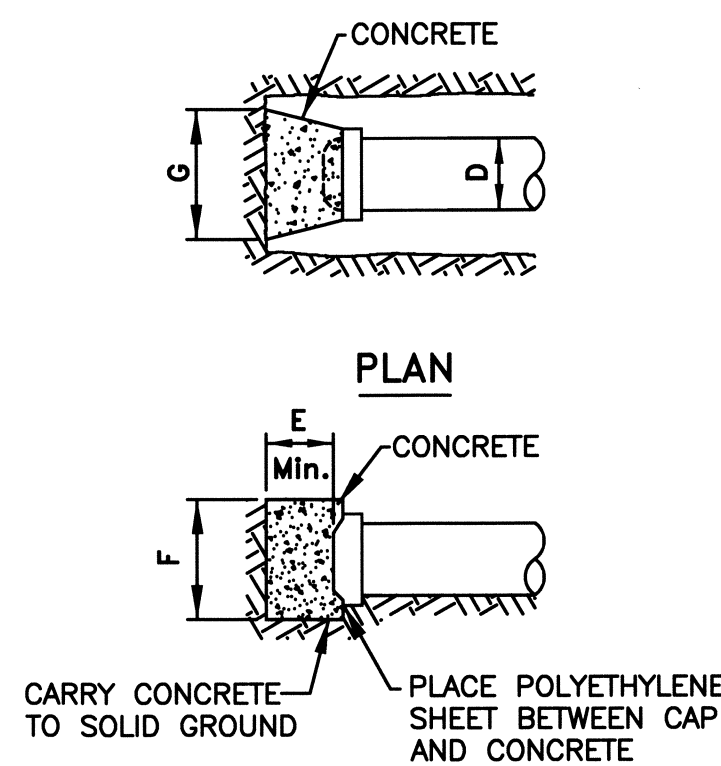


NOTES:

1. REFER TO CITY STANDARD DETAIL 400.32 AND 400.35.
2. IN AREAS OF LAWN DISTURBANCE, RESTORATION SHALL INCLUDE 6" OF TOPSOIL, SEED AND MULCH APPLIED IN ACCORDANCE WITH CITY OF SALISBURY SPECIFICATIONS.
3. AREAS OF GRAVEL ROADWAY OR DRIVEWAY, RESTORATION SHALL INCLUDE 6" OF ASTM D 2940 GA S/B GRADED AGGREGATE SUBBASE.

TRENCH AND PAVEMENT REPAIR WITHIN NORTHGATE DRIVE RIGHT-OF-WAY

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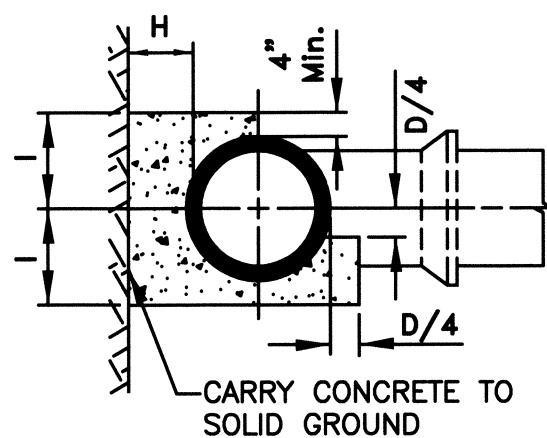
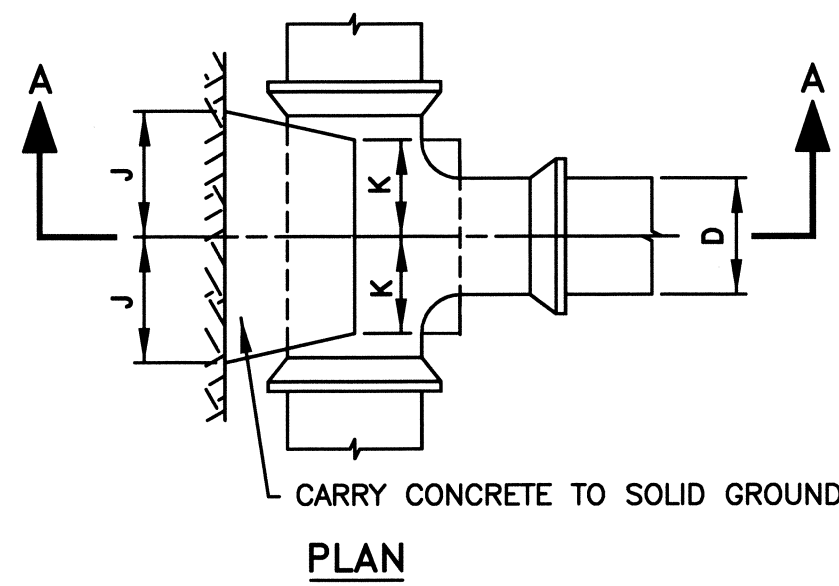


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 2. BUTTRESS DIMENSIONS SHOWN ARE MINIMUM DIMENSIONS ARE BASED UPON SOIL BEARING PRESSURE OF 3000 P.S.F. AND STATIC WATER PRESSURE OF 150 P.S.I. WHERE PRESSURE EXCEEDS 150 P.S.I. OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3000 P.S.F. SPECIAL BUTTRESS DESIGN IS REQUIRED.

BUTTRESS FOR CAPS											
D	3"	4"	6"	8"	10"	12"	16"	20"	24"	30"	36"
E	7"	7"	6"	8"	8"	10"	1' 0"	1' 4"	1' 8"	2' 0"	2' 0"
F	14"	14"	1' 0"	1' 4"	1' 8"	2' 0"	2' 8"	3' 3"	4' 0"	4' 9"	5' 9"
G	12"	12"	1' 5"	1' 11"	2' 5"	2' 10"	3' 9"	4' 9"	5' 8"	7' 6"	8' 10"

BUTTRESSES FOR CAPS

N.T.S

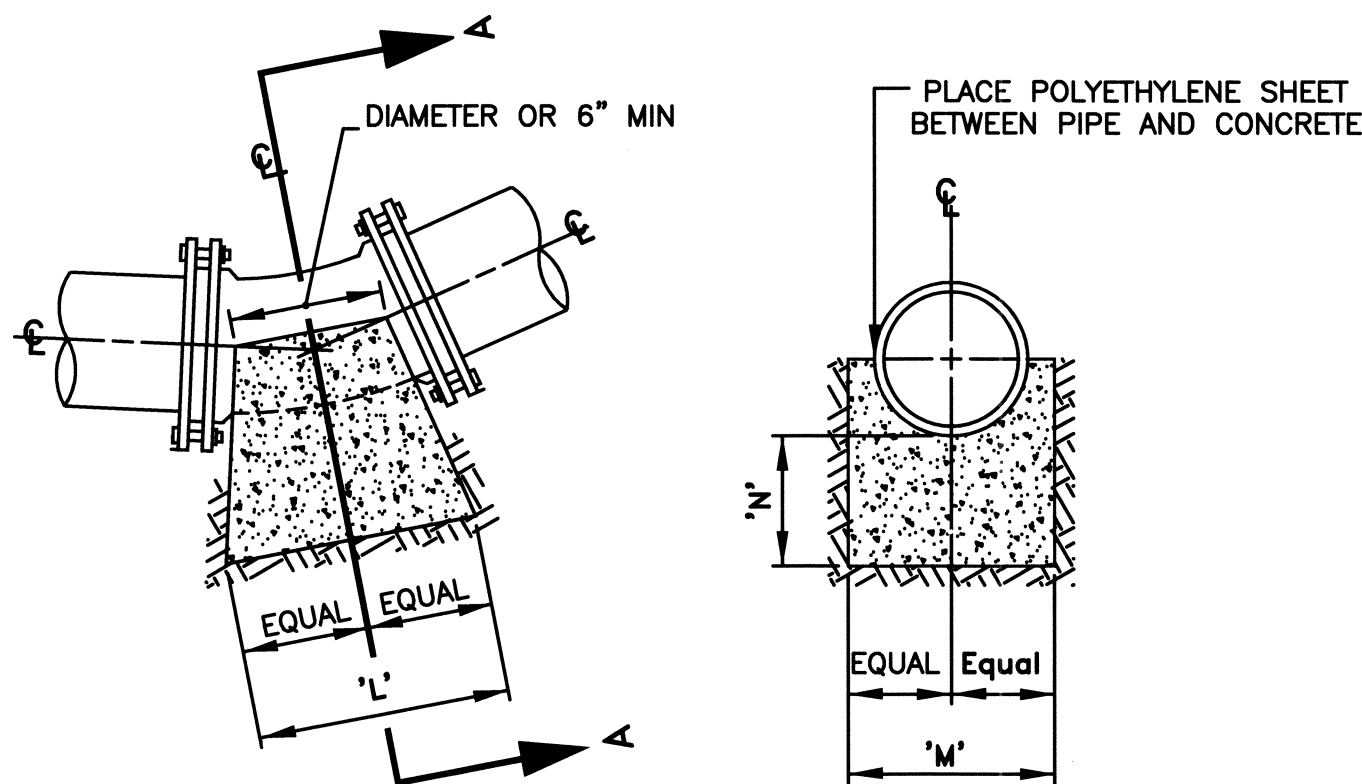


SECTION A-A

BUTTRESSES FOR TEES

N.T.S

BUTTRESS FOR TEES										
SIZE OF BRANCH										
D	6"	8"	10"	12"	16"	20"	24"	30"	36"	
H	8"	9"	10"	1' 0"	1' 2"	1' 4"	1' 6"	1' 9"	2' 0"	
I	8"	10"	1' 0"	1' 3"	1' 8"	2' 1"	2' 6"	3' 1"	3' 9"	
J	7"	9"	1' 3"	1' 2"	1' 6"	1' 11"	2' 4"	2' 10"	3' 5"	
K	6"	8"	8"	8"	10"	1' 2"	1' 4"	1' 6"	1' 10"	



- NOTES:
1. ALL CONCRETE TO BE MSHA MIX NO. 1.
 2. ALL BEARING SURFACES SHALL BE PLACED AGAINST UNDISTURBED GROUND WITH A MINIMUM SOIL BEARING PRESSURE OF 3000 LBS. PER SQUARE FOOT.
 3. THESE BUTTRESSES SHALL BE USED FOR HORIZONTAL AND VERTICAL BENDS.

BUTTRESS DIMENSIONS				
BEND		SIZE		
		3"	4"	6"
11-1/4°	L	0'- 6"	0'- 6"	0'- 6"
	M	1'- 0"	1'- 0"	1'- 2"
1/32	N	0'- 8"	0'- 8"	0'- 8"
22-1/2°	L	0'- 6"	0'- 8"	0'- 10"
	M	1'- 0"	1'- 0"	1'- 2"
1/16	N	0'- 8"	0'- 8"	0'- 8"
45°	L	0'- 10"	1'- 0"	1'- 2"
	M	1'- 0"	1'- 0"	1'- 2"
1/8	N	0'- 8"	0'- 8"	0'- 8"
90°	L	1'- 0"	1'- 4"	2'- 0"
	M	0'- 9"	0'- 10"	1'- 0"
1/4	N	1'- 8"	1'- 8"	1'- 8"

BUTTRESSES FOR USE AT HORIZONTAL AND VERTICAL BENDS

N.T.S

CITY OF SALISBURY
DEPARTMENT OF PUBLIC WORKS

MICHAEL S. MOULDS
DIRECTOR OF PUBLIC WORKS

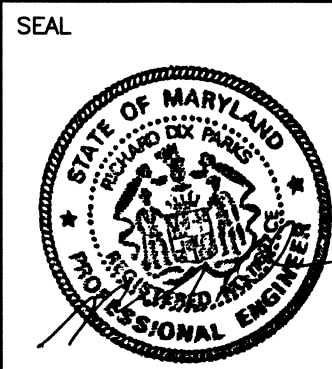
DATE

MISCELLANEOUS DETAILS

SCALE		AS NOTED		DWG. NO.
PROJECT NO.	10518.00	SHEET NO.	9 OF 20	D-3

NO	REVISION	DATE	BY	APP.
1	ISSUED FOR CONSTRUCTION			
0	ISSUED FOR BID			
C	AGENCY COMMENTS	6/13/13	AM	RDP
B	CLIENT COMMENTS	12/17/12	AM	RDP
A	ISSUED TO CLIENT	6/12/12	AM	RDP

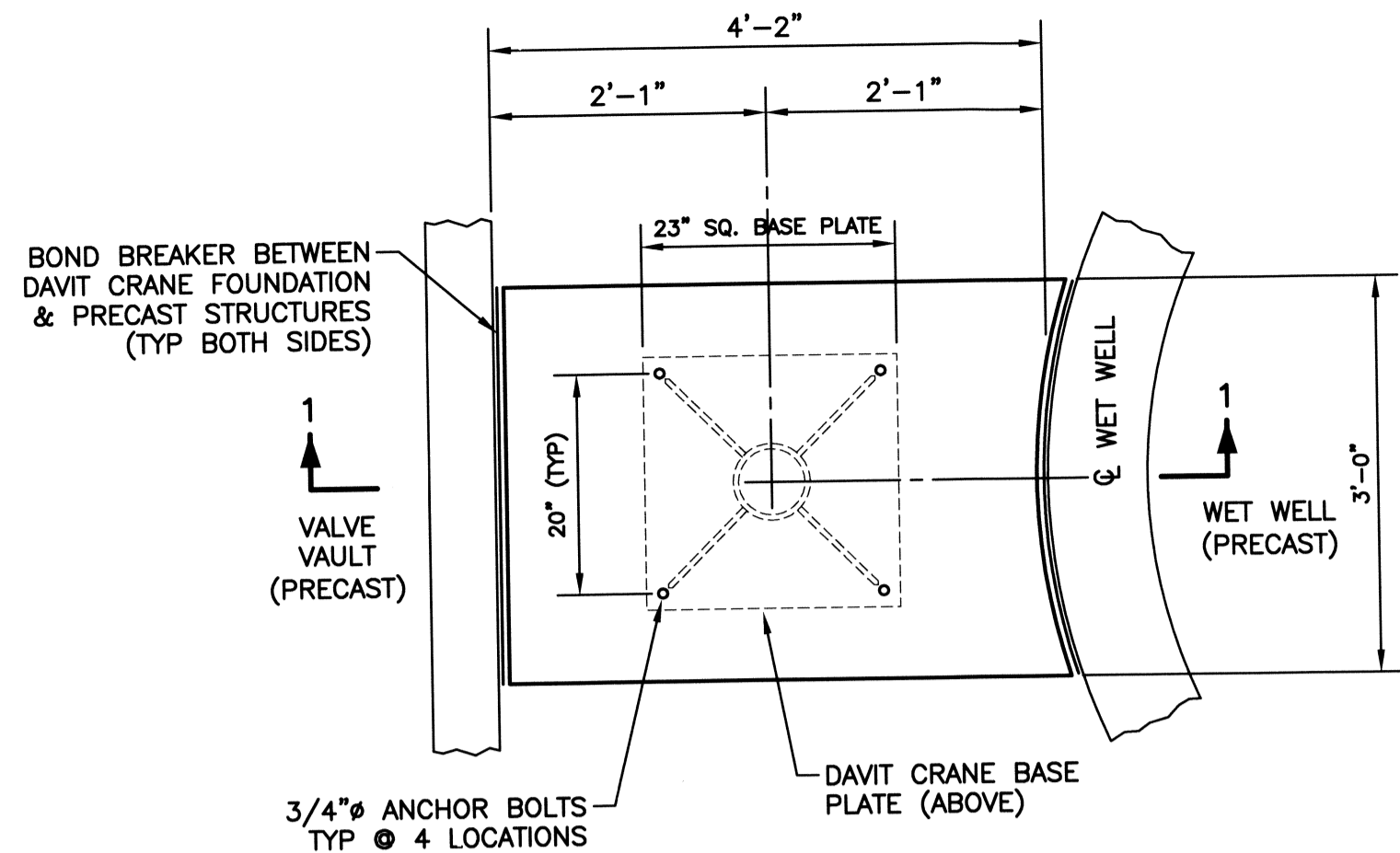
RICHARD D. PARKS, P.E.	
DESIGNED BY	DESIGN
R. D. PARKS, P.E.	CHECKED
DRAWN	CHECKED
CADD	
DATE	SURVEY DATE
MAY 2012	FIELD BOOK



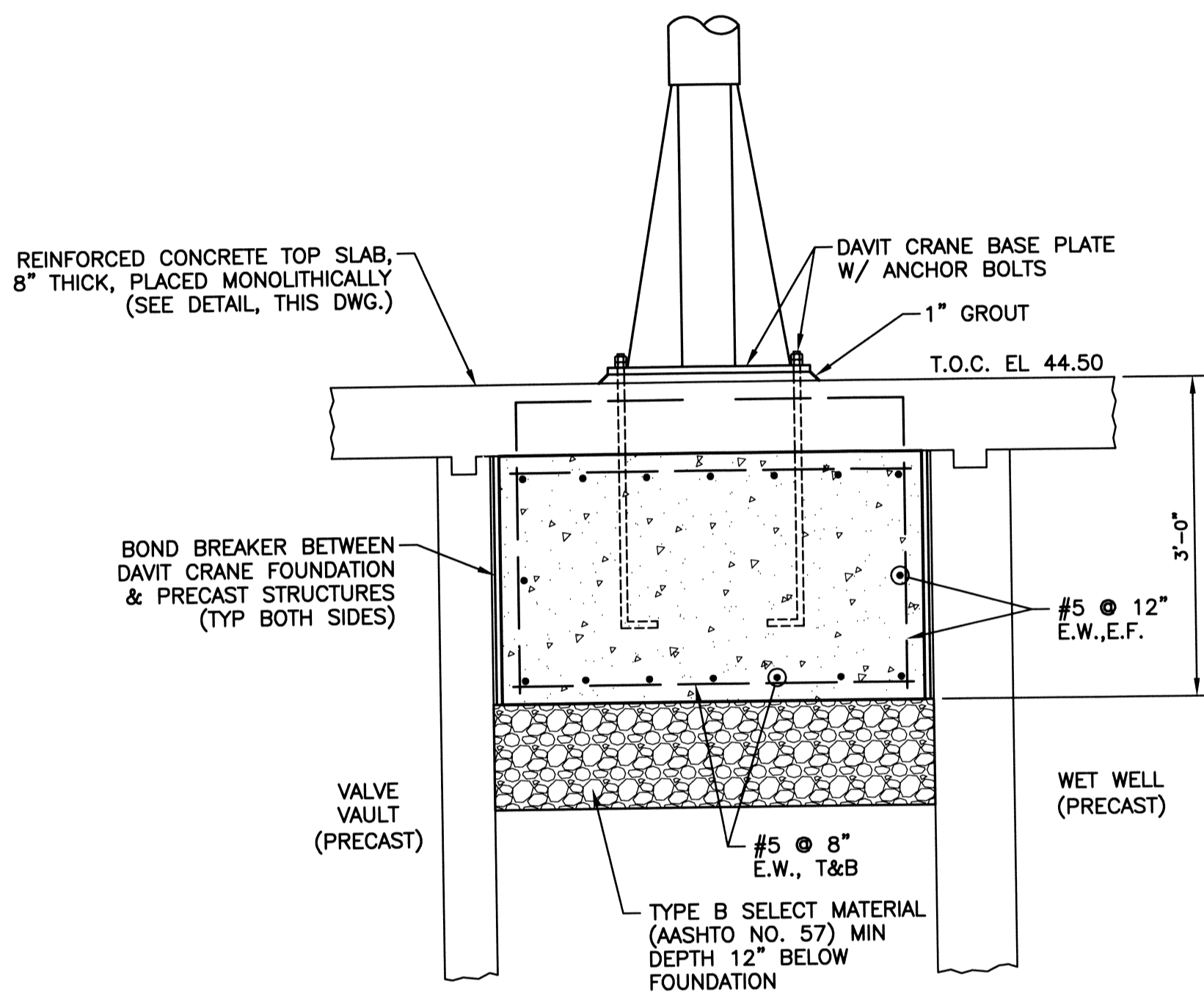
PROFESSIONAL CERTIFICATION
I, RICHARD D. PARKS, P.E., hereby certify that these documents were prepared and approved by me and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 11697, expiration date 11-1-2017.

CLIENT & PROJECT
CITY OF SALISBURY
125 NORTH DIVISION STREET
SALISBURY, MARYLAND 21801-4940
HAMPSHIRE ROAD SEWAGE PUMP STATION
REPLACEMENT AND UPGRADES
SALISBURY, WICOMICO COUNTY, MARYLAND

ARRC
ENGINEERING & ENVIRONMENTAL CONSULTANTS
1101 Opal Court, Third Floor
Hagerstown, Maryland 21740
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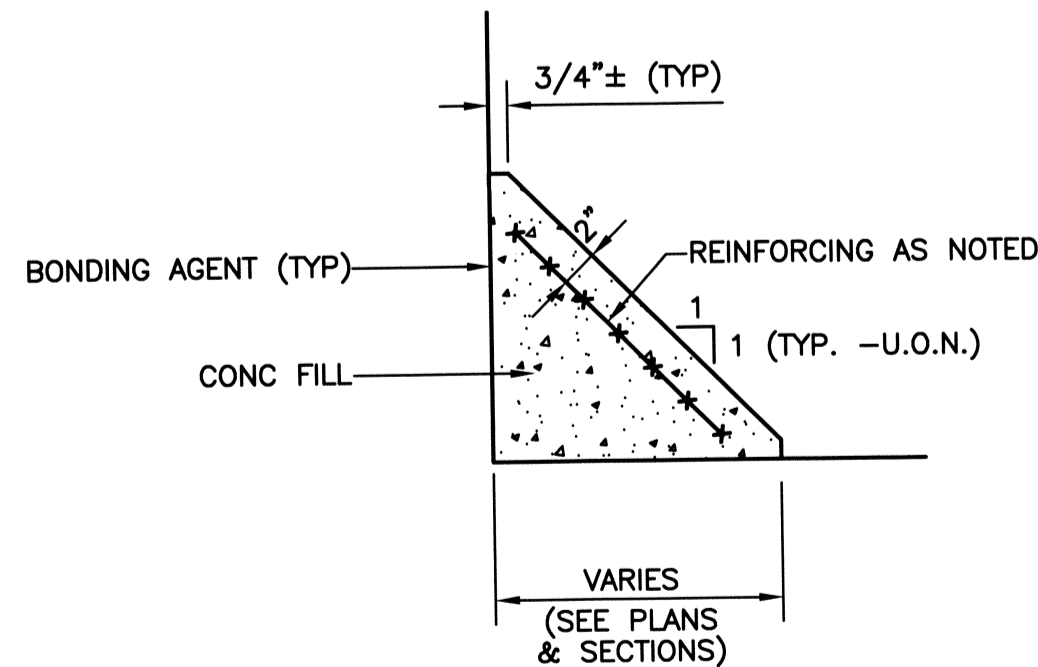
SECTIONAL PLAN



SECTION 1-1

DAVIT CRANE FOUNDATION

N.T.S.



TYPICAL CHANNEL FILLET DETAIL

NO SCALE

GENERAL STRUCTURAL NOTES

DESIGN

- THE FOLLOWING CODES HAVE BEEN USED IN DESIGN
2012 "INTERNATIONAL BUILDING CODE"
ACI 318 "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE"
ACI 350 "ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES"
- ALLOWABLE STRESS DESIGN (ASD) AS SPECIFIED IN THE AISC MANUAL. ASTM (FY=36 KSI) FOR I-BEAMS, CHANNELS, ANGLES, SPLICE PLATES, BEARING STIFFENERS, OUTRIGGER PLATES.
- MAXIMUM ALLOWABLE BEARING PRESSURE FOR WETWELL AND VALVE VAULT FOUNDATION SHALL BE 4000 PSF. FOUNDATIONS FOR OTHER STRUCTURES LESS THAN 5- FEET DEEP SHALL BE 3000 PSF.

CONCRETE

- STRUCTURAL CONCRETE SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4000 psi AND USE TYPE II PORTLAND CEMENT.
- AIR ENTRAINMENT SHALL BE PROVIDED. ALL STRUCTURES SHALL BE CONSIDERED "MODERATE" EXPOSURE FOR AIR ENTRAINMENT PROPORTIONING EXCEPT TANK STRUCTURES SHALL BE CONSIDERED "SEVERE" EXPOSURE. SPECIAL AIR ENTRAINMENT PERCENTAGES ARE REQUIRED FOR AREAS RECEIVING SURFACE HARDENER (COMPLY WITH HARDENER MANUFACTURER'S REQUIREMENTS).
- ALL REINFORCING STEEL SHALL CONFORM TO ASTM A615, GRADE 60 DEFORMED AND WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185.
- LAPS SPLICES AND EMBEDMENTS FOR REINFORCEMENT SHALL FOLLOW THE CHART SHOWN ON THESE DRAWINGS, UNLESS NOTED OTHERWISE.
- ANY REVISIONS TO JOINT LOCATIONS, POUR SEQUENCING, OR REINFORCING SPLICES MUST BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO REINFORCING SHOP DRAWING SUBMITTAL.
- ALL CONCRETE SHALL BE CURED USING AN APPROVED ACI METHOD. IF A CURING COMPOUND IS TO BE USED, MATERIAL SHALL HAVE A FUGITIVE DYE AND HAVE TWO COATS (SECOND COAT APPLIED IN 90-DEGREE DIRECTION OF THE FIRST COAT).
- PROVIDE KEYED CONSTRUCTION JOINTS IN THE SLAB-ON-GRADE SUCH THAT THERE ARE NO COLD JOINTS AND ALL THE POURED CONCRETE CAN BE PROPERLY FINISHED IN A GIVEN WORK DAY. KEYED CONSTRUCTIONS JOINTS SHALL BE AT A CONTROL JOINT LOCATION INDICATED ON PLANS.

DESIGN SPECIFICATIONS

- ALLOWABLE STRESS DESIGN (ASD) AS SPECIFIED IN THE LATEST AISC MANUAL.
- THE 2012 INTERNATIONAL BUILDING CODE (IBC2012).
- ASCE
- CURRENT AWS CODE.

MATERIALS

- STRUCTURAL STEEL: ASTM A36 (FY=36 KSI) FOR I-BEAMS, CHANNELS, ANGLES, SPLICE PLATES, BEARING STIFFENERS, OUTRIGGER PLATES.
- STAINLESS STEEL: ASTM A276 GRADE 304 (FY=30KSI).
- ANCHOR BOLTS: 1/2" HILTI STAINLESS STEEL KWIK BOLT 3 EXPANSION ANCHOR WITH MIN. 3 1/2" EMBEDMENT, OR APPROVED EQUAL.
- CONNECTION BOLTS: 3/8" ASTM A325SC GALVANIZED BOLTS.
- WELDS: USE E70-SERIES ELECTRODES AND CONFORM TO THE CURRENT AWS CODE; QUALITY CERTIFIED WELDER IS REQUIRED FOR FIELD WELDING.
- CONCRETE: fc=4 KSI.

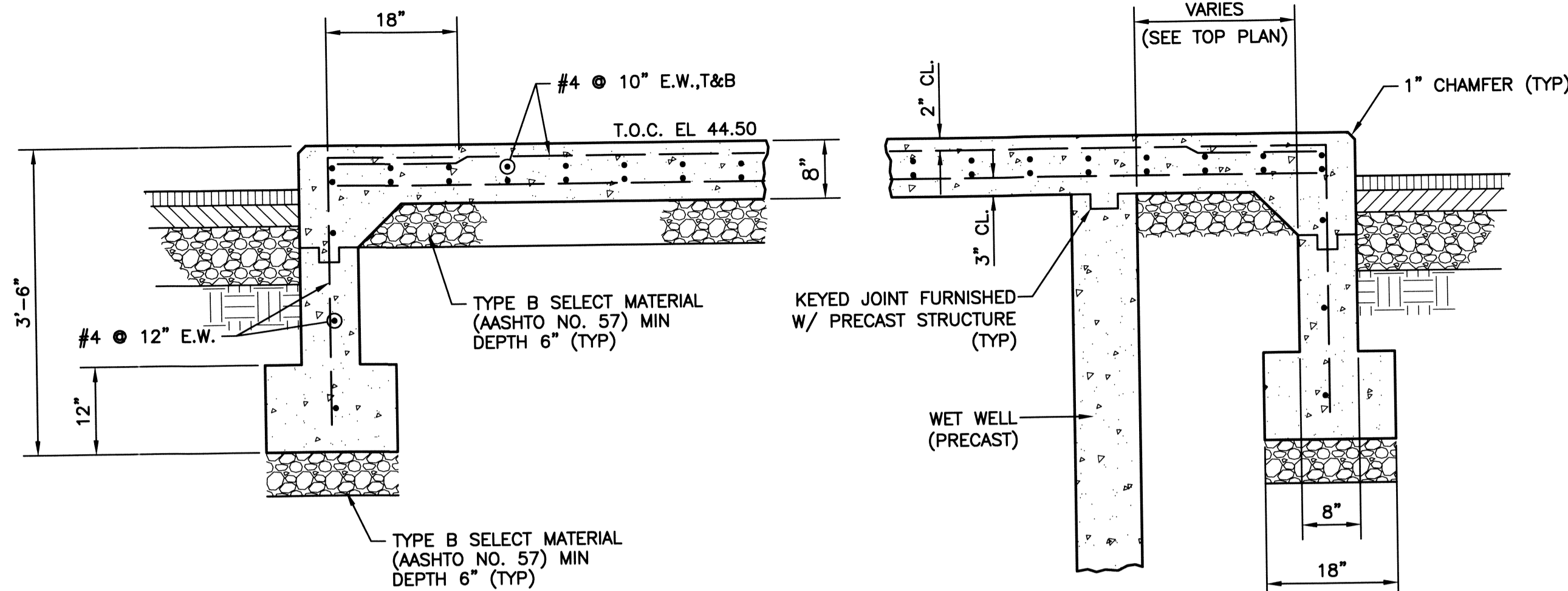
BAR SIZE	MIN LAP SPLICE LENGTH (INCHES)		MIN EMBEDMENT LENGTH (INCHES)	
	STANDARD	TOP BAR	STANDARD	TOP BAR
3	14	16	12	14
4	14	18	12	14
5	19	25	15	19
6	28	36	21	28
7	47	61	36	47
8	61	79	47	61
9	69	90	53	69
10	77	100	59	77

THE ABOVE CHART INCORPORATES THE FOLLOWING ASSUMPTIONS AND IS BASED UPON ACI 318-99, SECTIONS 12.2.2 AND 3.

- CONCRETE f'c= 4000 PSI AND IS CONSIDERED "NORMAL WEIGHT"
- REINFORCING fy= 60,000 PSI AND IS NOT EPOXY COATED.
- LAP SPLICES ARE TENSION LAPS, CLASS B
- TOP BAR IS DEFINED AS ANY REINFORCING WITH MORE THAN 12 INCHES OF FRESH CONCRETE IS CAST BELOW THE REINFORCING
- MINIMUM 1.5 INCHES OF COVER AND MINIMUM 4 INCH REINFORCING CLEAR SPACING

REINFORCING SPLICE AND EMBEDMENT CHART

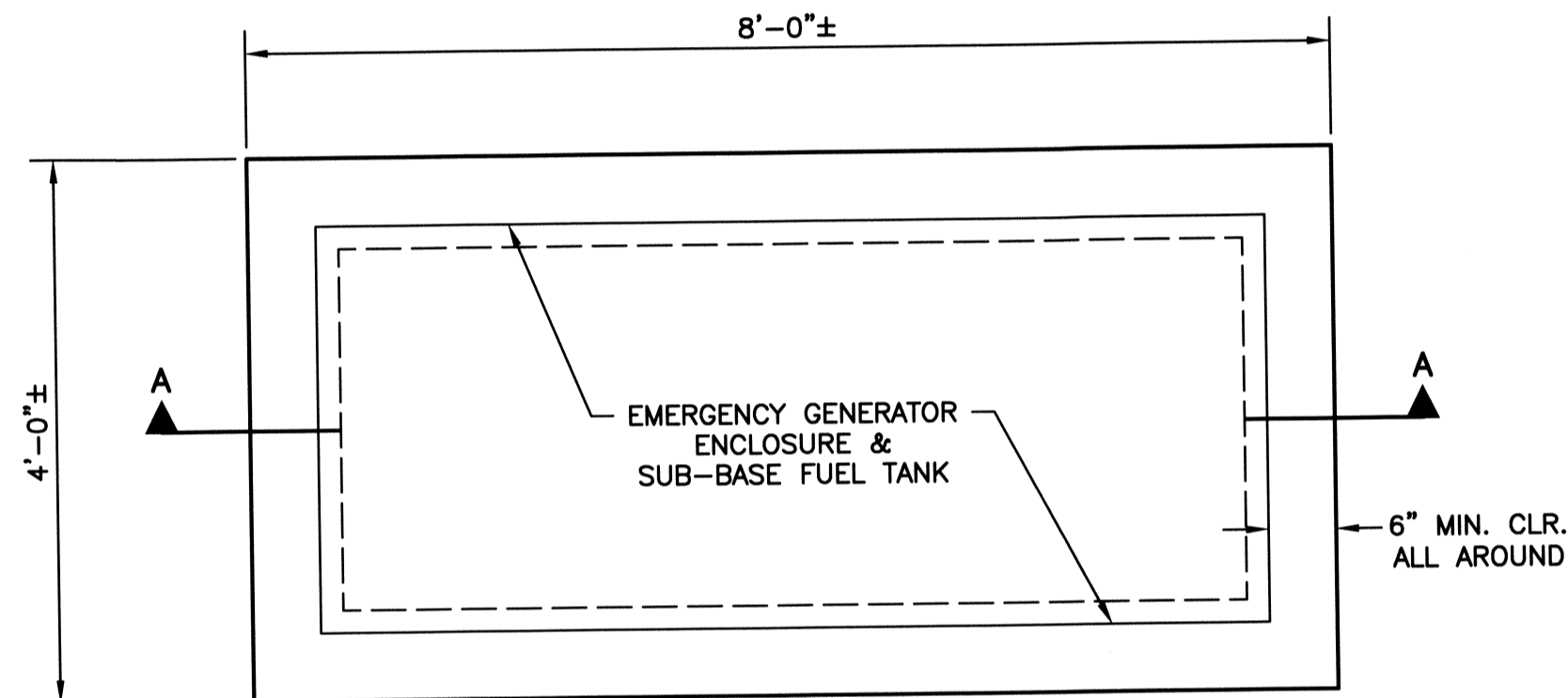
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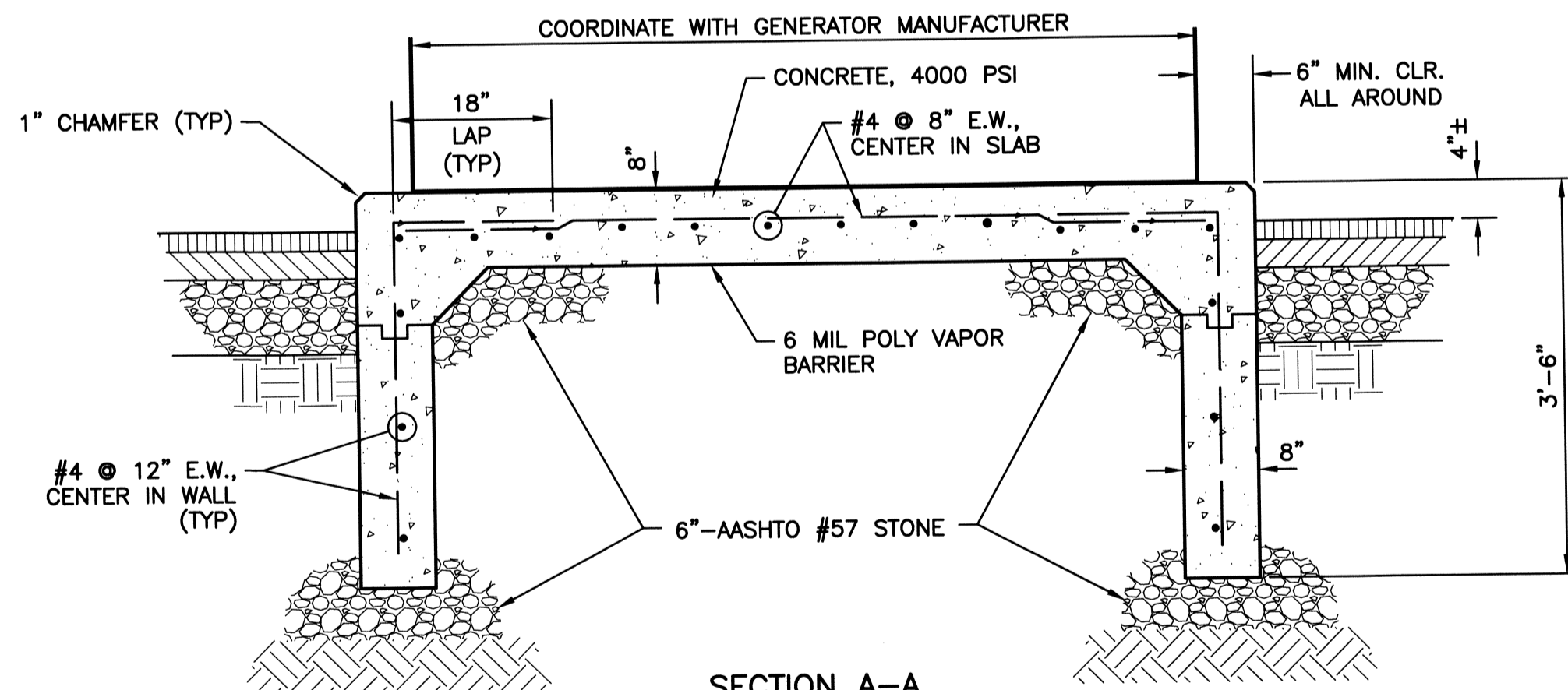
TYPICAL SECTION

CONCRETE TOP SLAB DETAIL (FOR WET WELL, VALVE VAULT & DAVIT CRANE)

N.T.S.



PLAN



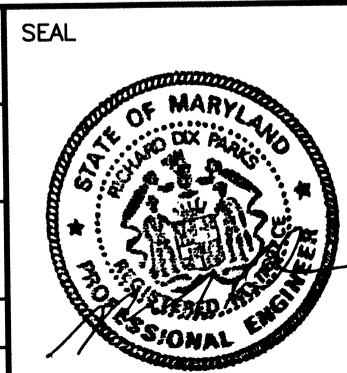
SECTION A-A

CONCRETE GENERATOR PAD

N.T.S.

NO	REVISION	DATE	BY	APP.	NO	REVISION	DATE	BY	APP.
1	ISSUED FOR CONSTRUCTION								
0	ISSUED FOR BID								
C	AGENCY COMMENTS	6/13/13	AM	RDP					
B	CLIENT COMMENTS	2/12/12	AM	RDP					
A	ISSUED TO CLIENT	6/12/12	AM	RDP					

RICHARD D. PARKS, P.E.	
RELEASED BY	CHECKED
DESIGN	
R. D. PARKS, P.E.	
DRAWN	CHECKED
CADD	
DATE	SURVEY DATE
MAY 2012	FIELD BOOK




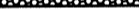


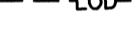



PROFESSIONAL CERTIFICATION
I, RICHARD D. PARKS, P.E., hereby certify that these documents were prepared and approved by me and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 11697, expiration date 11-1-2017.

CLIENT & PROJECT
CITY OF SALISBURY
125 NORTH DIVISION STREET
SALISBURY, MARYLAND 21801-4940
HAMPSHIRE ROAD SEWAGE PUMP STATION
REPLACEMENT AND UPGRADES
SALISBURY, WICOMICO COUNTY, MARYLAND

ARRC
ENGINEERING & ENVIRONMENTAL CONSULTANTS
1101 Opal Court, Third Floor
Hagerstown, Maryland 21740
Tel 301.791.1100

CITY OF SALISBURY DEPARTMENT OF PUBLIC WORKS			
MICHAEL S. MOULDS DIRECTOR OF PUBLIC WORKS			DATE
TITLE STRUCTURAL NOTES AND DETAILS			
SCALE AS NOTED			DWG. NO. S-1
PROJECT NO. 10518.00	SHEET NO. 10 OF 20	REV.	



- | | |
|--|------------------------------------|
|  | STABILIZED CONSTRUCTION FENCE |
|  | SILT FENCE |
|  | LIMIT OF DISTURBANCE |
|  | INLET PROTECTION |
|  | 2" MILL AND OVERLAY |
|  | FULL DEPTH PAVEMENT RECONSTRUCTION |
|  | NEW 4-INCH FORCE MAIN |
|  | TEMPORARY STOCKPILE AREA |

[illegible]

SEQUENCE OF CONSTRUCTION

1. NOTIFY THE CITY OF SALISBURY AT LEAST FIVE DAYS AND MDE AT 410-901-4020 AT LEAST 2 WEEKS PRIOR TO THE START OF CONSTRUCTION TO SCHEDULE A PRE-CONSTRUCTION MEETING. ADDITIONAL MEETINGS MAY BE REQUIRED PER THE SEDIMENT CONTROL INSPECTOR.
2. INSTALL SEDIMENT CONTROL MEASURES INCLUDING BUT NOT LIMITED TO: INLET PROTECTION, SILT FENCE, AND STABILIZED CONSTRUCTION ENTRANCE.
3. INSTALL TEMPORARY MAINTENANCE OF TRAFFIC MEASURES AND SEDIMENT CONTROL MEASURES AS REQUIRED.
4. INSTALL NEW FORCE MAIN AND PAVEMENT PATCH.
5. INSTALL NEW PUMP STATION WET WELL, VALVE VAULT, DRY WELL AND CONTROLS. THE PROJECT IS DESIGNED TO MINIMIZE DISRUPTION TO WASTEWATER PUMPING. DURING THOSE TIMES WHEN SHORT TERM DISRUPTION OF SERVICE IS UNAVOIDABLE, CONTRACTOR SHALL BYPASS PUMP FROM INFLUENT MANHOLE TO EXISTING EMERGENCY FORCEMAIN BYPASS.
6. INSTALL NEW MANHOLE AND GRAVITY SEWER TO NEW WETWELL.
7. REMOVE AND INSTALL NEW GRAVEL AND BASE PAVING ON HAMPSHIRE ROAD.
8. MILL EXISTING PAVEMENT ON NORTHGATE DRIVE.
9. PERFORM FINAL SURFACE PAVING ON NORTHGATE DRIVE AND HAMPSHIRE ROAD.
10. STABILIZE ALL DISTURBED GRASS AREAS AND INSTALL LANDSCAPING AND FENCING AT PUMP STATION SITE.
11. REMOVE TEMPORARY SEDIMENT CONTROL MEASURES AND MAINTENANCE OF TRAFFIC MEASURES.

NOTES

1. SOILS WITHIN THE PROJECT SITE ARE CLASSIFIED AS PEPPERBOX-ROCKAWALKIN COMPLEX (PrA), HYDROLOGIC SOIL GROUP 'C'.
2. THERE ARE NO WETLANDS OR FLOODPLAIN IN THE PROJECT SITE.

TEMPORARY SEEDING NOTES

GENERAL

1. SCOPE: PLANTING SHORT TERM VEGETATION TO STABILIZED, CLEARED OR GRADED AREAS SUBJECT TO EROSION FOR A PERIOD OF 7 DAYS OR MORE.
2. STANDARDS: PERMANENT SEEDING SHALL CONFORM TO ALL REQUIREMENTS OF "2011 MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL" PUBLISHED JOINTLY BY WATER RESOURCES ADMINISTRATION, SOIL CONSERVATION SERVICE, AND STATE SOIL CONSERVATION COMMITTEE.
3. SEDIMENT AND EROSION CONTROL: ALL PERIMETER CONTROLS MUST BE STABILIZED IN 3 DAYS; ALL INTERIOR CONTROLS MUST BE STABILIZED IN 7 DAYS.

PERMANENT SEEDING & SOD NOTES

GENERAL

1. SCOPE: PLANTING PERMANENT, LONG-LIVED VEGETATIVE COVER ON GRADED OR CLEARED AREAS.
2. STANDARDS: PERMANENT SEEDING SHALL CONFORM TO ALL REQUIREMENTS OF "2011 MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL" PUBLISHED JOINTLY BY WATER RESOURCES ADMINISTRATION, SOIL CONSERVATION SERVICE, AND STATE SOIL CONSERVATION COMMITTEE.

SPECIFICATIONS

1. SITE PREPARATION
 - A) PRIOR TO SEEDING INSTALL ALL REQUIRED SEDIMENT AND EROSION CONTROL MEASURES.
 - B) FINE GRADING REQUIRED FOR PERMANENT SEEDING.
2. SOIL AMENDMENTS
 - A) FERTILIZER SHALL BE APPLIED AT THE RATE OF SHOWN BELOW.

SPECIFICATIONS FOR VEGETATIVE ESTABLISHMENT

STANDARD STABILIZATION NOTE: FOLLOWING INITIAL SOIL DISTURBANCE OR RE-DISTURBANCE, SEEDING FOR PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES GREATER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1); AND SEVEN (7) CALENDAR DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE NOT UNDER ACTIVE GRADING. ONCE VEGETATION IS ESTABLISHED, THE SITE SHALL HAVE 95% GROUNDCOVER TO BE CONSIDERED STABILIZED.

PERMANENT SEEDING SUMMARY (FOR ALL DISTURBED AREAS)

SEED MIXTURE (FOR HARDINESS ZONE 7B-) (FROM TABLE B.3)					FERTILIZER RATE (10-20-20)			LIME RATE
NO.	SPECIES	APPLICATION RATE (lb/ac)	SEEDING DATES	SEEDING DEPTHS	N	P205	K20	
6	TALL FESCUE	40	2/15 TO 4/30 5/1 TO 5/31	1/4"-1/2"	45 lb/ac (1.0 lb/ 1000 sf)	90 lb/ac (2.0 lb/ 1000 sf)	90 lb/ac (2.0 lb/ 1000 sf)	2 tons/ac (100 lb/ 1000 sf)
6	PERENNIAL RYEGRASS	25						
6	WHITE CLOVER	5						

TEMPORARY SEEDING FOR SITE STABILIZATION

SPECIES	SEEDING RATE		SEEDING DEPTHS	RECOMMENDED SEEDING DATES
	(lb/ac)	(lb/1,000 SF)		
ANNUAL RYEGRASS	40	1.0	1/2"	FEB. 15 TO APRIL 30, AUG. 15 TO NOV. 30
FOXTAIL MILLET	30	0.7	1/2"	MAY 1 TO AUG. 14

1. BETWEEN OCTOBER 15 AND MARCH 1, WHEN THE GROUND IS FROZEN, USE MULCH ONLY, THEN SEED WITH TEMP. MIXTURE WHEN GROUND THAWS.
2. AREAS WHICH ARE DESIGNATED "GRASS/FORAGE AREAS" ON THE FINAL FOREST CONSERVATION PLAN (OR ON ASSOCIATED SITE PLAN, CONSTRUCTION DRAWINGS OR ON ASSOCIATED IMPROVEMENT PLANS) SHALL BE GRASSLAND AND FORAGE HABITAT AREAS MAINTAINED AT A 2-4 FOOT HEIGHT DURING THE GROWING SEASON. THESE AREAS SHALL CONSIST OF MARYLAND NATIVE GRASSES, PERENNIALS, AND LEGUMES. BESIDES ENHANCING WATER QUALITY, THESE AREAS ARE INTENDED TO PROVIDE A HABITAT FOR WILDLIFE. MOWING SHALL NOT BE ALLOWED, EXCEPT ONCE EACH AUTUMN, OR ONCE EVERY OTHER AUTUMN, AND EXCEPT IN THE CASES WHERE THE REMOVAL OF NOXIOUS WEEDS OR SPECIES WARRANTS MOWING AS A METHOD OF EITHER MANUAL REMOVAL OR HERBICIDE APPLICATION. IT IS RECOMMENDED THAT MOWING OCCUR AT LEAST EVERY OTHER AUTUMN IN ORDER TO SUPPRESS WOODY MATERIAL, UNLESS THE OWNER WISHES TO ALLOW THE SUBJECT GRASS/FORAGE AREAS TO REVERT TO FOREST CONDITIONS.
3. ALL PLANT MATERIAL SHALL BE MAINTAINED IN A LIVING CONDITION.

SPECIFICATIONS

1. SITE PREPARATION
 - A) PRIOR TO SEEDING, INSTALL ALL REQUIRED SEDIMENT AND EROSION CONTROLS MEASURES.
 - B) FINAL GRADING NOT REQUIRED FOR TEMPORARY SEEDING.
2. SOIL AMENDMENTS
 - A) FERTILIZER SHALL BE APPLIED AT THE RATE SHOWN IN THE TABLE B.3.
 - B) ACID SOILS SHALL BE LIMED.
3. SEEDBED PREPARATION
 - A) SOIL SHALL BE LOOSENED TO A DEPTH OF 3-INCHES BY RAKING, DISCING, OR OTHER ACCEPTABLE MEANS PRIOR TO SEEDING.
4. SEEDING
 - A) SELECT A MIXTURE FROM STANDARD SPECIFICATIONS.
 - B) APPLY SEED UNIFORMLY WITH A CYCLONE SEEDER DRILL, CULTIPACKER, OR HYDRO SEEDER.
5. MULCHING
 - A) MULCH SHALL BE APPLIED IMMEDIATELY AFTER SEEDING. MULCH MATERIALS AND APPLICATIONS SHALL CONFORM TO THE STANDARD SPECIFICATIONS.

SITE ANALYSIS

DISTURBED AREA	1.10 ACRES
IMPROVED AREA	1.09 ACRES
AREA TO BE CLEARED	1.10 ACRES
AREA TO BE VEGETATED	0.01 ACRES
AREA TO BE PAVED	1.09 ACRES
TOTAL CUT	1596 CY
TOTAL FILL (#57 STONE)	1479 CY
TOPSOIL	5 CY

SEDIMENT AND EROSION CONTROL NOTES

1. ALL EROSION/SEDIMENT CONTROL MEASURES SHALL COMPLY WITH THE "MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL" AS APPROVED BY THE COUNTY.
2. ALL EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE PLACES PRIOR TO OR AT THE INITIATION OF GRADING.
3. DURING CONSTRUCTION, ALL SEDIMENT CONTROL STRUCTURES WILL BE INSPECTED AFTER EACH RAINFALL AND REPAIRED IF NECESSARY. SEDIMENT TO BE REMOVED TO A SUITABLE DISPOSAL AREA AND STABILIZED WITH PERMANENT VEGETATIVE COVER. (SEE SECTION B-4-5 OF 2011 MARYLAND STANDARDS AND SPECIFICATION FOR SOIL EROSION AND SEDIMENT CONTROL "PUBLISHED JOINTLY BY WATER RESOURCE ADMINISTRATION, SOIL CONSERVATION SERVICE, STATE SOIL CONSERVATION COMMITTEE").
4. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING ALL SEDIMENT AND EROSION CONTROL MEASURES UNTIL DISTURBED AREAS ARE STABILIZED.
5. AFTER FINE GRADING, ALL DISTURBED AREAS ARE TO BE PERMANENTLY MULCHED AND SEEDDED (SEE SECTION B-4-5).
6. NO PERMANENT SLOPE SHALL BE GREATER THAN 2:1
7. ALL GROUNDWATER ENCOUNTERED DURING FORCEMAIN AND PUMP STATION INSTALLATION THAT WILL BE PUMPED OUT OF THE TRENCH WILL NEED TO GO THROUGH A DEWATERING DEVICE PRIOR TO LEAVING THE SITE.

STOCKPILE NOTES

1. NO STOCKPILING ALLOWED ON ASPHALT.
2. ALL STOCKPILES LEFT AT THE END OF THE DAY NEED TO BE STABILIZED UNTIL THE NEXT REDISTURBANCE.

FOR UTILITY WORK ONLY OR FOR OFF-SITE UTILITY WORK

1. PLACE ALL EXCAVATED MATERIAL ON HIGH SIDE OF TRENCH, SILT FENCE ON LOW SIDE.
2. ONLY DO AS MUCH WORK AS CAN BE DONE IN ONE DAY SO BACKFILLING, FINAL GRADING, SEEDING AND MULCHING CAN OCCUR.
3. ANY SEDIMENT CONTROL MEASURES DISTURBED BY CONSTRUCTION WILL BE REPAIRED ON THE SAME DAY.

DEVELOPER

I CERTIFY THAT THIS PLAN OF SEDIMENT CONTROL WILL BE IMPLEMENTED TO THE FULLEST EXTENT, AND ALL CLEARING, GRADING, CONSTRUCTION OR DEVELOPMENT WILL BE DONE PURSUANT TO THIS PLAN. ANY RESPONSIBLE PERSONNEL INVOLVED IN CONSTRUCTION PROJECT WILL HAVE A CERTIFICATION OF ATTENDANCE AT A DEPARTMENT OF ENVIRONMENT APPROVED TRAINING PROGRAM FOR THE CONTROL OF SEDIMENT AND EROSION BEFORE BEGINNING THE PROJECT. I ALSO AUTHORIZE PERIODIC ON-SITE EVALUATION BY THE WICOMICO CONSERVATION DISTRICT PERSONNEL AND COOPERATING AGENCIES.

Owner

Developer

Date

ENGINEER

I CERTIFY THAT THIS PLAN OF SEDIMENT CONTROL IS DESIGNED WITH MY PERSONAL KNOWLEDGE OF THE SITE CONDITION AND HAS BEEN DESIGNED TO THE STANDARDS AND SPECIFICATIONS ADOPTED BY THE WICOMICO SOIL CONSERVATION DISTRICT.

Engineer

Date

CITY OF SALISBURY
DEPARTMENT OF PUBLIC WORKS

MICHAEL S. MOULDS
DIRECTOR OF PUBLIC WORKS

DATE

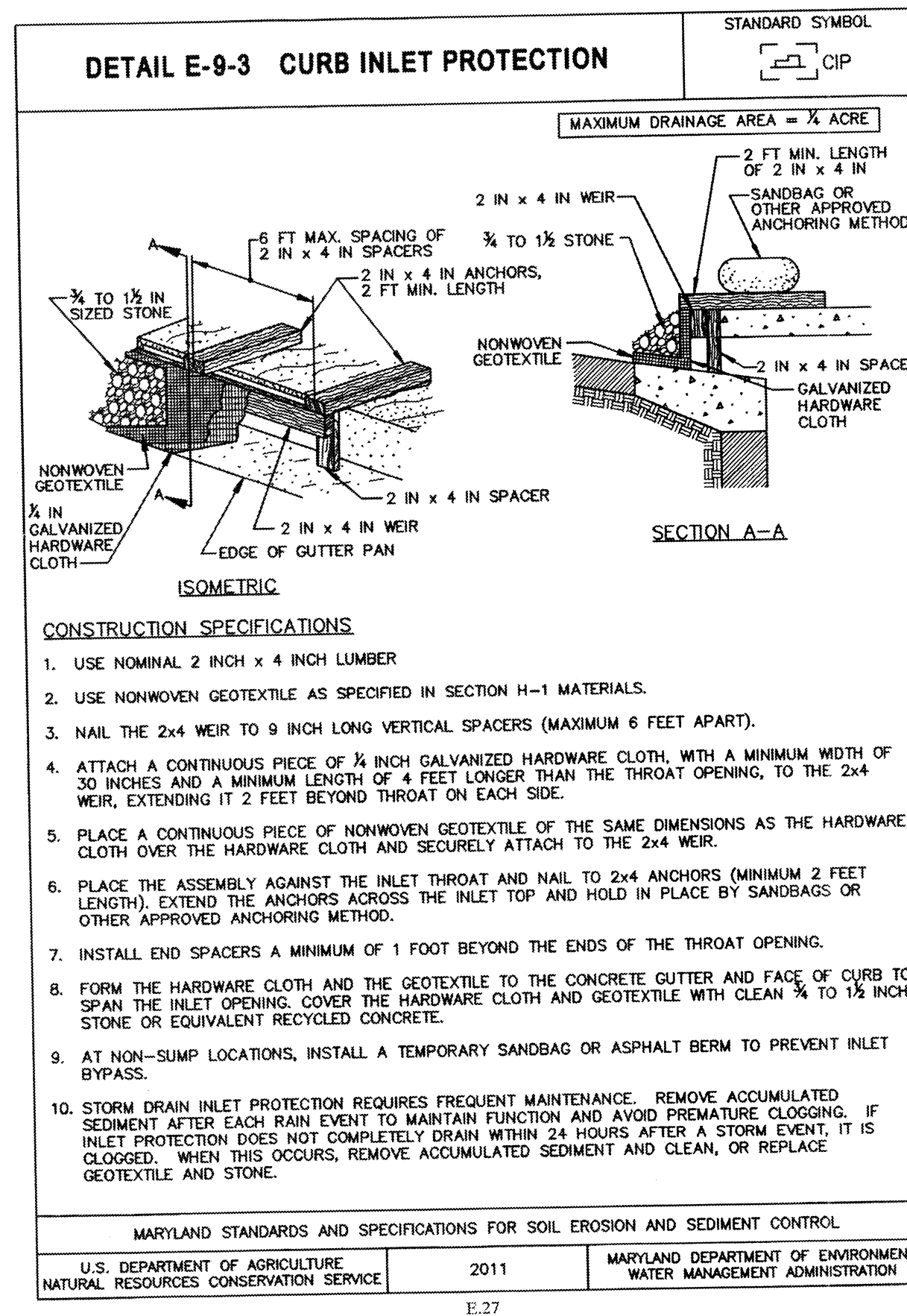
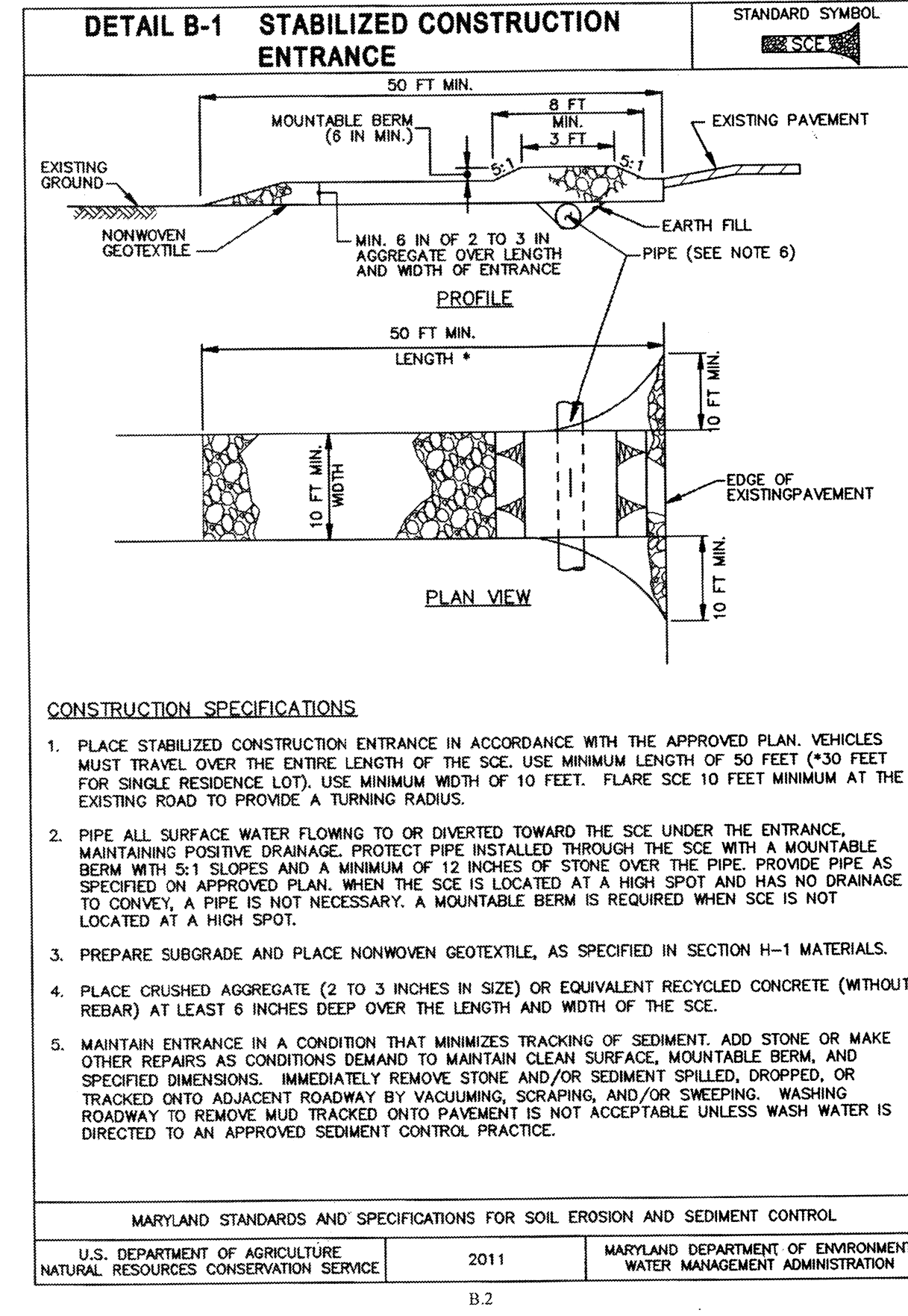
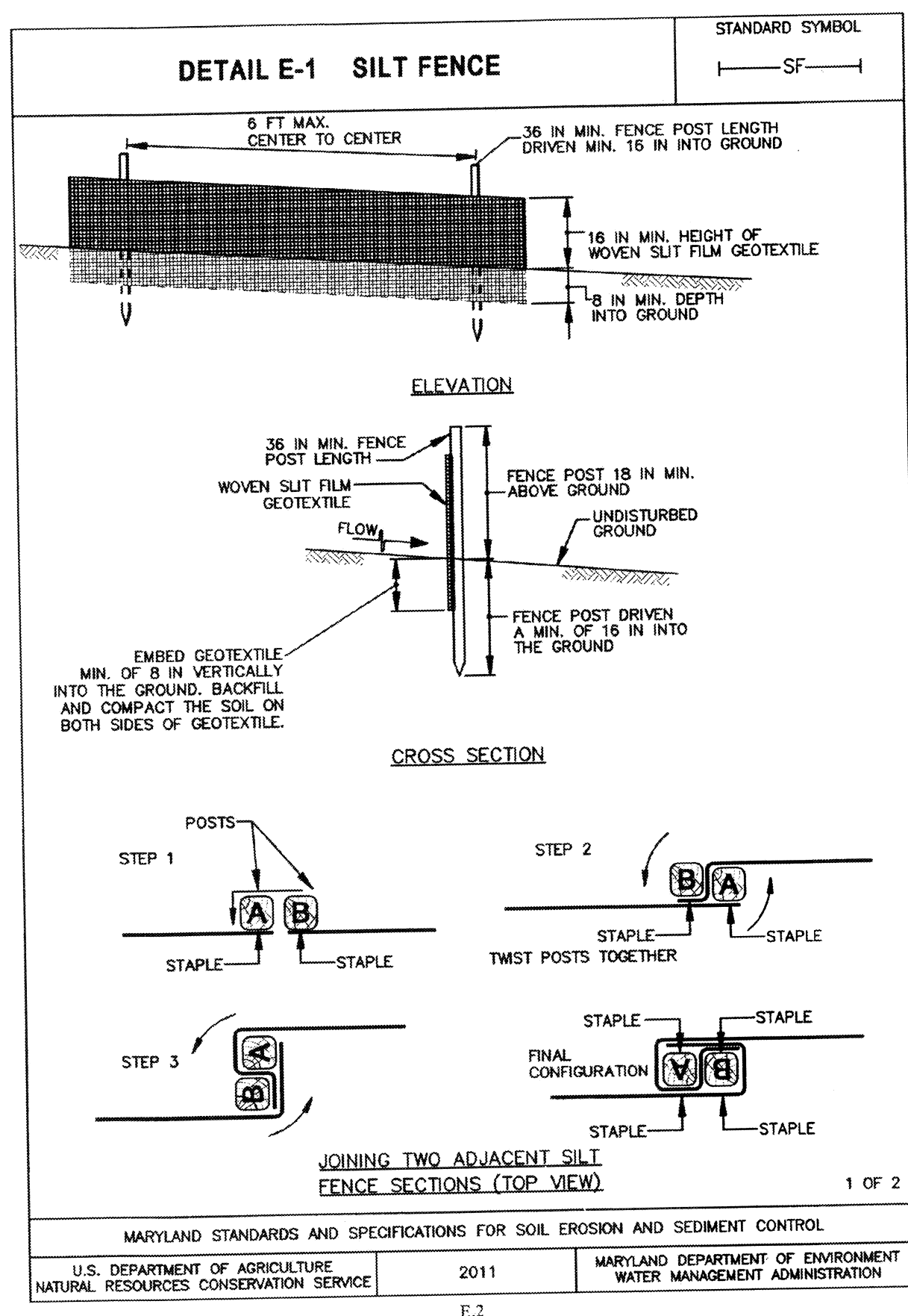
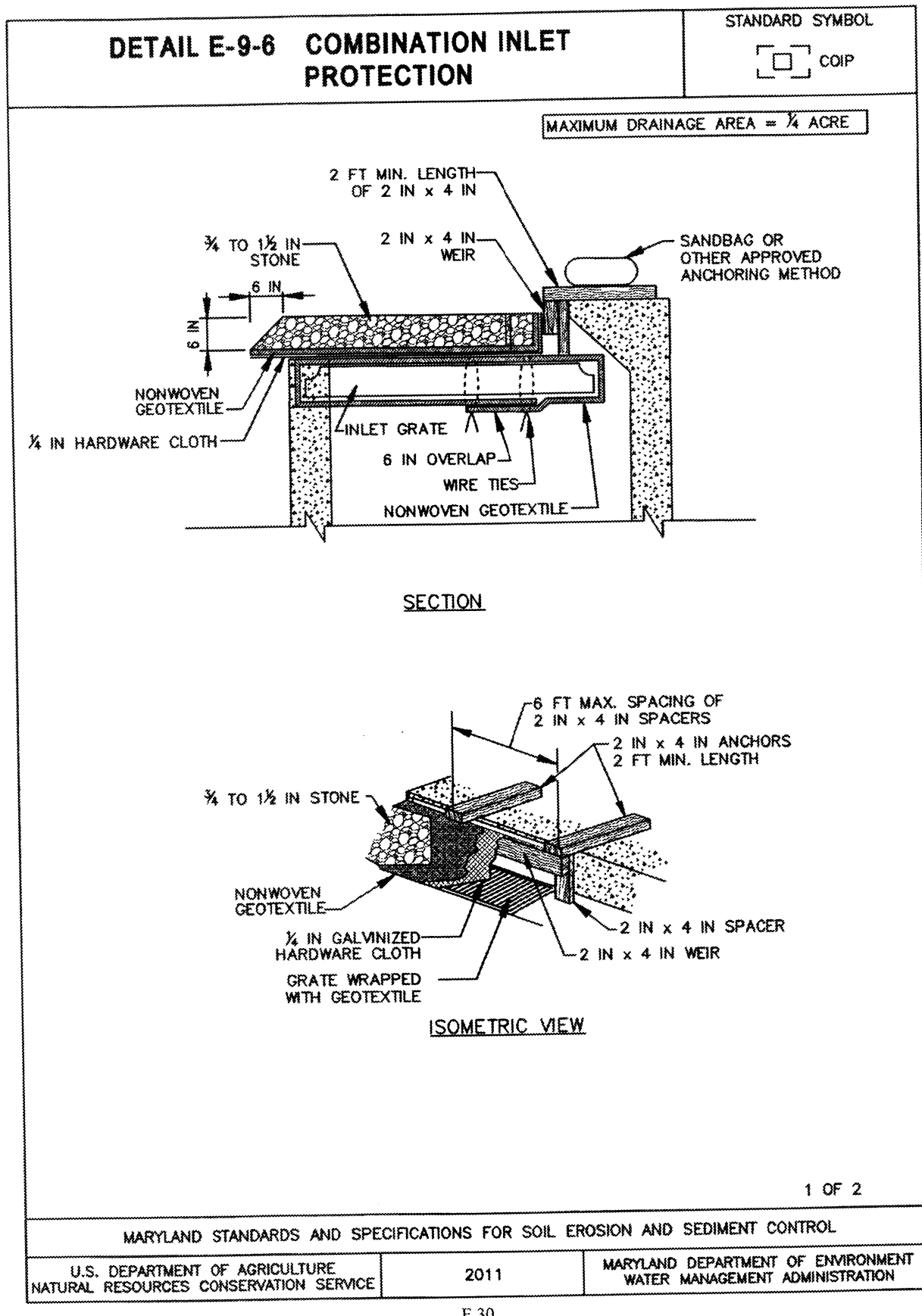
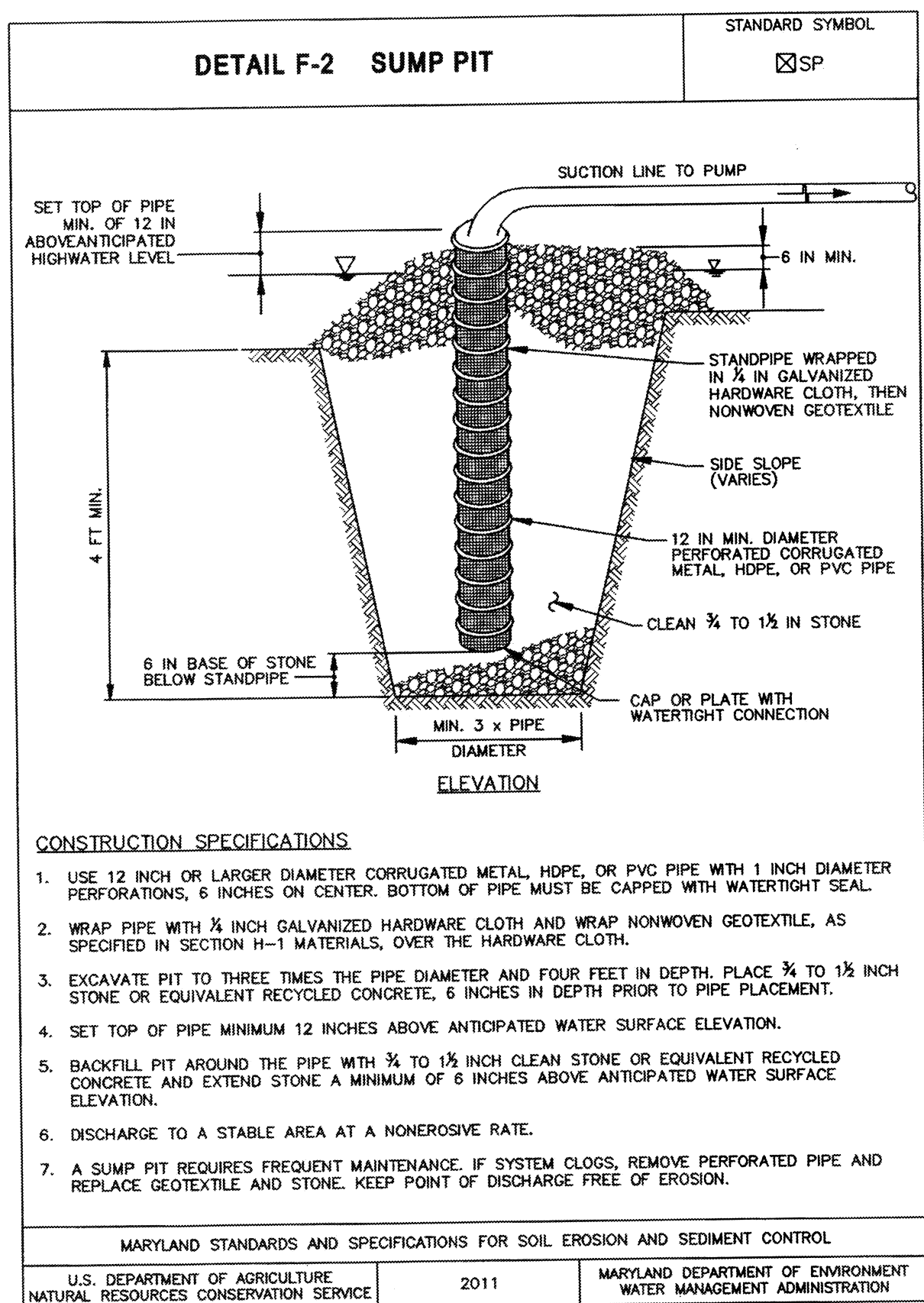
TITLE
SEDIMENT AND EROSION CONTROL
NOTES

SCALE
AS NOTED

PROJECT NO.
10518.00

SHEET NO.
12 OF 20

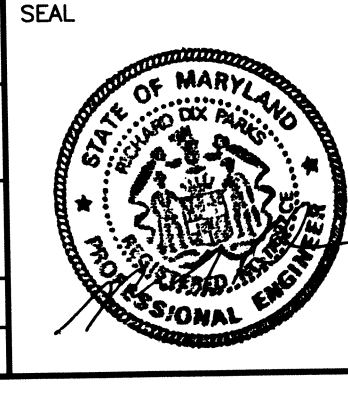
DWG. NO.
SC-2



CITY OF SALISBURY DEPARTMENT OF PUBLIC WORKS	
MICHAEL S. MOULDS DIRECTOR OF PUBLIC WORKS	DATE
TITLE SEDIMENT AND EROSION CONTROL DETAILS	
SCALE AS NOTED	DWG. NO. SC-3
PROJECT NO. 10518.00	SHEET NO. 13 OF 20
REV.	

NO	REVISION	DATE	BY	APP.
1	ISSUED FOR CONSTRUCTION			
0	ISSUED FOR BID			
C	AGENCY COMMENTS	6/13/13	AM	RDP
B	CLIENT COMMENTS	2/19/12	AM	RDP
A	ISSUED TO CLIENT	6/12/12	AM	RDP
NO	REVISION	DATE	BY	APP.

RICHARD D. PARKS, P.E.	
DESIGN	CHECKED
R. D. PARKS, P.E.	
DRAWN	CHECKED
CADD	
DATE	SURVEY DATE
MAY 2012	FIELD BOOK



PROFESSIONAL CERTIFICATION

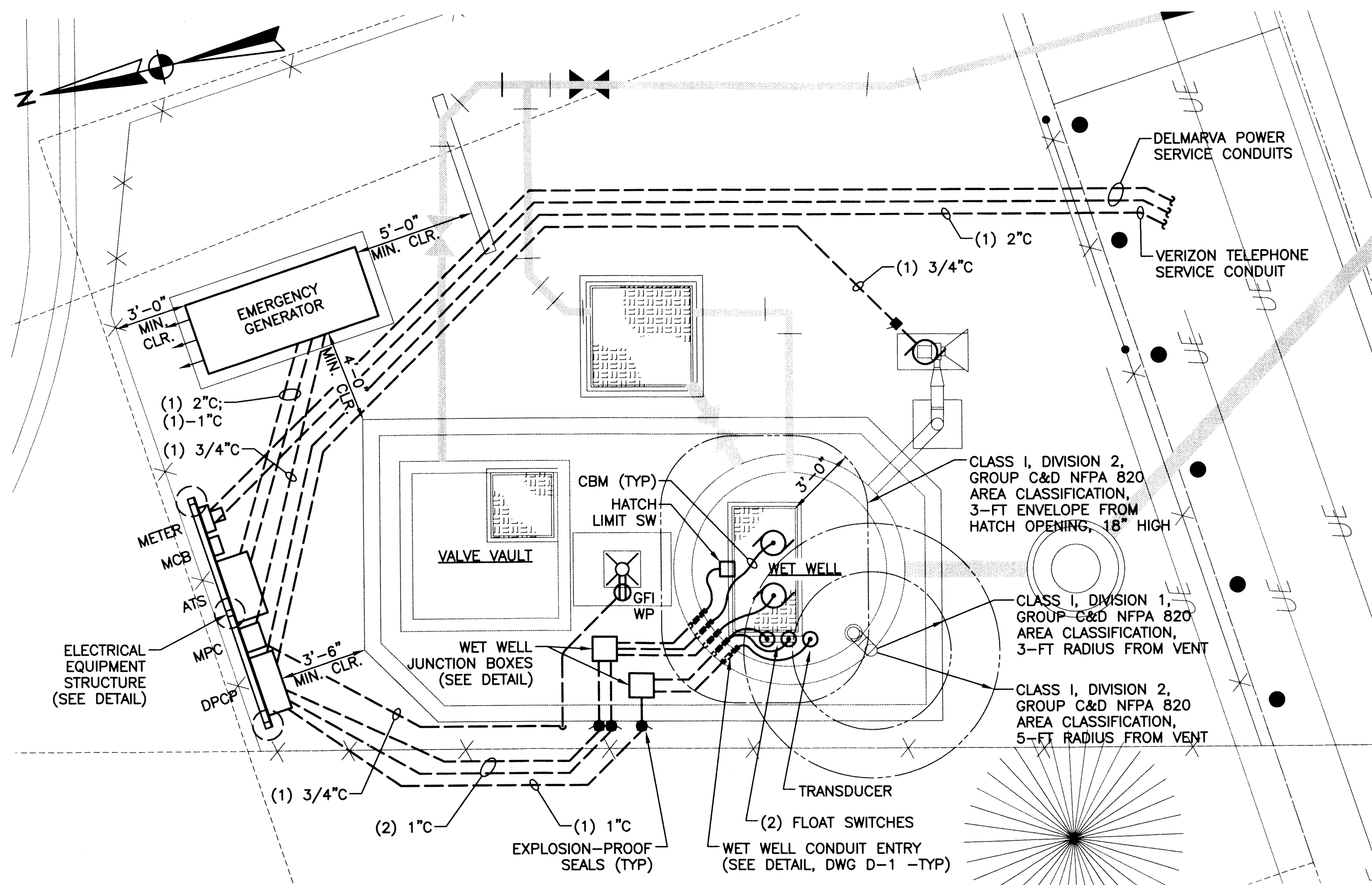
I, RICHARD D. PARKS, P.E., hereby certify that these documents were prepared and approved by me and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 11697, expiration date 11-1-2017.

CLIENT & PROJECT

CITY OF SALISBURY
125 NORTH DIVISION STREET
SALISBURY, MARYLAND 21801-4940

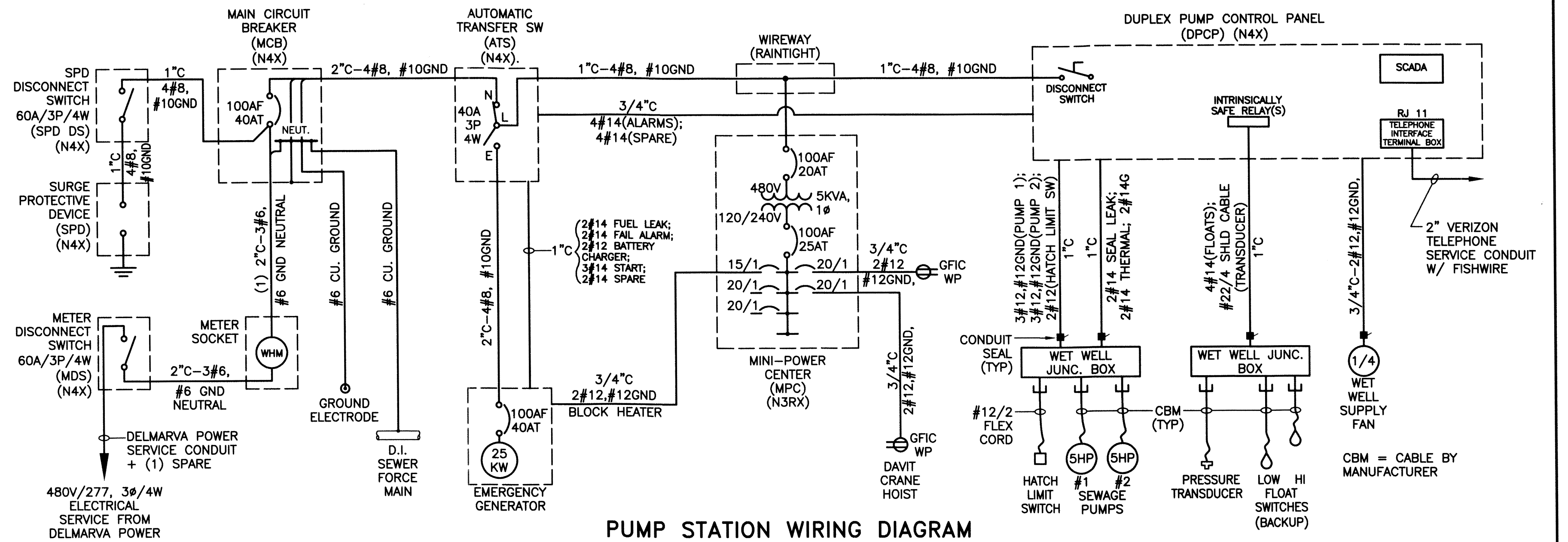
HAMPSHIRE ROAD SEWAGE PUMP STATION
REPLACEMENT AND UPGRADES
SALISBURY, WICOMICO COUNTY, MARYLAND



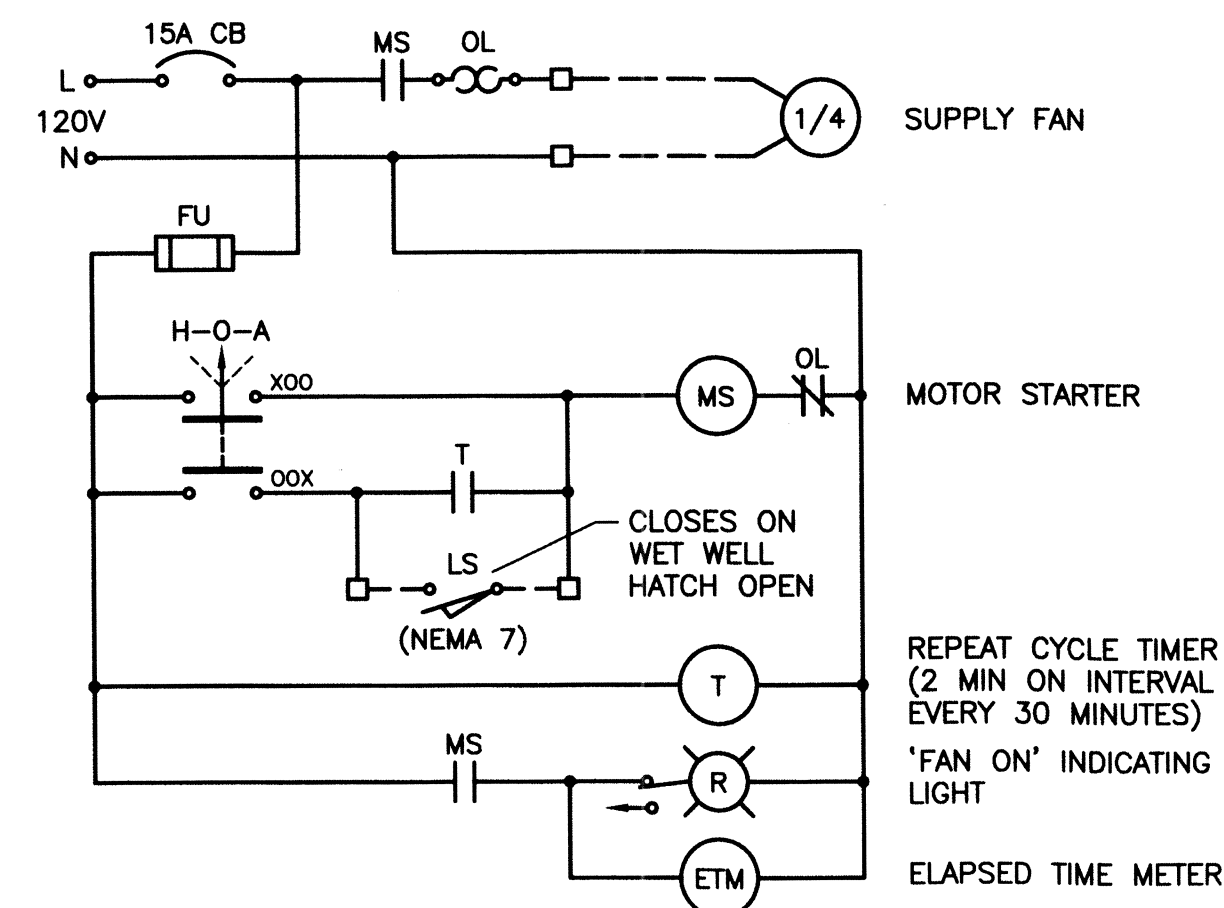


PUMP STATION ELECTRICAL SITE PLAN

SCALE: 1/4" = 1'-0"



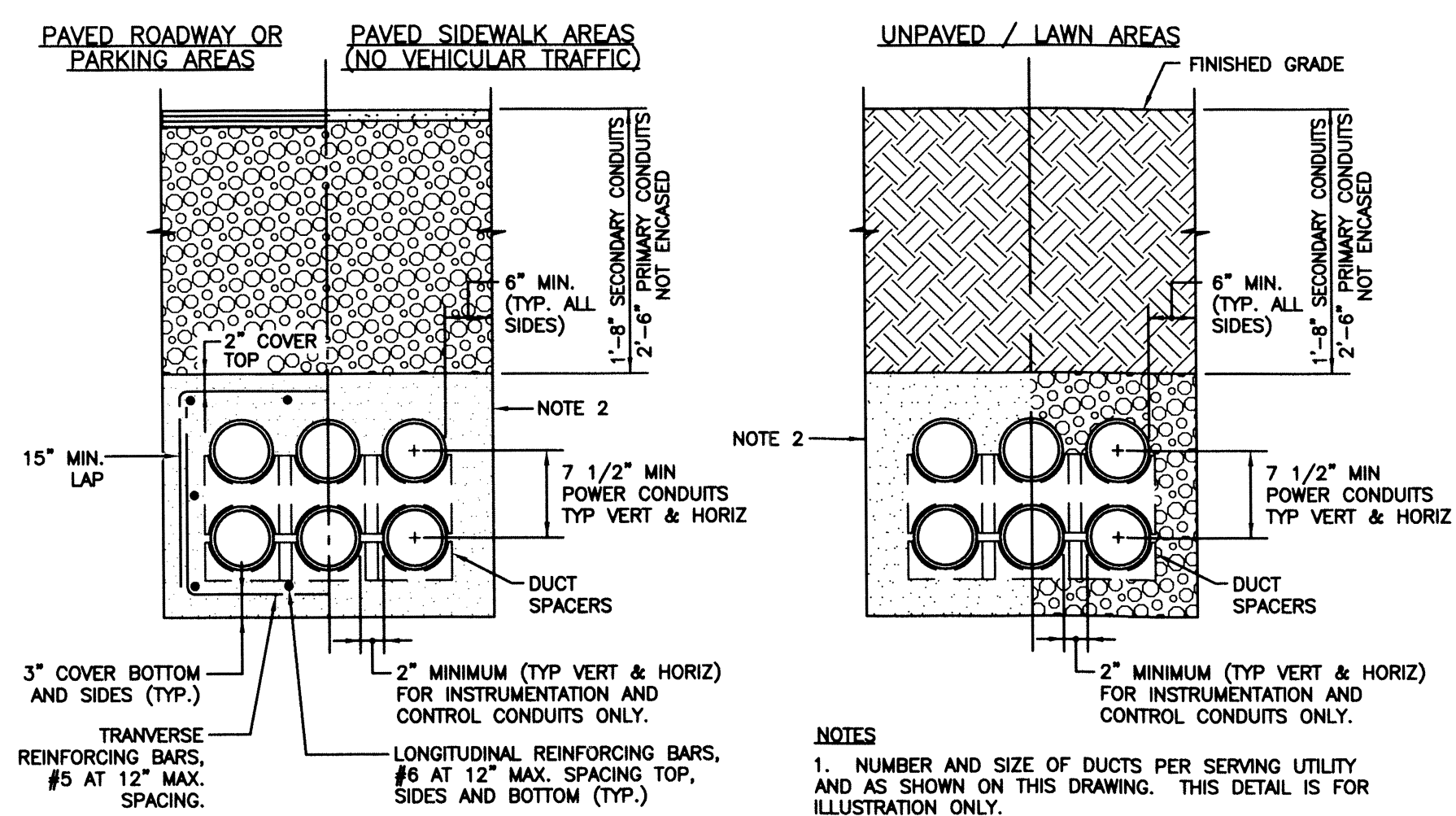
PUMP STATION WIRING DIAGRAM



NOTES:
 1. HATCH SWITCH SHALL ENERGIZE SUPPLY FAN WHEN HATCH IS OPENED.
 2. FAN CONTROLS LOCATED IN PUMP STATION CONTROL PANEL.
 3. FAN SHALL SUPPLY TWO AIR CHANGES PER HOUR VIA CYCLE TIMER WHEN HATCH SWITCH NOT ACTIVATED.

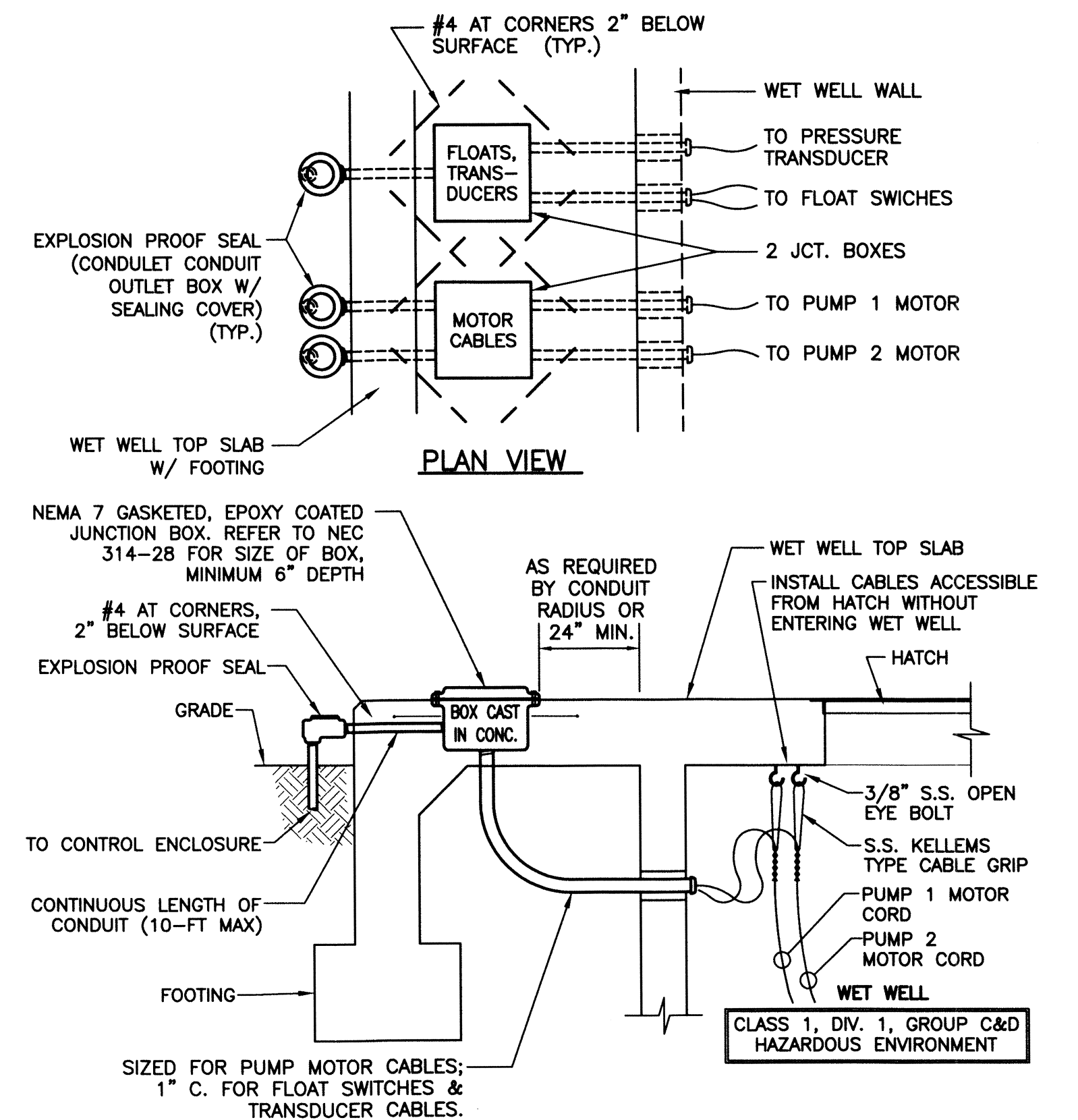
WET WELL SUPPLY FAN

CONTROLS IN DUPLEX PUMP CONTROL PANEL



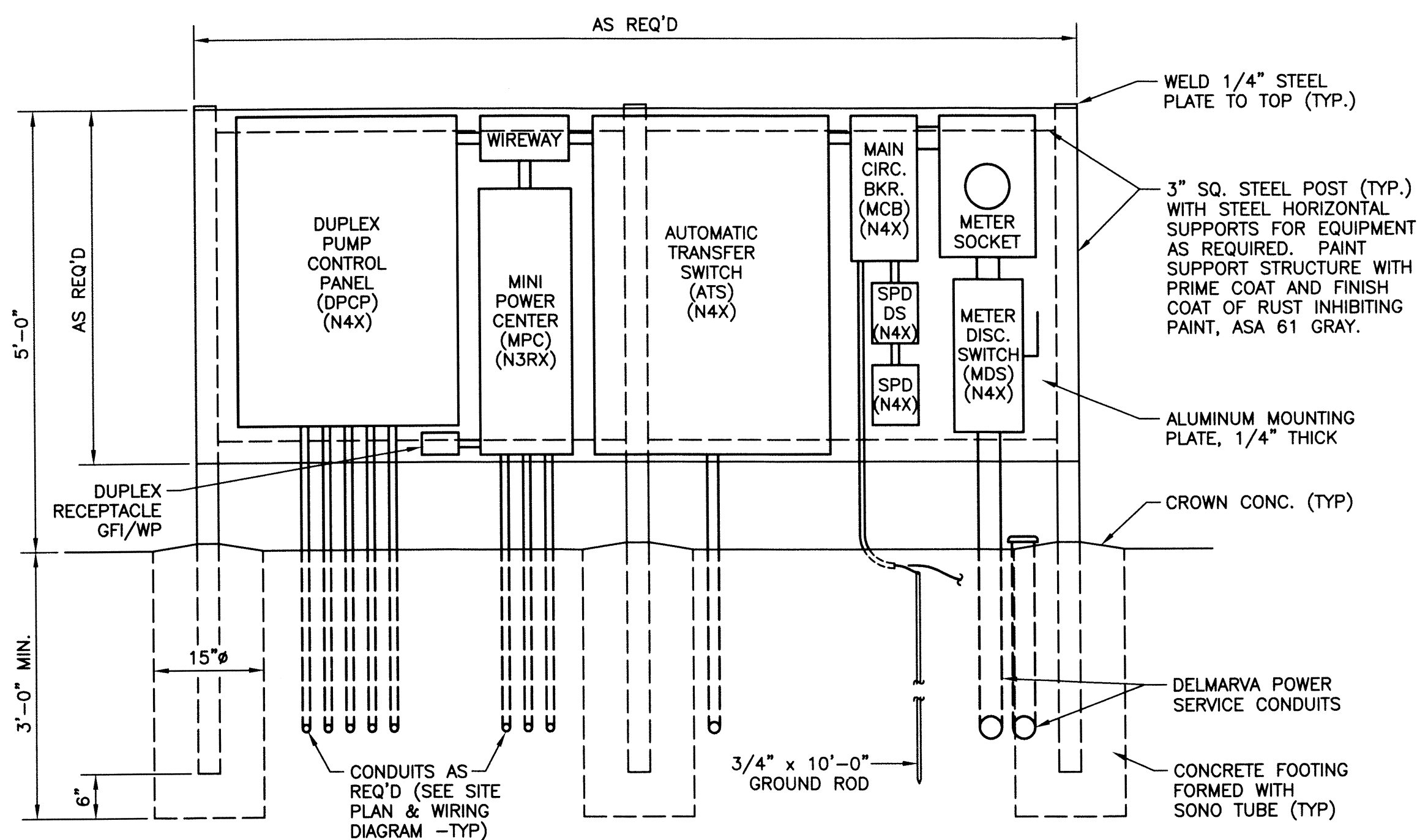
TYPICAL DUCT BANK DETAILS

NO SCALE



TYPICAL JUNCTION BOX AT WELL WELL

NOT TO SCALE

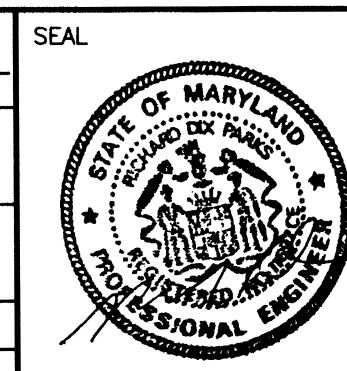


ELECTRICAL EQUIPMENT STRUCTURE

NO SCALE

NO	REVISION	DATE	BY	APP.	NO	REVISION	DATE	BY	APP.	NO	REVISION	DATE	BY	APP.
1	ISSUED FOR CONSTRUCTION				1	ISSUED FOR CONSTRUCTION				1	ISSUED FOR CONSTRUCTION			
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C	AGENCY COMMENTS	6/13/13	AM	ROP	C	AGENCY COMMENTS	6/13/13	AM	ROP	C	AGENCY COMMENTS	6/13/13	AM	ROP
B	CLIENT COMMENTS	12/17/12	AM	ROP	B	CLIENT COMMENTS	12/17/12	AM	ROP	B	CLIENT COMMENTS	12/17/12	AM	ROP
A	ISSUED TO CLIENT	6/12/12	AM	ROP	A	ISSUED TO CLIENT	6/12/12	AM	ROP	A	ISSUED TO CLIENT	6/12/12	AM	ROP

RICHARD D. PARKS, P.E.	CHECKED
DESIGN	
W.R. SWEITZER, P.E.	CHECKED
CADD	
DATE	SURVEY DATE
MAY 2012	FIELD BOOK



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CLIENT & PROJECT
 CITY OF SALISBURY
 125 NORTH DIVISION STREET
 SALISBURY, MARYLAND 21801-4940
 HAMPSHIRE ROAD SEWAGE PUMP STATION
 REPLACEMENT AND UPGRADES
 SALISBURY, WICOMICO COUNTY, MARYLAND

ARRC
 ENGINEERING & ENVIRONMENTAL CONSULTANTS
 1101 Opal Court, Third Floor
 Hagerstown, Maryland 21740
 Tel 301.791.1100

CITY OF SALISBURY DEPARTMENT OF PUBLIC WORKS	DATE
MICHAEL S. MOULDS DIRECTOR OF PUBLIC WORKS	
TITLE PUMP STATION ELECTRICAL PLAN, SCHEMATICS, DETAILS	DWG. NO. E-1
SCALE AS NOTED	
PROJECT NO. 10518.00	SHEET NO. 14 OF 20
REV.	

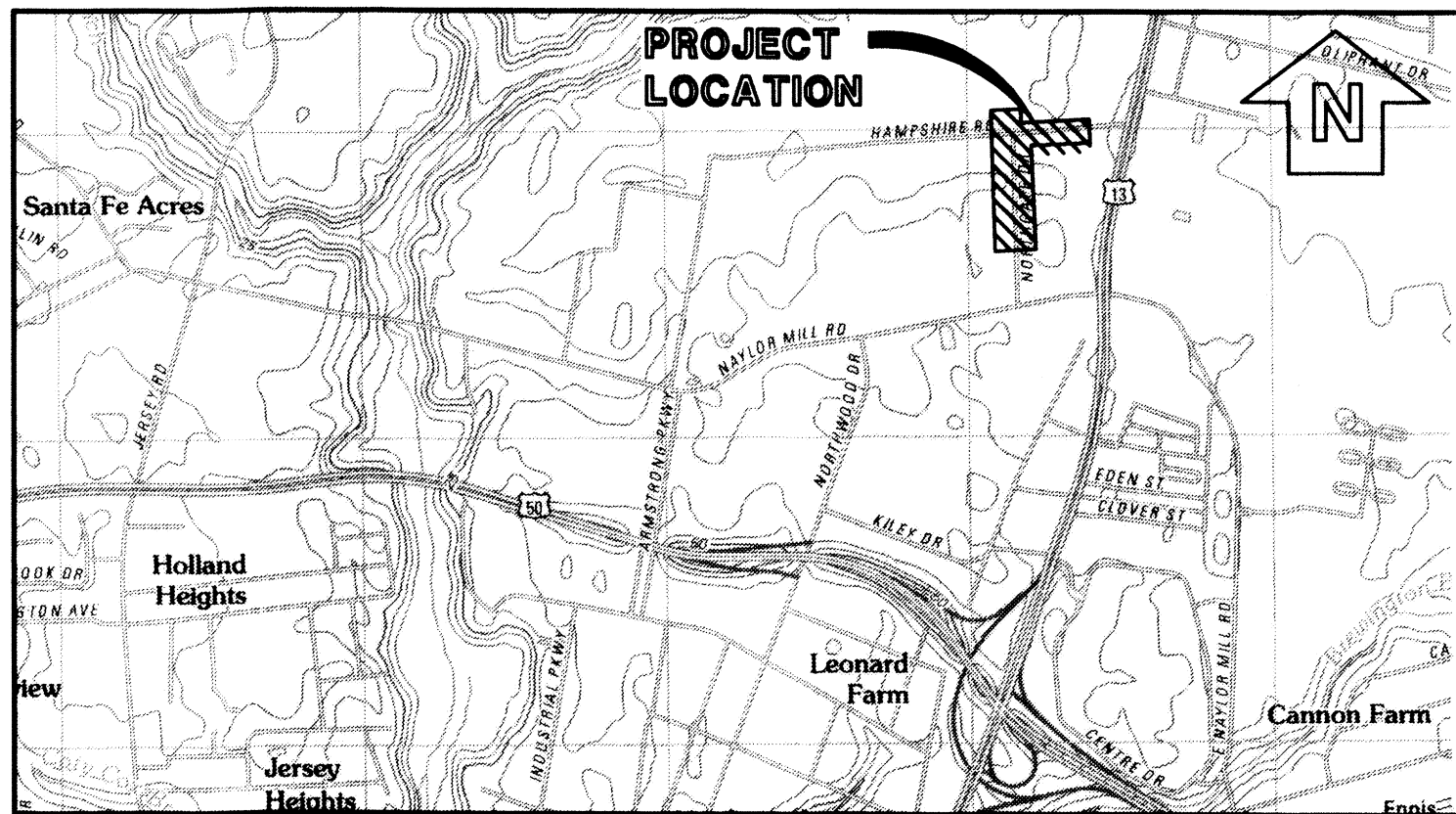
GENERAL NOTES
TEMPORARY TRAFFIC CONTROL PLAN

- ALL TRAFFIC CONTROL DEVICES WILL BE FURNISHED BY THE CONTRACTOR AND REMOVED FROM VIEW WHEN NOT IN USE.
- PEDESTRIAN TRAFFIC SHALL BE DETOURED AROUND ALL WORK ZONES.
- ALL FLAGGERS MUST BE ATSSA CERTIFIED (MARYLAND SPECIFIC) AND ADHERE TO ALL OF MARYLAND'S STANDARDS FOR FLAGGING.
- THE CONTRACTOR WILL MAINTAIN ALL TRAFFIC CONTROL DEVICES 24 HOURS PER DAY AND 7 DAYS PER WEEK. PRIOR TO START OF CONSTRUCTION, THE CONTRACTOR SHALL DESIGNATE AND SUBMIT TO THE CITY THE NAME OF THE PERSON DESIGNATED AS THE TRAFFIC MANAGER WITH CURRENT EMERGENCY CONTACT PHONE NUMBERS.
- A PUBLIC NOTICE IS TO BE PLACED IN THE 'OUR TOWN' SECTION OF THE DAILY TIMES FOR AT LEAST 3 CONSECUTIVE DAYS WITHIN 1 WEEK PRIOR TO IMPLEMENTATION OF EACH PHASE OF WORK AND OR GAPS IN WORK GREATER THAN 5 DAYS OF THE TCP. EACH NOTICE SHALL BE A MINIMUM SIZE OF 1 1/2' WIDE BY 3 1/2' TALL. A COPY OF EACH NOTICE SHALL BE FORWARDED TO SPW FOR APPROVAL PRIOR TO IMPLEMENTATION OF EACH PHASE OF THE TCP.
- THE WORK ZONE MUST BE MANNED ON A DAILY BASIS WHILE THE TCP IS IN PLACE.
- THE WORK ZONE AND ALL TRAFFIC CONTROL DEVICES MUST CONFORM TO THE LATEST VERSION OF THE MARYLAND MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES AT ALL TIMES.
- ALL EQUIPMENT MUST BE FHWA APPROVED/NCARP - 350 RATED.
- ALL SIGNS, ARROW BOARDS, BARRICADES, LIGHTS, FLAGMEN, ETC. NEEDED FOR MAINTENANCE OF TRAFFIC SHALL BE FURNISHED BY THE CONTRACTOR. ALL TRAFFIC CONTROL DEVICES SHALL BE PROPERLY MAINTAINED TO INSURE THAT THE GENERAL PUBLIC'S SAFETY IS NEVER JEOPARDIZED. ALL TRAFFIC CONTROL DEVICES ARE TO CONFORM AND ADHERE TO THOSE SPECIFIED AND SET FORTH IN THE MARYLAND DEPARTMENT OF TRANSPORTATION "NEW WORK ZONE TRAFFIC CONTROL" AND/OR "MARYLAND MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS."
- SALISBURY PUBLIC WORKS SIGNATURES ARE ONLY APPLICABLE TO WORK BEING PERFORMED WITHIN CITY OF SALISBURY RIGHT OF WAYS AND UTILITY EASEMENTS.
- VMBS WILL BE REQUIRED ALONG ALL ROADS LEADING TO THE CONSTRUCTION AREA A MINIMUM OF 1 WEEK PRIOR TO WORK STARTING WORK TO NOTIFY THE PUBLIC OF PENDING TRAFFIC PATTERN CHANGES. VMB'S SHALL REMAIN FOR THE ENTIRE DURATION OF PROJECT, RELOCATION MAY BE NECESSARY AS CONSTRUCTION PROGRESSES.
- THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING PERMISSION FROM EACH PROPERTY OWNER PRIOR TO THE PLACEMENT OF SIGNAGE OR TRAFFIC CONTROL DEVICES. THE CONTRACTOR MUST ALSO CALL MISS UTILITY PRIOR TO THE PLACEMENT OF ANY IN-GROUND SIGNAGE.
- A MINIMUM OF 13-FOOT TRAVEL LANES SHALL BE MAINTAINED. (13' WIDTH IS MEASURED FROM THE EDGE-OF-BARREL/CONE TO EDGE OF BARREL/CONE OR TO FACE-OF-CURB). A MINIMUM 5' OF CLEARANCE MUST BE MAINTAINED BETWEEN ANY OPEN MANHOLES OR TRENCHES AND THE TRAVEL LANE.
- TRENCHES ARE TO BE BACKFILLED AND SUITABLE FOR VEHICULAR AND OR PEDESTRIAN TRAFFIC DURING NON-WORKING HOURS.
- ACCESS TO BUSINESSES AND RESIDENCES MUST BE MAINTAINED AT ALL TIMES.
- ALL DISTURBED PAVEMENT MARKINGS SHALL BE REPLACED IN ACCORDANCE WITH CHAPTER 3 OF THE MARYLAND MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES. THE CITY RESERVES RIGHT TO MODIFY THE EXTENT OF STRIPING REQUIREMENTS AS NECESSARY. DOUBLE LINE STRIPING IS CONSIDERED TO BE INTEGRAL.
- RESOLUTION #2000 THE CITY OF SALISBURY STREET CLOSURE RULES TO SUPPLEMENT THE CITY OF SALISBURY MUNICIPAL CODE AND RESOLUTION #2298 CITY OF SALISBURY OF SALISBURY POLICY FOR THE REPAIR OF STREETS AND RIGHTS OF WAY MUST BE ADHERED TO AT ALL TIMES.
- CONTRACTOR MUST HAND DELIVER A 'NOTICE TO BUSINESSES AND RESIDENTS' TO ALL BUSINESSES AND RESIDENTS WITHIN THE GENERAL VICINITY OF THE TCP 5 BUSINESS DAYS PRIOR TO START OF EACH PHASE OF THE WORK. THE NOTICE MUST BE ON COMPANY LETTERHEAD AND INCLUDE THE CONTACT PHONE NUMBER AND NAME OF THE TRAFFIC MANAGER AND A BRIEF DESCRIPTION OF WHAT CITIZENS CAN EXPECT (I.E. NOISE, 1-LANE TRAFFIC, ETC.). IT IS ALSO TO CONTAIN THE NAME AND PHONE NUMBER FOR A DESIGNATED SALISBURY PUBLIC WORKS CONTACT WHICH WILL BE PROVIDED AT THE PRE-CONSTRUCTION MEETING. A COPY MUST BE FORWARDED TO RON WELLS OR FRANK ENNIS FOR APPROVAL PRIOR TO DISTRIBUTION.
- THE CITY RESERVES THE RIGHT TO REQUIRE MODIFICATIONS TO THE TCP AS NECESSARY FOR PUBLIC SAFETY, TO IMPROVE TRAFFIC FLOW OR TO CORRECT DEFICIENCIES IN THE PLAN. ANY MODIFICATIONS SHALL BE AT NO ADDITIONAL COST TO THE CITY.
- A PRE-CONSTRUCTION MEETING MUST BE HELD ON SITE A MINIMUM OF 5 WORKING DAYS PRIOR TO IMPLEMENTATION OF EACH PHASE OF THE TCP. NOTIFY RON WELLS AT 410-548-5460, BY EMAIL AT RWELLS@CITY.SALISBURY.MD.US OR FRANK ENNIS AT 410-548-5460, BY E-MAIL AT FENNIS@CITY.SALISBURY.MD.US TO SCHEDULE THIS MEETING.
- THE OWNER/CONTRACTOR MUST GIVE 5 DAYS NOTICE PRIOR TO THE START OF EACH PHASE OF WORK TO: SALISBURY PUBLIC WORKS (RON WELLS OR FRANK ENNIS), WICOMICO COUNTY EMERGENCY SERVICES, THE MARYLAND STATE HIGHWAY ADMINISTRATION, WICOMICO COUNTY BOARD OF EDUCATION'S TRANSPORTATION DEPT. AND CENTRAL ALARM AS APPLICABLE.
- LANE SHIFTS AND CLOSURES OVER 3 DAYS IN DURATION SHALL REQUIRE EXISTING STRIPING TO BE BLACKED OUT AND THE APPROPRIATE COLORED TEMPORARY STRIPING INSTALLED ALONG THE PATH OF BARRELS & CONES TO INDICATE THE REVISED TRAVEL PATH, PER MDOT. STRIPING SHALL BE RESTORED TO ITS INITIAL PATTERN ONCE EACH PHASE OF THE TCP IS COMPLETED.

HAMPSHIRE ROAD SEWAGE PUMP STATION REPLACEMENT and IMPROVENMENTS

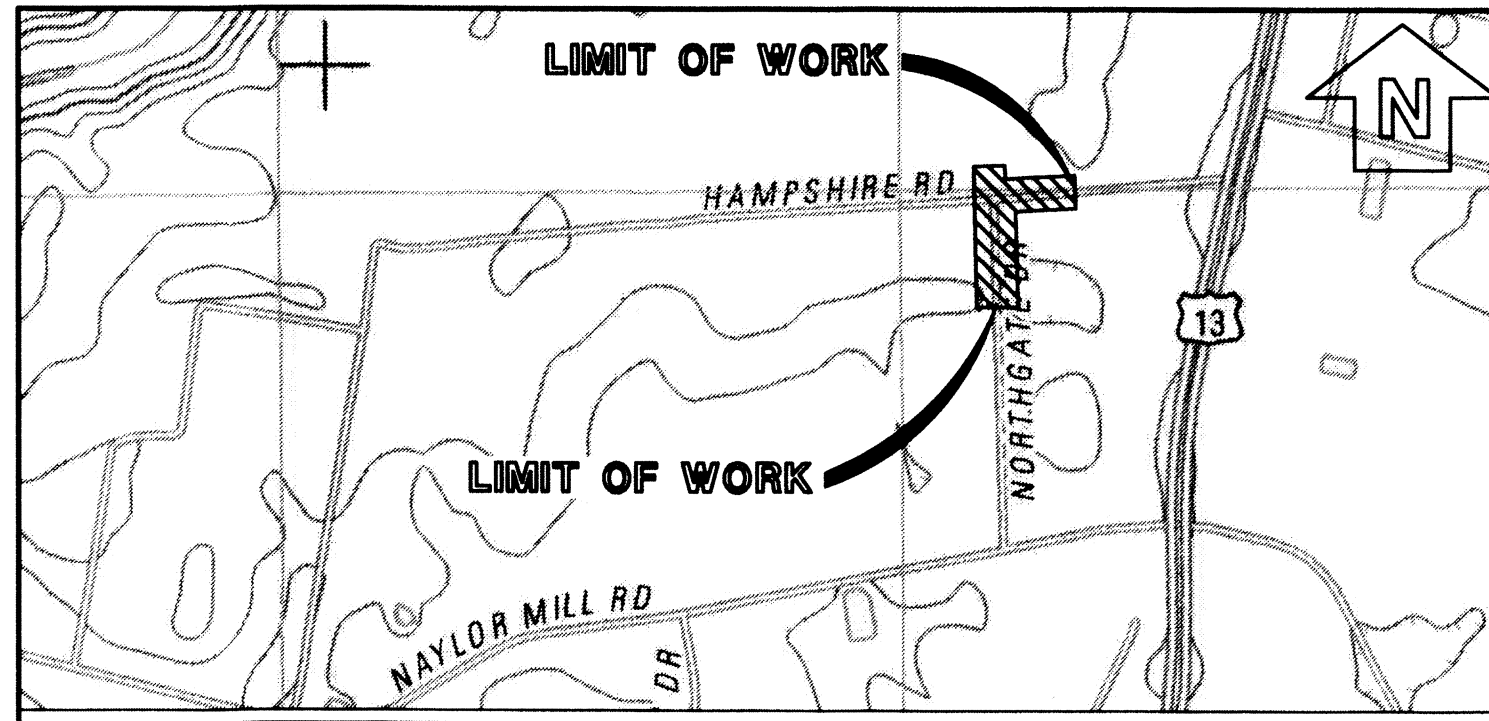
TRAFFIC CONTROL PLAN

APRIL 2013



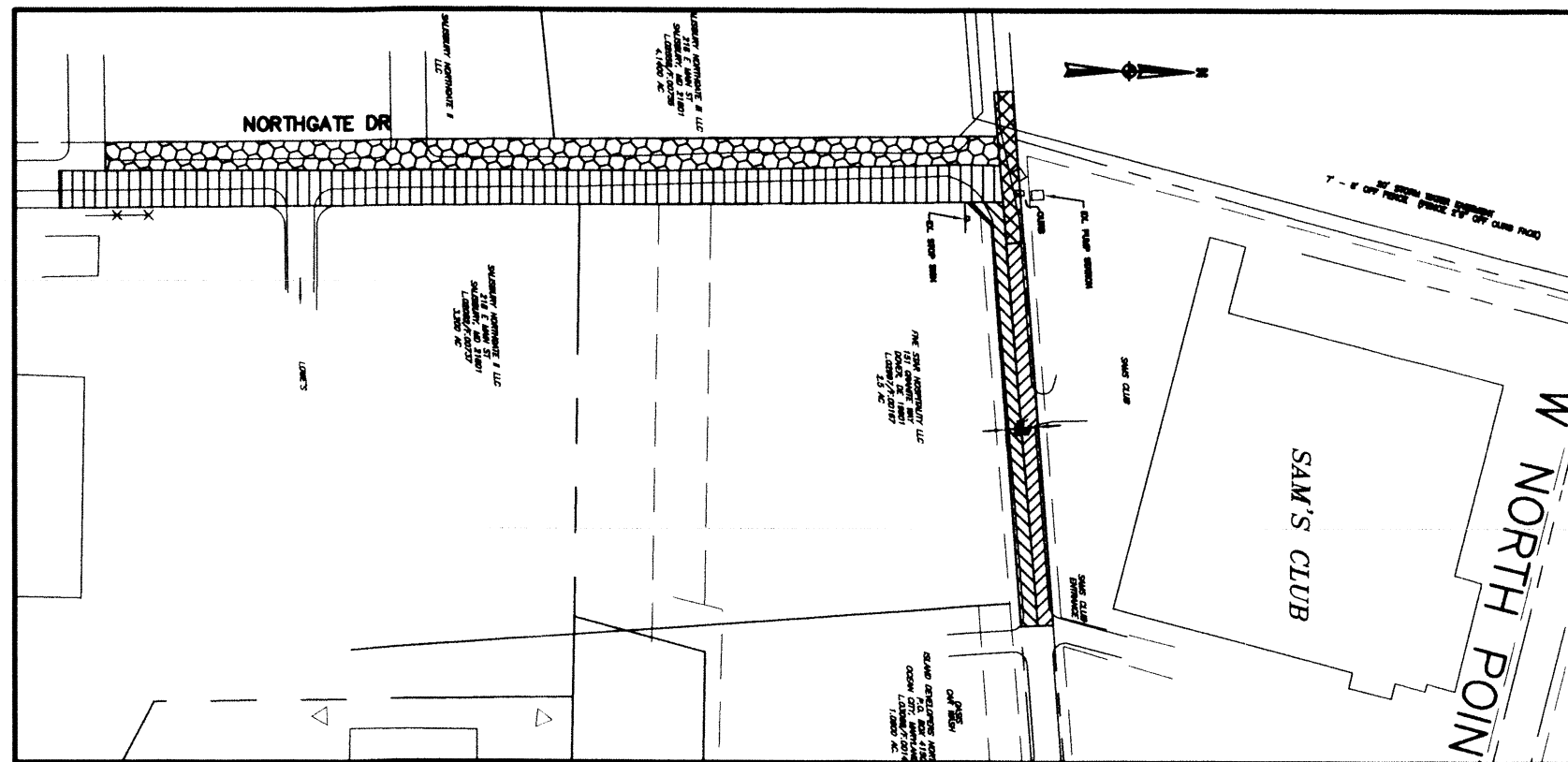
VICINITY MAP

SCALE: 1" = 2000'



LOCATION MAP

SCALE: 1" = 1000'



KEY PLAN

SCALE: 1" = 200'

- PHASE I AND PHASE VII
- PHASE II, PHASE V, AND PHASE VIII
- PHASE III AND PHASE VII
- PHASE IV AND PHASE VII
- PHASE VI AND PHASE VII

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED UNDER MY SUPERVISION AND IN ACCORDANCE WITH THE MARYLAND MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITION. I FURTHER CERTIFY THAT TO THE BEST OF MY ABILITY THE PLAN FEATURES THE MINIMUM AMOUNT OF TRAFFIC DISRUPTION NECESSARY TO COMPLETE THE WORK IN AND ALONG THE PUBLIC ROADWAY.

RICHARD D. PARKS, P.E.
NO. 11697

4/12/13

DATE

INDEX

TP-1A	COVER, GENERAL NOTES
TP-1	TRAFFIC CONTROL PLAN, PHASE 1 AND 2
TP-2	TRAFFIC CONTROL PLAN, PHASE 3 AND 4
TP-3	TRAFFIC CONTROL PLAN, PHASE 5 AND 6
TP-4	TRAFFIC CONTROL PLAN, PHASE 7
TP-5	TRAFFIC CONTROL PLAN, PHASE 8, TYPICAL SKETCH

CONSTRUCTION SCHEDULE

SCHEDULE

START DAY - _____

END DAY - _____

HOURS OF OPERATION - 9am to 3pm

TOTAL DAYS - 46 WORKING DAYS

4 INCLIMATE WEATHER DAYS

7 DAYS FOR CURING OF CONCRETE CURB

- PHASE 1**
- 2 DAYS 1-1 CONSTRUCT MANHOLE AND GRAVITY SEWER MAIN IN THE WESTBOUND LANE OF HAMPSHIRE ROAD.
- 2 DAYS 1-2 CONSTRUCT FORCE MAIN IN THE WESTBOUND LANE OF HAMPSHIRE ROAD.
- 7 DAYS 1-3 REMOVE AND REPLACE CONCRETE CURB ALONG HAMPSHIRE ROAD.
- 1 DAY 1-4 INSTALL BITUMINOUS DRIVEWAY FROM HAMPSHIRE ROAD TO THE PUMP STATION.
- 12 DAYS (1 DAY INCLIMATE WEATHER, 7 DAYS CURING TIME FOR CONCRETE CURB)
- PHASE 2**
- 9 DAYS 2-1 CONSTRUCT SEWER FORCE MAIN IN NORTHGATE DRIVE AND CONNECT TO EXISTING MANHOLE.
- 1 DAY 2-2 INSTALL PERMANENT ROAD PATCH OVER SEWER FORCE MAIN.
- 10 DAYS (1 DAY INCLIMATE WEATHER)
- PHASE 3**
- 5 DAYS 3-1 REMOVE EXISTING PAVING TO SUBGRADE IN THE WESTBOUND LANE OF HAMPSHIRE ROAD.
- 3 DAYS 3-2 INSTALL AGGREGATE BASE COURSE.
- 2 DAYS 3-3 INSTALL HOT MIX ASPHALT BASE COURSE.
- 10 DAYS (1 DAY INCLIMATE WEATHER)
- PHASE 4**
- 5 DAYS 4-1 REMOVE EXISTING PAVING TO SUBGRADE IN THE EASTBOUND LANE OF HAMPSHIRE ROAD.
- 3 DAYS 4-2 INSTALL AGGREGATE BASE COURSE
- 2 DAYS 4-3 INSTALL HOT MIX ASPHALT BASE COURSE
- 10 DAYS (1 DAY INCLIMATE WEATHER)
- PHASE 5**
- 1 DAY 5-1 MILL NORTHBOUND LANE OF NORTHGATE DRIVE
- PHASE 6**
- 1 DAY 6-1 MILL SOUTHBOUND LANE OF NORTHGATE DRIVE
- PHASE 7**
- 1 DAY 7-1 INSTALL HOT MIX ASPHALT WEARING COURSE ON WESTBOUND LANE OF HAMPSHIRE ROAD AND SOUTHBOUND LANE OF NORTHGATE DRIVE
- PHASE 8**
- 1 DAY 8-1 INSTALL HOT MIX ASPHALT WEARING COURSE ON EASTBOUND LANE OF HAMPSHIRE ROAD AND NORTHBOUND LANE OF NORTHGATE DRIVE

CITY OF SALISBURY
DEPARTMENT OF PUBLIC WORKS

CITY PROJECT # 03-12-INF

MICHAEL S. MOULDS, P.E.
DIRECTOR OF PUBLIC WORKS

DATE

FRANK ENNIS
TECHNICAL SERVICES MANAGER

DATE

TITLE COVER, GENERAL NOTES

SCALE

AS SHOWN


PROJECT NO.

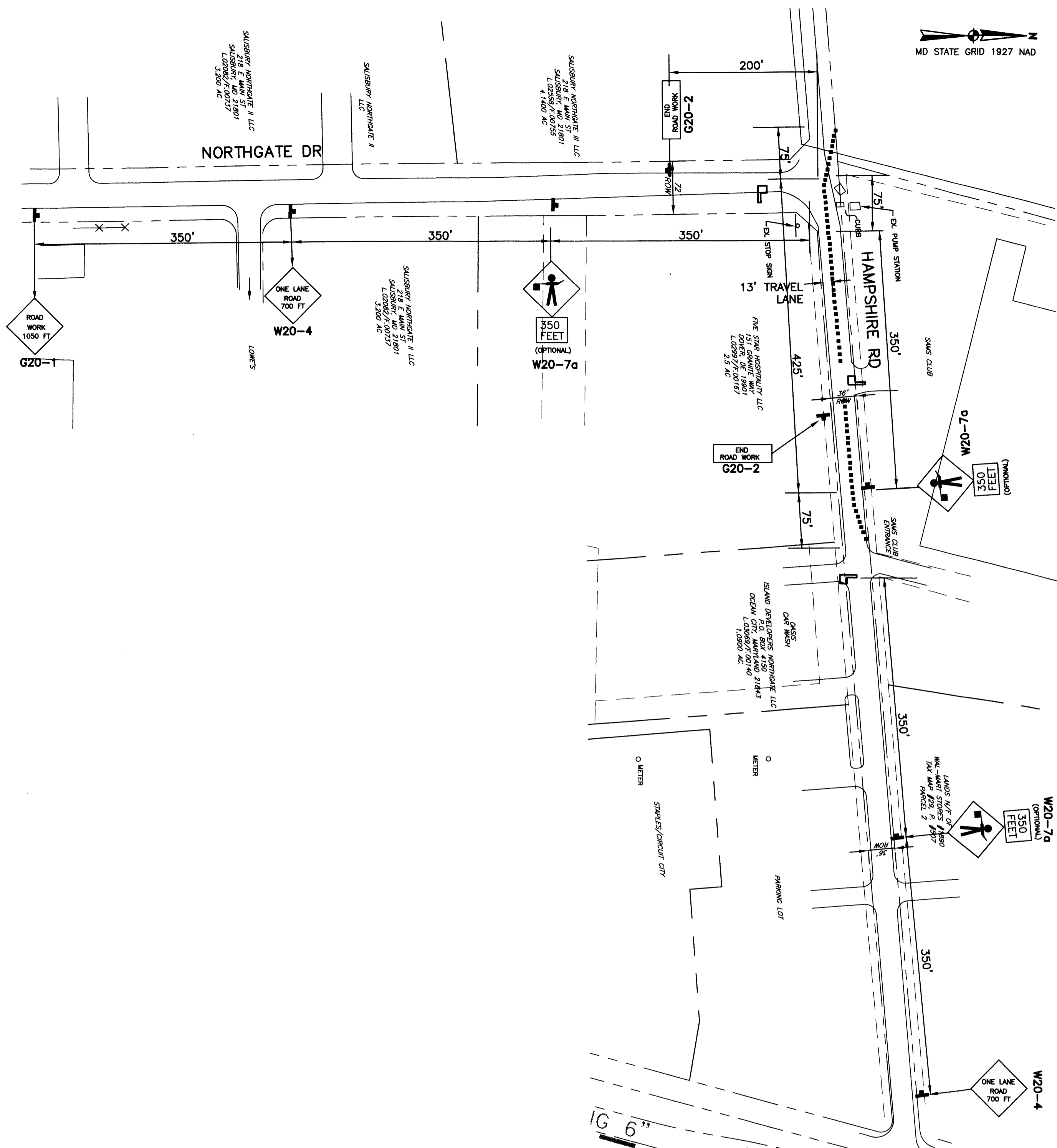
SHEET NO.

15 OF 20

DWG. NO.
TP-1-A



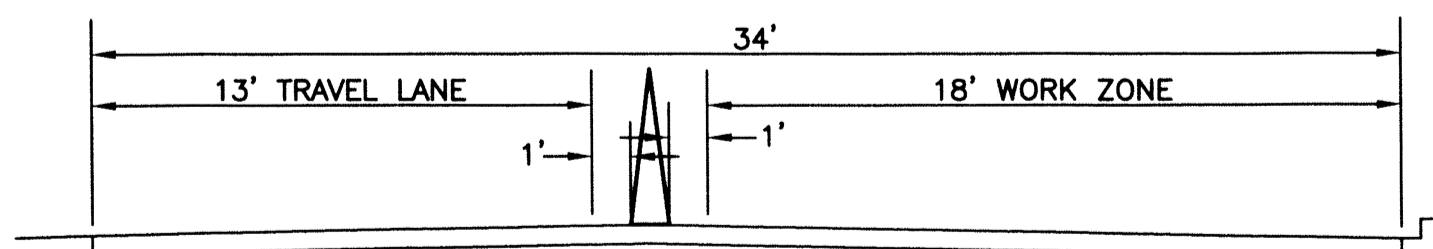
										<div><div>SEAL</div><div></div><div>PROFESSIONAL CERTIFICATION</div></div>										<div><div>CLIENT & PROJECT</div><div>CITY OF SALISBURY 125 N. DIVISION STREET, ROOM 202 SALISBURY, MARYLAND 21801-4940</div><div>HAMPSHIRE ROAD PUMP STATION REPLACEMENT AND IMPROVEMENTS CITY OF SALISBURY, WICOMICO COUNTY, MARYLAND</div></div>										<div><div><div>TITLE</div><div>TRAFFIC CONTROL PLAN</div></div><div><div>SCALE</div><div>AS SHOWN</div></div><div><div>PROJECT NO.</div><div>10518.00</div></div><div><div>SHEET NO.</div><div>16 OF 20</div></div><div><div>REV.</div><div></div></div><div><div>DWG. NO.</div><div>TP-1</div></div></div>									
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PHASE III TRAFFIC CONTROL PLAN

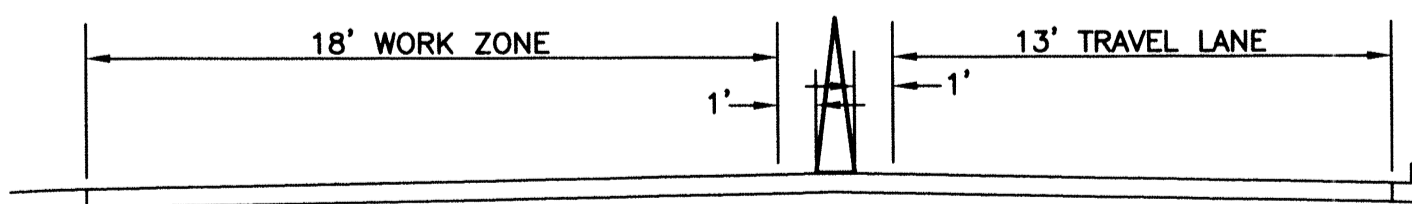
SCALE: 1" = 100'

PHASE III REMOVE PAVING IN WESTBOUND LANE OF HAMPSHIRE ROAD. INSTALL AGGREGATE BASE, BITUMINOUS BASE COURSE. 10 WORKING DAYS (1 DAY INCLIMATE WEATHER)



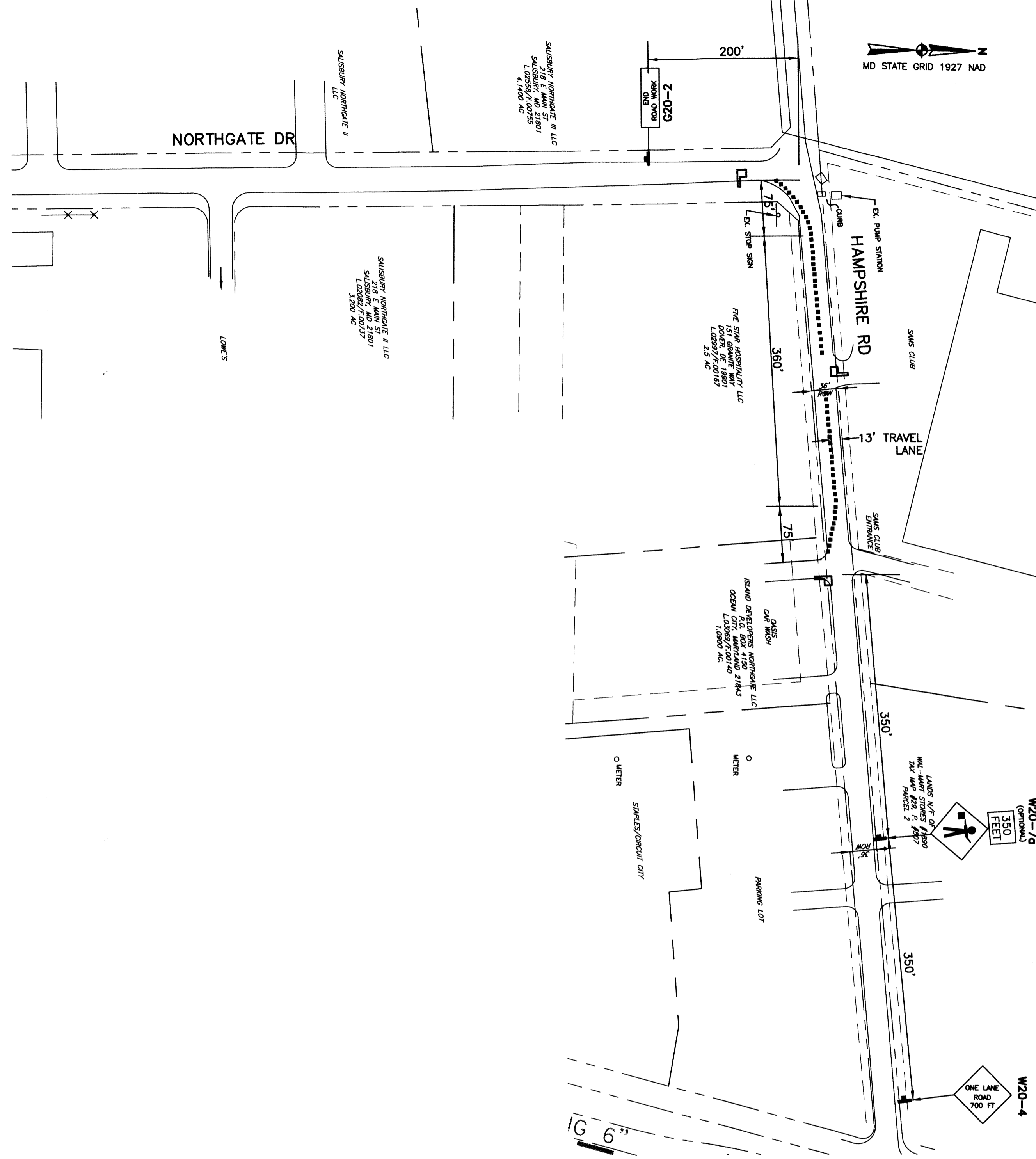
HAMPSHIRE RD PHASE 3

SCALE: 1" = 5'



HAMPSHIRE RD PHASE 4

SCALE: 1" = 5'



PHASE IV TRAFFIC CONTROL PLAN

SCALE: 1" = 100'

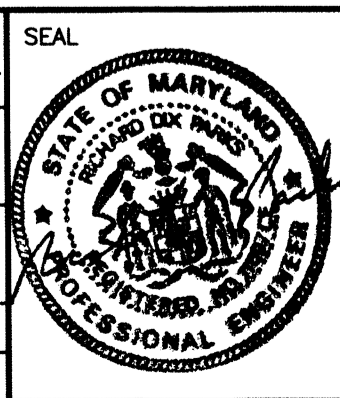
PHASE IV REMOVE PAVING IN EASTBOUND LANE OF HAMPSHIRE ROAD. INSTALL AGGREGATE BASE, BITUMINOUS BASE COURSE. 10 WORKING DAYS (1 DAY INCLIMATE WEATHER)

CITY OF SALISBURY
DEPARTMENT OF PUBLIC WORKS
CITY PROJECT # 03-12-INF
MICHAEL S. MOULDS, P.E.
DIRECTOR OF PUBLIC WORKS
DATE
FRANK ENNIS
TECHNICAL SERVICES MANAGER
DATE

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RICHARD D. PARKS, P.E.
NO. 11697
11-17-17
DATE

NO	REVISION	DATE	BY	APP.
1	ISSUED FOR CONSTRUCTION			
0	ISSUED FOR BID			
D	AGENCY COMMENTS	05/29/15	JLW	RDP
C	AGENCY COMMENTS	6/13/13	ACM	RDP
B	AGENCY COMMENTS	12/12/12	ACM	RDP
A	ISSUED TO CLIENT			
NO	REVISION	DATE	BY	APP.

RICHARD D. PARKS, P.E.	SEAL
RELEASED BY	PROFESSIONAL CERTIFICATION
DESIGN	I, RICHARD D. PARKS, P.E., hereby certify that these documents were prepared and approved by me and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 11697, expiration date 11-1-2017.
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DRAWN	CHECKED
CAD	
DATE	SURVEY DATE
NOVEMBER 2012	FIELD BOOK

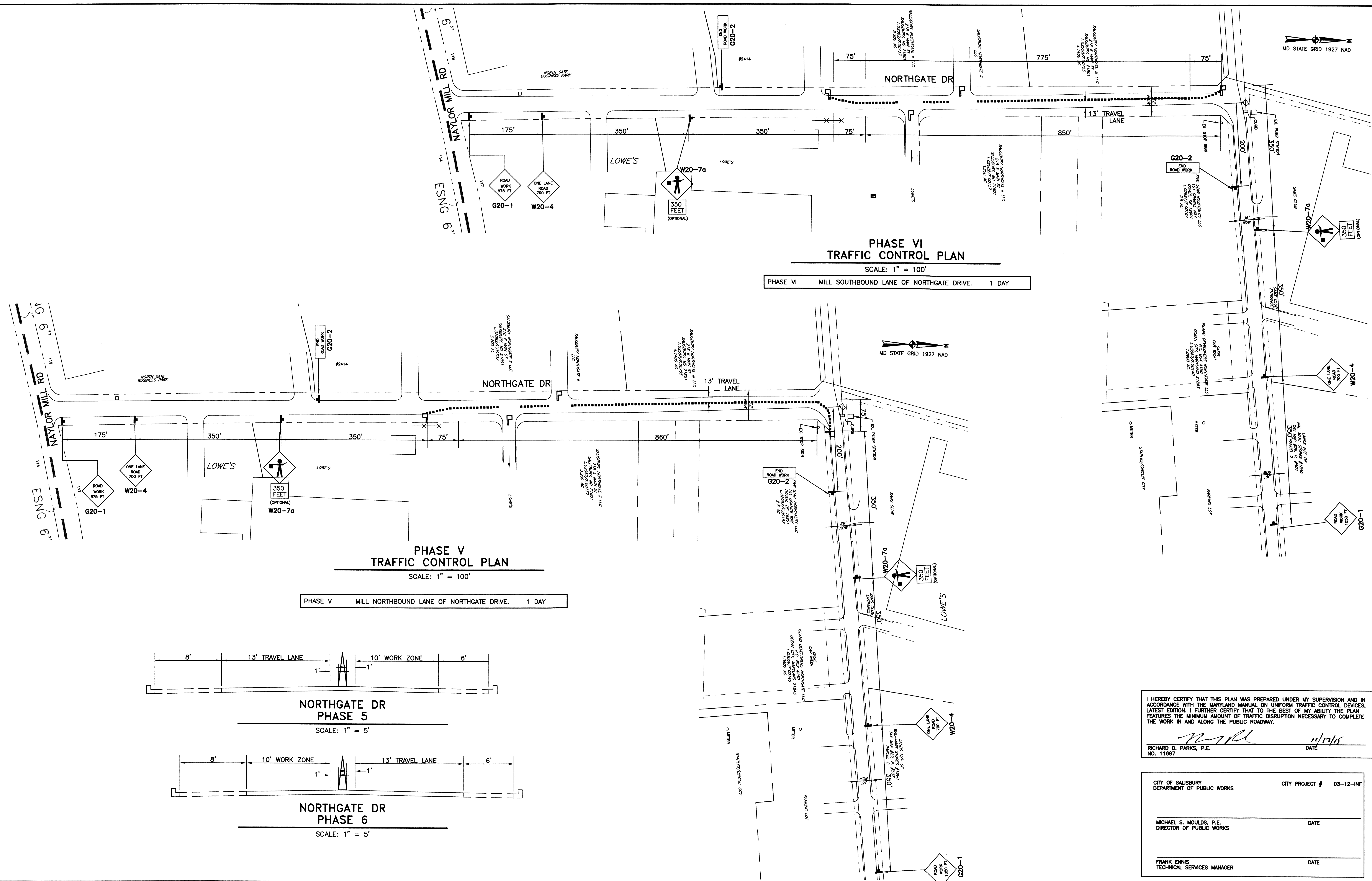


CITY OF SALISBURY
125 N. DIVISION STREET, ROOM 202
SALISBURY, MARYLAND 21801-4940
HAMPSHIRE ROAD PUMP STATION
REPLACEMENT AND UPGRADES
CITY OF SALISBURY, WICOMICO COUNTY, MARYLAND

CLIENT & PROJECT
CITY OF SALISBURY
125 N. DIVISION STREET, ROOM 202
SALISBURY, MARYLAND 21801-4940
HAMPSHIRE ROAD PUMP STATION
REPLACEMENT AND UPGRADES
CITY OF SALISBURY, WICOMICO COUNTY, MARYLAND

ARRCO
ENGINEERING & ENVIRONMENTAL CONSULTANTS
1101 Opal Court, Third Floor
Hagerstown, Maryland 21740
Tel 301.791.1100

TITLE	TRAFFIC CONTROL PLAN
SCALE	AS SHOWN
PROJECT NO.	10518.00
SHEET NO.	17 OF 20
DWG. NO.	TP-2



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Richard D. Parks, P.E. 11/17/15
RICHARD D. PARKS, P.E. DATE
NO. 11697

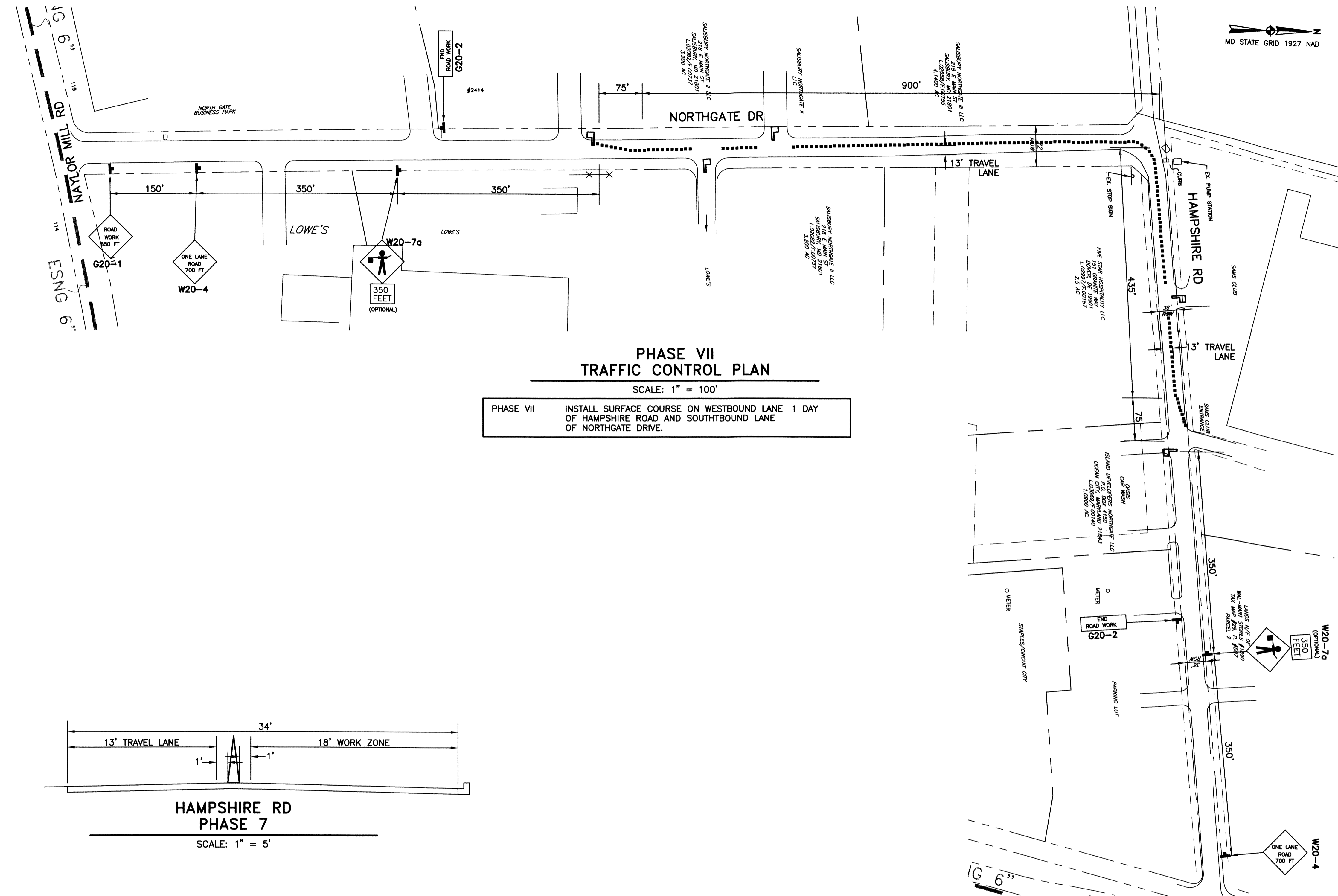
CITY OF SALISBURY DEPARTMENT OF PUBLIC WORKS	CITY PROJECT # 03-12-INF
MICHAEL S. MOULDS, P.E. DIRECTOR OF PUBLIC WORKS	DATE
FRANK ENNIS TECHNICAL SERVICES MANAGER	DATE

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RICHARD D. PARKS, P.E.				RELEASED BY				DESIGN				CHECKED			
R.D. PARKS, P.E.				DRAWN				CHECKED							
CAD				DATE				SURVEY DATE							
NOVEMBER 2012				FIELD BOOK											

SEAL				PROFESSIONAL CERTIFICATION				CLIENT & PROJECT			
				I RICHARD D. PARKS, P.E. hereby certify that these documents were prepared and approved by me and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 11697, expiration date 11-1-2017.				CITY OF SALISBURY 125 N. DIVISION STREET, ROOM 202 SALISBURY, MARYLAND 21801-4940 HAMPSHIRE ROAD PUMP STATION REPLACEMENT AND UPGRADES CITY OF SALISBURY, WICOMICO COUNTY, MARYLAND			

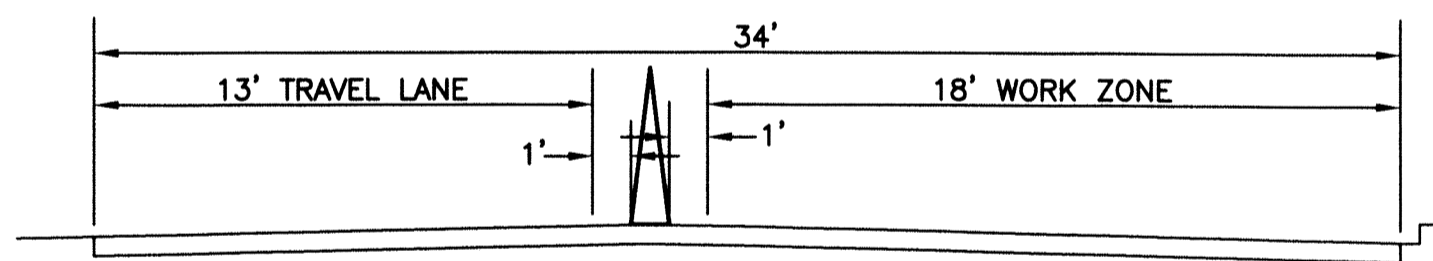
				TITLE			
1101 Opal Court, Third Floor Hagerstown, Maryland 21740 Tel 301.791.1100				TRAFFIC CONTROL PLAN			
				SCALE			
				AS SHOWN			
				PROJECT NO.			
				10518.00			
				SHEET NO.			
				18 OF 20			
				REV.			
				TP-3			



**PHASE VII
TRAFFIC CONTROL PLAN**

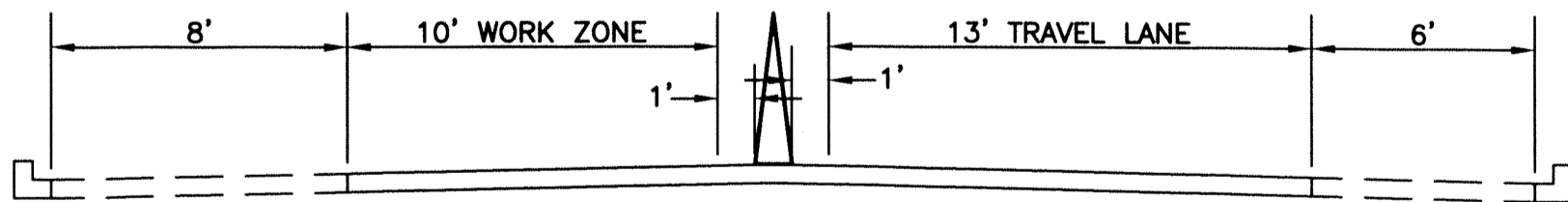
SCALE: 1" = 100'

PHASE VII INSTALL SURFACE COURSE ON WESTBOUND LANE 1 DAY OF HAMPSHIRE ROAD AND SOUTHBOUND LANE OF NORTHGATE DRIVE.



**HAMPSHIRE RD
PHASE 7**

SCALE: 1" = 5'



**NORTHGATE DR
PHASE 7**

SCALE: 1" = 5'

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED UNDER MY SUPERVISION AND IN ACCORDANCE WITH THE MARYLAND MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITION. I FURTHER CERTIFY THAT TO THE BEST OF MY ABILITY THE PLAN FEATURES THE MINIMUM AMOUNT OF TRAFFIC DISRUPTION NECESSARY TO COMPLETE THE WORK IN AND ALONG THE PUBLIC ROADWAY.

RICHARD D. PARKS, P.E.
NO. 11697

11/17/15
DATE

CITY OF SALISBURY
DEPARTMENT OF PUBLIC WORKS

CITY PROJECT # 03-12-INF

MICHAEL S. MOULDS, P.E.
DIRECTOR OF PUBLIC WORKS

DATE

FRANK ENNIS
TECHNICAL SERVICES MANAGER

DATE

NO	REVISION	DATE	BY	APP.	NO	REVISION	DATE	BY	APP.
1	ISSUED FOR CONSTRUCTION								
0	ISSUED FOR BID								
D	AGENCY COMMENTS	05/29/15	JLW	RDP					
C	AGENCY COMMENTS	6/13/13	AM	RDP					
B	AGENCY COMMENTS	12/20/12	AM	RDP					
A	ISSUED TO CLIENT								

RICHARD D. PARKS, P.E.

RELEASED BY

R.D. PARKS, P.E.

DRAWN

CAD

DATE

NOVEMBER 2012

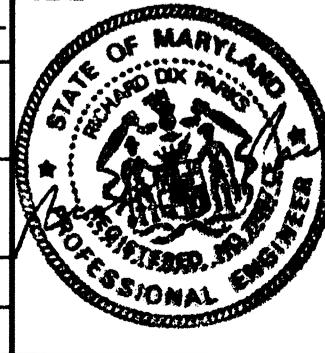
CHECKED

CHECKED

SURVEY DATE

FIELD BOOK

SEAL



PROFESSIONAL CERTIFICATION

I RICHARD D. PARKS, P.E. hereby certify that these documents were prepared and approved by me and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 11697, expiration date 11-1-2017.

CLIENT & PROJECT

CITY OF SALISBURY
125 N. DIVISION STREET, ROOM 202
SALISBURY, MARYLAND 21801-4940

HAMPSHIRE ROAD PUMP STATION
REPLACEMENT AND UPGRADES
CITY OF SALISBURY, WICOMICO COUNTY, MARYLAND



1101 Opal Court, Third Floor
Hagerstown, Maryland 21740
Tel 301.791.1100

TITLE TRAFFIC CONTROL PLAN

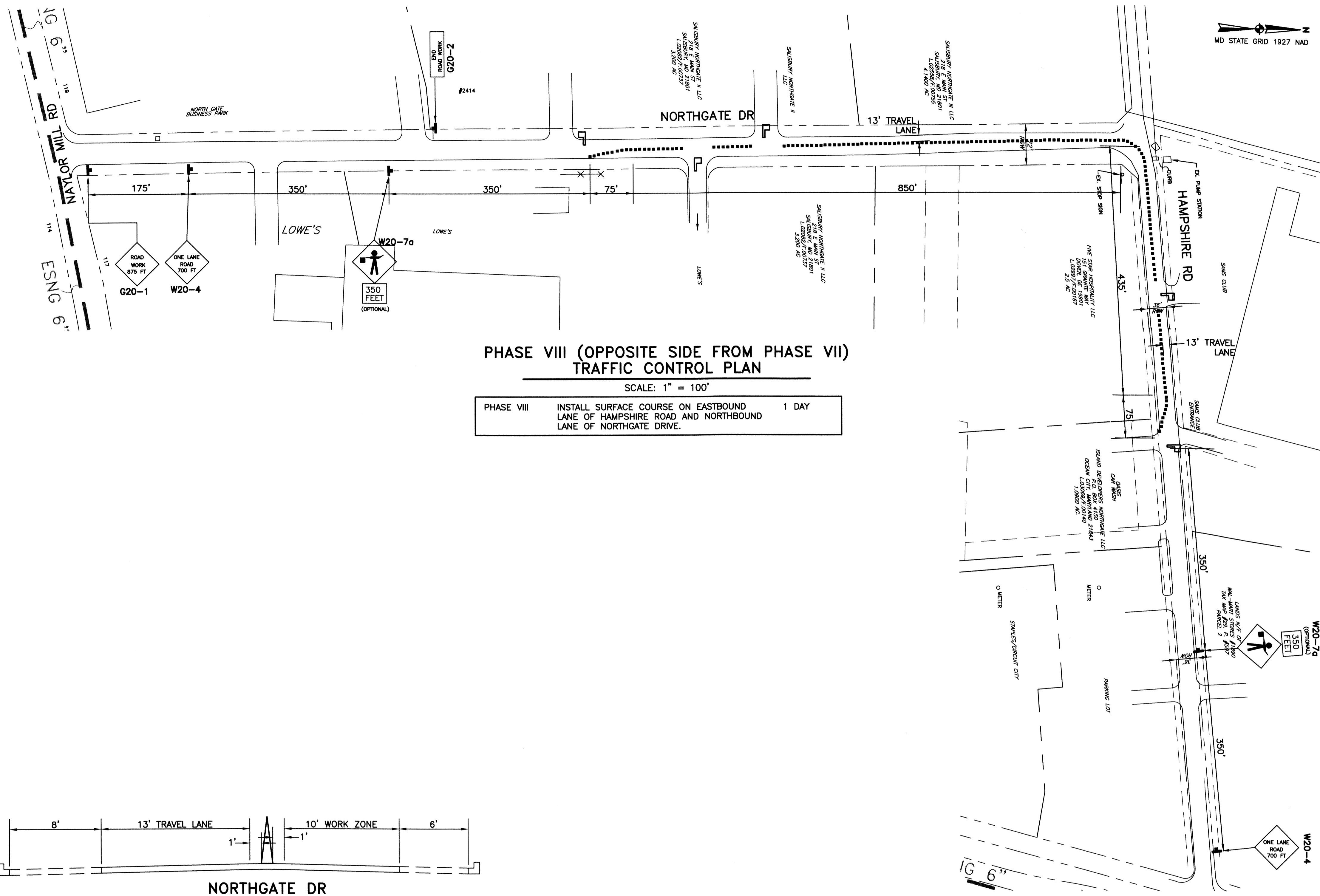
SCALE AS SHOWN

PROJECT NO. 10518.00

SHEET NO. 19 OF 20

DWG. NO.

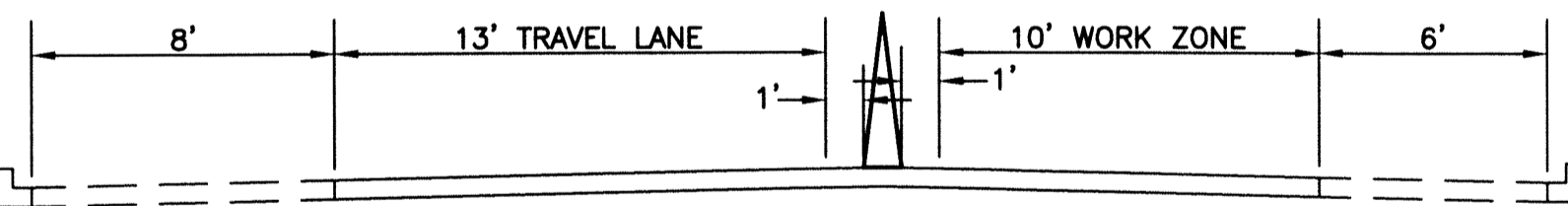
TP-4



**PHASE VIII (OPPOSITE SIDE FROM PHASE VII)
TRAFFIC CONTROL PLAN**

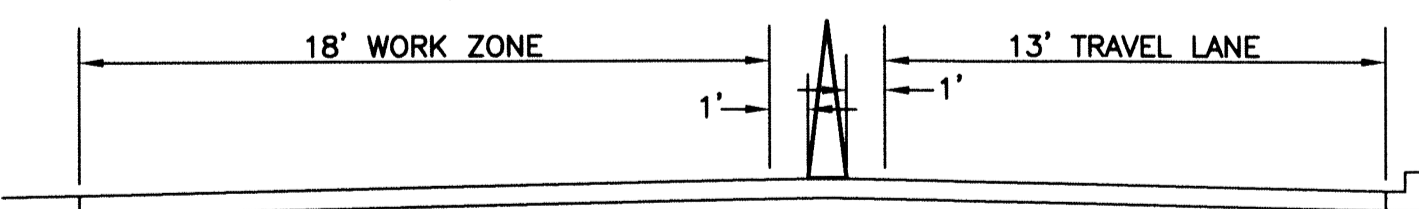
SCALE: 1" = 100'

PHASE VIII INSTALL SURFACE COURSE ON EASTBOUND LANE OF HAMPSHIRE ROAD AND NORTHBOUND LANE OF NORTHGATE DRIVE. 1 DAY



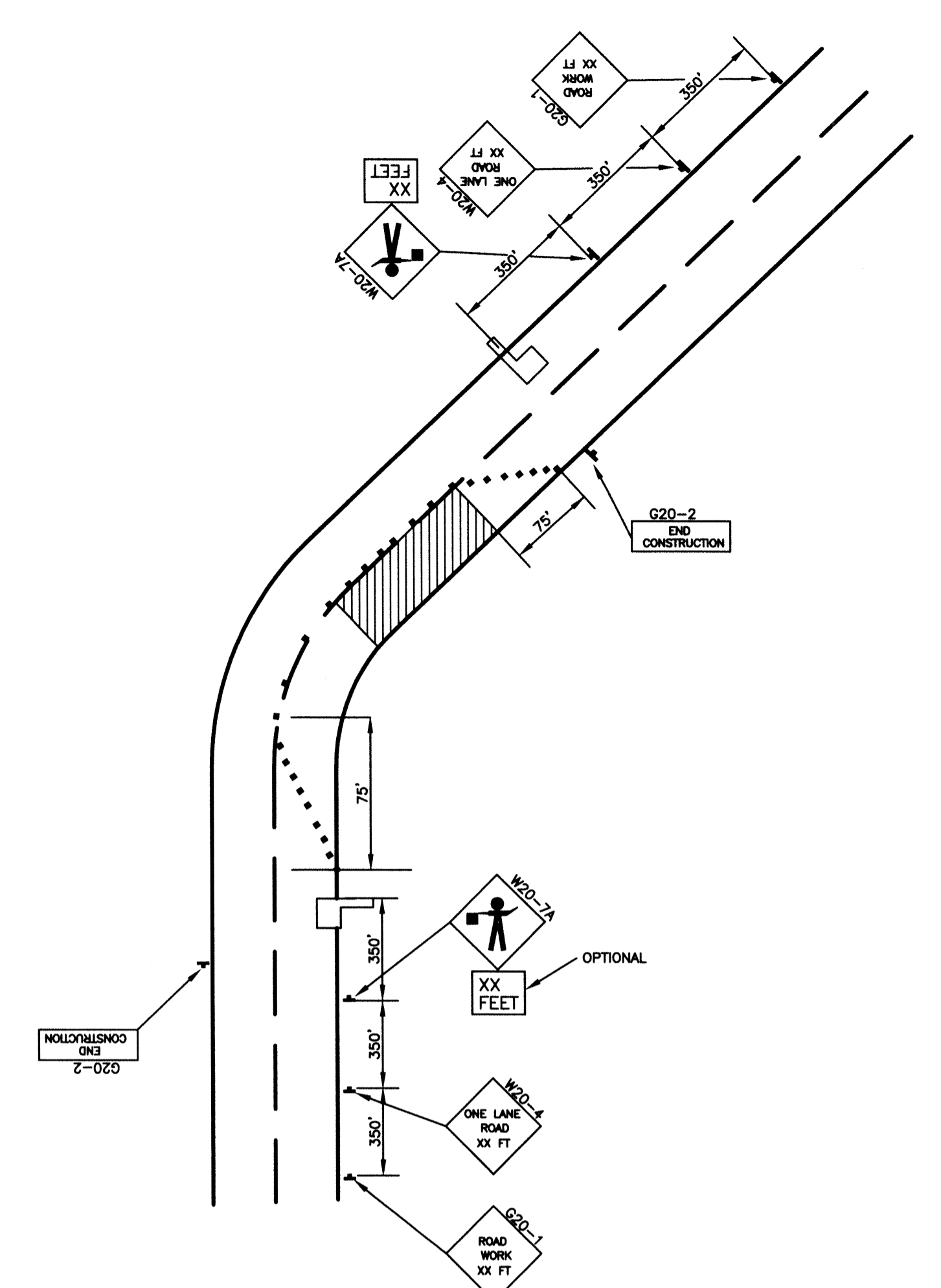
**NORTHGATE DR
PHASE 8**

SCALE: 1" = 5'

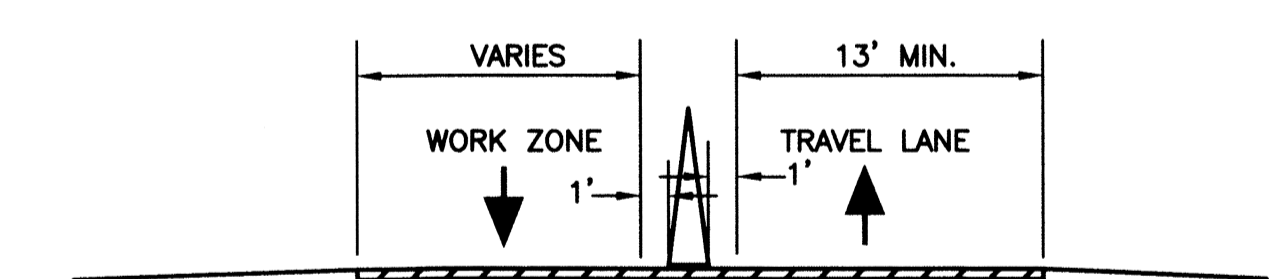


**HAMPSHIRE RD
PHASE 8**

SCALE: 1" = 5'



**FIGURE 6H-10. LANE CLOSURE
ON A TWO-LANE ROAD USING FLAGGERS**
(TA-10)



**TYPICAL TRAFFIC CONTROL PLAN
CROSS SECTION**

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED UNDER MY SUPERVISION AND IN ACCORDANCE WITH THE MARYLAND MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITION. I FURTHER CERTIFY THAT TO THE BEST OF MY ABILITY THE PLAN FEATURES THE MINIMUM AMOUNT OF TRAFFIC DISRUPTION NECESSARY TO COMPLETE THE WORK IN AND ALONG THE PUBLIC ROADWAY.

RICHARD D. PARKS, P.E. 11/15/17
NO. 11697 DATE

CITY OF SALISBURY DEPARTMENT OF PUBLIC WORKS		CITY PROJECT # 03-12-INF
MICHAEL S. MOULDS, P.E. DIRECTOR OF PUBLIC WORKS		DATE
FRANK ENNIS TECHNICAL SERVICES MANAGER		DATE

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