

North Brunswick Sanitary District

Waste Water System Standards & Specifications

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1.1 DEFINITIONS:

Except as specifically defined herein, all words used in these standards have their customary dictionary definitions. For the purposes of this policy, certain words or terms used herein are defined as follows:

1.1.1 Words used in the present tense include the future tense. Words used in the singular include the plural and words used in the plural include the singular.

1.1.2 The word "shall" is always mandatory.

1.1.3 The word "may" is permissive.

1.1.4 The word "lot" includes the words "plat" or "parcel".

1.1.5 The word "person" includes a firm, association, organization, partnership, trust company, or corporation as well as an individual.

1.1.6 NBSD- North Brunswick Sanitary District

1.1.7 DENR-North Carolina Department of Environmental and Natural Resources.

1.1.8 Lot- A part of a subdivision, or parcel of land used as a building site or intended for such use, immediate or future.

1.1.9 Utility Right-of-Way/Easement. Private rights-of-way or easements for NBSD utilities shall not be deemed dedicated to the NBSD but for use of the NBSD'S utilities.

1.1.10 Public Right-of-Way/Easement-Public rights-of-way or easements are considered to mean street rights-of-way or any other public right-of-way.

1.1.11 ENGINEER-A person registered as a Professional ENGINEER in good standing with the North Carolina Board of engineering Examiners.

1.1.12 Land Surveyor-A person registered as a Land Surveyor by the North Carolina Board of ENGINEERING Examiners.

1.1.13 Subdivision-The division of a tract of land into two or more lots for the purpose, whether immediate or future, of sale, legacy or development. This includes all division of land involving a new street or a change in the arrangement of streets and includes any re-subdivision of land. Subdivision shall also refer to uses of land not ordinarily considered a subdivision uses are mobile home parks, multifamily projects, townhouses, and planned unit developments.

1.1.14 Developer-Any person, firm, corporation, or other legal entity improving property for commercial, industrial, or residential purposes.

1.1.15 Plat-A map or drawing upon which the development plan is presented for approval.

1.1.16 CONTRACTOR-A person or entity authorized to perform construction by the State of North Carolina Licensing Board for contractors. A CONTRACTOR may not perform work outside of his licensed capacity. This includes well drillers, water and sewer lines, pump station, and electrical CONTRACTORS. Where required, all sub-contractors must be certified. NBSD reserves the right to accept or reject any CONTRACTOR or subcontractor selected to perform work on the system to be conveyed to NBSD.

1.1.17 Design-The design of sewer systems shall be done only by persons properly registered under the Professional ENGINEER'S Act of the Business and Professions Code of North Carolina.

1.1.18 Standard Drawings-Standard drawings approved by NBSD for sewer system construction purposes shall be considered a part of these standards and shall be used in conjunction with these Standards for all subdivision and extension of sewer system installations. Construction by methods differing from the Standard Drawings which will give equivalent or better results may be approved by NBSD if prior approval of such methods is obtained.

1.1.19 Conflicts-In case of conflict between plans, specifications, these Standards or Standard Drawings, precedence shall be given in the following order: (1) Standard Drawings, (2) These Standards, (3) Plans, and (4) Specifications. However, a deviation from the Standard Drawings or these Standards will be approved if a specific note regarding the particular deviation is included on the Plans and Specifications.

1.1.20 Customer-Customer means any person, firm, association, or governmental agency supplied or entitled to be supplied with water service.

1.1.21 Other Specifications-Whenever in these Standards other specifications are mentioned, it shall be understood that the materials or methods mentioned shall conform to all requirements of the latest revision of the specifications so mentioned.

1.1.22 Paved Surface-Paved surface includes any pavement used on any street in the counties, whether such pavement is composed of concrete, asphalt, oil, gravel, crushed rock or any combination of said forms of pavement.

1.1.23 P.S.I.G.-P.S.I.G means pounds per square inch, gage.

1.1.24 Drawings-Drawings mean all plans, profiles, maps, or drawings which show the location, character, dimensions, and details of the work which as been approved for construction by the ENGINEER.

1.1.25 Service Lateral-Service lateral means a connection between a water main and user house service.

1.1.26 Pump Station-Pump station means a structure and/or pumping facility to facilitate the further transmission of water through the use of pumps and periodic minimal storage.

1.1.27 These Standards-These standards shall mean the standards contained herein.

1.1.28 User Connection-User connection means the point of connection of a user's piping to NBSD'S service lateral.

1.1.29 Water Main-Water main means any pipe or conduit that is part of a transmission system and is used to transport or is intended to be able to transport water flow to more than one user connection.

1.1.30 Water System-Water system means the source, facilities, and transmission system and shall include all those facilities of the water system under the control of NBSD up to the customer's connection.

1.1.31 Use of Water-Connection of house service laterals and subsequent use of water either temporarily or permanently, shall not be allowed prior to acceptance of the water system by NBSD.

1.1.32 OWNER-The Developer

1.2 SCOPE OF DRAWINGS AND SPECIFICATIONS:

A. Any provisions contained in the specifications or shown on standard drawings which are not applicable to the work under this contract shall be disregarded.

B. The developer will be responsible for the adequacy of the general design of the finished work. The design of standard products used in the work, temporary work required to protect existing work or adjoining property, and

temporary work required keeping existing or new facilities in operation shall be the sole responsibility of the CONTRACTOR.

C. Reference to standard specifications (ASTM, AWWA, ANSI, et cetera), national codes, local or state codes and laws and ordinances shall mean the latest edition of said document in effect at the time of taking bids, unless specifically stated otherwise.

D. It is the intent that the work under this contract shall result in a complete, properly usable and fully operational installation, structure or plant; and that workmanship shall be of the best quality consistent with the materials and construction methods shown on the drawings and as specified.

E. The words "furnish", "furnish and install", "install" and "provide" or similar words, shall mean, unless otherwise specifically stated, "furnish and install complete in place and ready for service".

F. Incidental work and miscellaneous accessories not specifically mentioned or shown, but necessary for the proper completion of the work, shall be provided without change in the contract price. Such incidental work and accessories shall be of the same quality as specified for the major component of which the incidental work or accessory is an essential part.

G. The work of all trades under this contract shall be coordinated by the CONTRACTOR in such a manner as to obtain the best workmanship possible for the entire project. All components of the work shall be installed or erected in accordance with the best practices of the particular trade.

H. The CONTRACTOR shall be responsible for making the construction of habitable structures completely weatherproof, and for making equipment and utility installation properly perform the specified function. If he is prevented from so doing by any limitations of the drawing or specifications, the CONTRACTOR shall immediately notify the ENGINEER in writing of such limitations before proceeding with construction in the area where the problem or limitation exists.

I. Materials or methods described by words which have a well known technical or trade meaning shall in fact refer to that recognized standard. Standard specifications or manufacturer's literature, when referenced, are intended to establish the minimum acceptable requirements.

J. Any reference to manufacture's brand or trade names or model numbers is intended merely to establish the standard of quality required for the particular product or material. Products or materials of other manufacturers which, in the opinion of NBSD, are equivalent to that specified with respect to quality, workmanship and economy of operation, and are suitable for the purpose intended, must be approved NBSD prior to installation.

K. The CONTRACTOR shall be responsible for making all necessary arrangements with governmental departments, public utilities, public carriers, service companies and corporations owning or controlling roadways, railways, water, sewer, gas, electrical, telephone and telegraph facilities, such as pavements, tract, piping, wires, cables, conduits, poles, guys, et cetera, including incidental structures connected therewith that are encountered in the work in order that such items may be properly shored, supported, protected or relocated. He shall give all proper notices, shall comply with the requirements of such parties in the performance of his work, shall permit entrance of such parties on the project in order that they may perform their necessary work, and shall pay all charges and fees made by such parties for this work.

L. The CONTRACTOR'S attention is called to the fact that there may be delays on the project due to work to be done by governmental agencies, public utilities and others in repairing or moving poles, conduits, et cetera. The CONTRACTOR shall cooperate with the above parties in every way possible so that the construction can be completed in the least possible time.

M. Unless otherwise specified the CONTRACTOR shall provide at his expense all tests and testing services required by the contract documents.

1.3 PERMITS: The CONTRACTOR shall be responsible for procuring any permits for the use of property beyond the limits of the OWNER'S property or of permanent rights-of-way as necessary for working or storage space during the prosecution of the work.

1.4 SUBMISSIONS, REPORTS, RECORDS AND DATA:

A. The CONTRACTOR shall submit all schedules, quantities, costs, payrolls, reports, estimates, records, shop drawings, details and other data as required by the contract documents or as may be specifically requested.

B. The apparent successful bidder shall furnish to the ENGINEER for approval a complete cost breakdown of his bid within 10 days after submission of bids. The breakdown shall include all items for each unit of construction, and shall show the cost of labor, materials and equipment, other necessary costs and the total cost for each unit of work. Bidders shall consult with the ENGINEER prior to submitting the breakdown to insure a complete understanding of the requirements. Names of the project superintendent and others responsible for the work shall be included.

C. The CONTRACTOR shall furnish periodic itemized estimates of work done for the purpose of making partial payments thereon. The costs employed in making up these estimates will be used only for determining the basis of partial payments and will not be considered as a basis for changes in the contract price.

D. The CONTRACTOR shall notify the ENGINEER of the source of all material and equipment required for the work and shall supply samples of materials as specified in the technical sections, or at the ENGINEER'S request. Samples shall be submitted for approval by the ENGINEER and NBSD prior to purchase and delivery to the job. Unless otherwise specified three samples of each type or grade of material showing construction, color, finish, et cetera shall be submitted.

E. Prior to submittal of any shop drawings, the CONTRACTOR shall prepare a list of all materials, equipment and items required for the installation and submit this list to the ENGINEER. The list shall include each specific item, along with the applicable specification section. For items specified, the CONTRACTOR shall provide for review by the ENGINEER and NBSD three (3) sets of shop drawings on all items to be installed in the project.

1.5 JOB SITE DRAWINGS AND SPECIFICATIONS:

A. The CONTRACTOR shall maintain, in good and legible condition at the job site, one complete set of working drawings and specifications for the work, including all shop drawings. Such drawings and specifications shall be available for use by the ENGINEER or his representative at all time.

B. The drawings and specifications shall be marked, or notes acceptable to the ENGINEER provided, in order to reflect as-built conditions. Changes indicating such conditions shall be kept current at all times. Upon completion of the project, this complete set of drawings and specifications or notes showing as-built conditions shall be returned to the ENGINEER. The ENGINEER shall modify the construction drawings to reflect as-built conditions and provide RECORD DRAWINGS per as-built standards.

1.6 FUTURE USE:

1.7 MUTUAL RESPONSIBILITY OF CONTRACTORS:

If, through acts of neglect on the part of the CONTRACTOR, any other CONTRACTOR or subcontractor suffers loss or damage on the work, the CONTRACTOR agrees to settle with the other CONTRACTOR or subcontractor by agreement if the other CONTRACTOR or subcontractor agrees. If any other CONTRACTOR or subcontractor asserts any claim against NBSD on account of damage alleged to have been sustained, NBSD will notify the CONTRACTOR, who shall indemnify and hold harmless NBSD against such claim.

1.8 ORDER AND PROSECUTION OF WORK:

A. The CONTRACTOR shall not begin any work on the project without first notifying NBSD and the ENGINEER. The notice shall be in writing and shall be received by NBSD and ENGINEER at least seven days prior to the beginning of work. Any work done without prior notice will not be accepted. The CONTRACTOR shall notify NBSD and ENGINEER prior to beginning work in order to schedule a pre-construction conference to discuss and clarify all phases of the work.

B. The CONTRACTOR shall be solely responsible for the means, methods and sequence of construction, for the safety of workers and other persons on the construction site and of all materials and equipment to be incorporated in the work. The work shall be prosecuted at as many different points, at such times, in such sections and with such force as may be necessary to secure its completion within the contract time. The CONTRACTOR shall not suspend work without the prior approval of the Developer, NBSD or ENGINEER.

C. Pipeline work shall be prosecuted in such a manner that completed portions of the work can be properly dressed

off as work progresses. In case of work on streets and highways, two or more crews shall not work on contiguous areas at the same time. Streets and roads shall be dressed off as soon as work is completed therein. No open trenches shall be left unattended without proper barricades.

1.9 PUBLIC CONVENIENCE AND PROTECTION:

A. During progress of the work, the convenience and protection of the public must be provided for and interferences held to a minimum. At no time shall service to existing customers be interrupted without prior notice. Shutdowns shall be coordinated thru NBSD.

B. The CONTRACTOR shall conduct the work in a manner that will minimize inconvenience to traffic. Notice shall be given to the NCDOT prior to commencing work. Reasonable notice shall be given to the NCDOT and all residents affected by the work before interfering with private driveways. Access to businesses, industries, fire departments and other essential services shall be maintained in a passable condition at all times. Access to fire hydrants and other firefighting equipment shall be kept open at all times.

C. When necessary to close streets to traffic, suitable detours, signs and barriers and other traffic control devices shall be provided as required to minimize inconvenience to traffic. The CONTRACTOR shall notify the OWNER, law enforcement agencies, fire departments and ambulance services whenever a street is closed and again when it is opened.

D. When necessary, the CONTRACTOR shall provide watchmen and lights to burn between twilight and sunrise, and shall erect and maintain barriers and all other necessary protection about the work at his own expense. He shall also take other precautions necessary to protect life, limb and property. The OWNER reserves the right to remedy any neglect on the part of the CONTRACTOR in connection with protection of the work after 24 hours notice in writing; and in cases of emergency, the OWNER will have the right to remedy any neglect without previous notice; and in either case, deduct the cost of such remedy from money due to the CONTRACTOR.

1.10 SANITARY PROVISIONS: The CONTRACTOR shall provide temporary toilet facilities for the use of construction personnel. These facilities shall be maintained in a clean and sanitary condition and shall comply with all applicable codes and regulations. Temporary sanitary facilities shall be removed upon completion of the work and the premises left clean. Construction personnel shall not use permanent washroom facilities in existing facilities or new work except by written permission of the OWNER.

1.11 EXISTING FACILITIES:

A. Dimensions and elevations indicated on the drawings in reference to existing structures, location of utilities, sewer inverts or other information on existing facilities are based on the best available data, but are not guaranteed by the OWNER. The OWNER will not be responsible for their accuracy. Before proceeding with any work dependent upon such data, the CONTRACTOR shall field check and verify all dimensions, grades, inverts, lines, elevations or other conditions or limitations at the site of the work to avoid construction errors or damage to existing facilities. If work is performed by the CONTRACTOR or any subcontractors prior to adequate verification of applicable data any resultant extra cost for adjustment of work necessary to conform to existing conditions, or to repair damage to existing facilities, shall be assumed by the CONTRACTOR without additional cost to the OWNER.

B. In executing the work, the CONTRACTOR shall exert every effort not to damage existing facilities or to break into them. Damage that is done thereto shall be promptly repaired by the CONTRACTOR at his own expense. He shall not interrupt or interfere with operation of the existing facilities during construction except when absolutely necessary. Whenever existing facilities or utilities must be taken out of service, the CONTRACTOR shall consult with the ENGINEER and the OWNER as to procedure and shall be governed by their decision.

C. The OWNER does not guarantee that all existing buildings, structures, fences, pipelines, electrical lines, conduit, telephone cable, service connections or other facilities are shown on the drawings. It shall be the CONTRACTOR'S responsibility to locate and protect all such existing facilities prior to beginning construction.

D. Existing surface or subsurface improvements, such as pavement, curbs, sidewalks, pipes, utilities, footings, structures (including portions thereof), trees and shrubbery not indicated on the drawings or specified to be removed or altered, shall be protected from damage at all times during construction.

E. All such improvements damaged during construction shall be restored to a condition equal to that existing at the time of award of contract.

F. The CONTRACTOR shall connect his work to each part of the existing work or work previously installed in accordance with the drawings and specifications to provide a complete installation.

G. The CONTRACTOR shall do all cutting and patching of the work required to make the several parts fit together properly and to receive the work of others. The CONTRACTOR shall not endanger the work of others by cutting, excavating or otherwise altering their work and shall not cut or alter the work of others without the written consent of the ENGINEER. All cut and patched work shall be restored to the satisfaction of the ENGINEER.

H. The CONTRACTOR shall be responsible for removing and disposing of obstructions or obstacles at the job site or along the right-of-way to the satisfaction of the ENGINEER. Minor obstructions shall be removed and properly disposed of or protected and re-erected in as good condition as existing, at the same or other locations, as directed by the ENGINEER.

I. Fences at the site or along the right-of-way which interfere with construction operations shall be maintained by the CONTRACTOR until completion of the work, unless written permission is obtained from the OWNER to leave the fence dismantled until construction is completed. The CONTRACTOR shall remove, rebuild and extend fences as necessary to keep livestock away from the construction area or from straying away. Upon completion of work, all fences shall be restored to their original location and condition unless otherwise noted. The CONTRACTOR shall purchase new material, if necessary, to replace all materials damaged, lost or destroyed.

1.12 WORK DURING INCLEMENT WEATHER: No work shall be done except by permission of the ENGINEER when the weather is unfit for good and careful work to be performed. If the severity of the weather continues the CONTRACTOR, upon the direction of the ENGINEER, shall suspend all work until instructed to resume operations by the ENGINEER. The contract time will be extended as required to cover the duration of the order. Work damaged during periods of suspension due to inclement weather shall be repaired and/or replaced by the CONTRACTOR at his own expense.

1.13 RIGHTS-OF-WAY:

A. The OWNER will obtain all land and rights-of-way necessary for all work under this contract. If all land and rights-of-way are not obtained before construction begins the CONTRACTOR shall start work only upon such land and rights-of-way previously obtained by the OWNER, and no claim for damages will be allowed because of such delay. If the OWNER is unable, for any reason, to obtain the land and rights-of-way necessary for the work, the contract time will be extended as required to cover the time lost by such delay.

B. The CONTRACTOR shall confine his construction operations to the immediate vicinity of the locations shown on the drawings, and in no case shall he encroach beyond the limits of the OWNER'S property or rights-of-way. He shall place materials, equipment, supplies, et cetera so as to cause the least possible damage to property and interference with traffic.

C. The CONTRACTOR shall locate the limits of the rights-of-ways or property lines prior to beginning construction. He shall be responsible for damage to trees, crops or other property outside the limits of the right-of-way and shall make satisfactory settlement for damage directly with the property OWNER involved.

D. Where timber is located on the property or right-of-way the CONTRACTOR shall preserve and protect from damage all trees that do not directly interfere with the prosecution of the work. The CONTRACTOR shall not cut any tree greater than 6 inches in diameter and located more than 8 feet from the center-line of the ditch or structure without first consulting the ENGINEER.

E. Except where specifically directed otherwise by the property OWNER, the entire construction right-of-way shall be provided with a permanent grass cover within 30 days after backfilling. Topsoil shall be replaced and seed planted, fertilized and watered until a grass cover satisfactory to the ENGINEER and property OWNER is obtained. If necessary, a temporary grass cover shall be provided until a permanent cover can be established. Grassing shall be as specified in the technical sections. If required by the property OWNER shrubbery shall be replaced to the satisfaction of the ENGINEER and property OWNER.

1.14 WORK ON HIGHWAY RIGHT-OF-WAY:

A. The CONTRACTOR shall not begin work in the right-of-way of any State, County or City Department of Transportation until he has secured a copy of the necessary permits from the OWNER. He shall conform to all requirements of the Department of Transportation in the prosecution of this portion of the work. Each bidder shall

contact the local Department of Transportation representative to determine the exact requirements for work to be done.

B. The CONTRACTOR shall provide full time flag men with appropriate red flags at all times when work is in progress along highways. Suitable warning and descriptive signs shall be placed at each end of the working area while work is in progress along highways. These signs shall be well tended and shall be placed at sufficient distances from the work so that ample warning is given to approaching traffic. Signs shall be adequately lighted at night.

C. Where pipe is installed in open cut across a highway, the cut shall be immediately backfilled and all work of repairing the pavement completed immediately. The CONTRACTOR shall keep at least one full lane open for traffic at all times. Approval for lane closings shall be obtained from the appropriate agency. Any subsequent settlement in open cuts shall be immediately corrected and repaired.

D. Where a pipeline crossing under a highway is installed within encasement pipe, the encasement pipe shall be provided as specified in the technical sections.

E. Unless otherwise indicated, no excavated material shall be placed on the pavement side of the trench along highways. The least possible amount of trench shall be left open when work is not in progress, and equipment shall be removed from the pavement and shoulders during shutdown periods. Shoulders of roadways shall be left in good acceptable conditions and all disturbed topsoil and grass shall be replaced.

1.15 WORK ON RAILROAD RIGHT-OF-WAY:

A. The CONTRACTOR shall not begin work on railroad property until he has secured a copy of the necessary permits from the railroad agent. He shall conform to all requirements of the railroad in the prosecution of this portion of the work.

B. Where a pipeline crosses under a railroad a larger encasement pipe shall first be installed and the pipe laid in it. The work shall be done in accordance with requirements of the railroad company policy. Encasement pipe shall be provided as specified in the technical sections and shall be of the size shown on the drawings.

C. The CONTRACTOR shall pay the cost of flag men, inspectors and other expenses of the railroad in protecting the traffic. He shall notify the railroad of the time the work will be done and shall not begin work until authorized by railroad officials.

1.16 USE OF PREMISES:

A. The CONTRACTOR shall confine his equipment, the storage of materials and equipment and his operations to areas permitted by law, ordinances, permits, the requirements of the contract documents and as directed by the OWNER and ENGINEER, and shall not unreasonably encumber the premises with materials or Equipment.

B. The CONTRACTOR shall not overload any part of any structure with weights that will endanger its safety, nor shall he subject any part of the work to stresses or pressures that will endanger it.

C. The CONTRACTOR shall comply with and enforce the OWNER'S rules and instructions in connection with signs, advertisements, fires, smoking and the routing and parking of vehicles on the premises.

1.17 LINES AND GRADES:

A. The ENGINEER will establish control points and base lines for control of the work, and will establish bench marks and determine their elevation. The CONTRACTOR shall provide such stakes and non-technical assistance as the ENGINEER may require for the work.

B. The CONTRACTOR shall have on the job, at all times, a man who is capable of setting stakes, replacing damaged stakes, and who understands the value and use of stakes and cut sheets, to whom the ENGINEER may deliver information. The CONTRACTOR shall furnish and set necessary batter boards and other means of control and shall be fully responsible for their accuracy. Lines and grades will be established as follows:

1) For sewers and storm drains the CONTRACTOR shall stake all offset lines with tack centers. These shall be set sufficiently off from the center-line to allow for construction, and not over 50 feet apart when using batter boards. The CONTRACTOR shall be responsible for

protecting all stakes and shall make necessary replacements. After stakes have been set, the CONTRACTOR shall determine necessary elevations and furnish necessary cut sheets for field use. Copies of all cut sheets shall be furnished to the ENGINEER.

2) For water mains the ENGINEER will indicate on the plan the necessary control points to establish the center-line of the main, which is to be located by the CONTRACTOR. The ENGINEER will also indicate locations of fire hydrants and valves.

3) For plant or building work the ENGINEER will stake a construction base line, establish a bench mark and give its elevation to the CONTRACTOR. The CONTRACTOR shall stake all individual structures, provide batter boards and set elevations for the work.

1.18 SITE DATA:

The OWNER will make available to all prospective bidders, prior the receipt of bids, information he may have as to subsurface conditions in the vicinity of the work, topographical maps or other information that may assist the bidder in properly evaluating the amount and character of the work required for construction. Such information is given, however, as being the best information available to the OWNER at the specific location without the assumption of responsibility for its accuracy or for any conclusions that the CONTRACTOR might draw there from. The CONTRACTOR shall satisfy himself as to the nature of the work, shall investigate all other matters which may in any way affect the work under this contract and shall determine the character of equipment and facilities needed preliminary to, and during, the prosecution of the work. No verbal agreement or conversation with any officer, agent or employee of the OWNER or the ENGINEER, either before or after the execution of this contract, shall affect or modify any of the terms or obligations contained herein.

1.19 EQUIPMENT INSTALLATION:

When equipment of any kind is to be installed in a building or structure, and minor changes are necessary in the building or structure to accommodate the equipment, such changes shall be considered incidental to the proper completion of the work, and shall be made by the CONTRACTOR without additional compensation therefore.

1.20 QUANTITIES OF ESTIMATES:

The estimated quantities of work to be done and materials to be furnished under this contract shown in any of the documents, including the bid, are given for use in comparing bids and to indicate approximately the total amount of the contract. The OWNER reserves the right to increase or decrease the amount of work under this contract as specified elsewhere in these contract documents.

1.21 CLEANING UP:

A. During construction, the CONTRACTOR shall maintain the site and adjacent public and private property, including streets and highways, free from accumulations of waste, debris, rubbish and dirt caused by his operations. Dry materials and rubbish shall be wet down as necessary to prevent blowing dust.

B. At completion of the work the CONTRACTOR shall remove all waste materials, rubbish, tools, construction equipment and machinery, surplus materials and temporary facilities.

C. Cleaning and disposal operations shall be conducted in accordance with local ordinances and anti-pollution laws. Wastes shall not be disposed of into streams or waterways.

1.22 INSPECTION CERTIFICATES, BONDS AND GUARANTEES:

Upon completion of the work and prior to submission of certificate for final payment, the CONTRACTOR shall have had all work, as applicable, inspected by the proper authorities as required by the technical sections of the specifications and all applicable codes, laws and ordinances. Before final payment is made, the CONTRACTOR shall submit all inspection certificates to the ENGINEER covering such work, signed by the proper authorities, together with all required bonds, guarantees, certificate of no litigation, cost certificate, and record drawings. The engineer will provide for inspection by a qualified representative of the engineering firm, in order to insure that the compliance of the plans and specifications is adhered to. The inspector will report work activities performed, shall file reports and any discrepancies found in the work. Photos may also be required. Subsequent to the newly constructed facilities

being placed into service, should any discrepancies be found in the materials and workmanship, the contractor and the engineer will be responsible for restoring the defective work or material to compliance conditions. Cost associated for this will not be the responsibility of North Brunswick Sanitary District.

1.23 ESTIMATES NOT TO PREVENT FINAL REJECTION:

Final inspection and acceptance of the work will take place at completion of the work under this contract. Any inspection or acceptance of materials and workmanship at mills, shops or elsewhere to facilitate the progress of the work or to allow inclusion in a pay request will not preclude rejection of such materials or workmanship thereafter if the same is found unsuitable, or not in complete accordance with the contract documents.

1.24 FINAL INSPECTION:

Upon written notice from the CONTRACTOR that the work is complete, the ENGINEER, OWNER and applicable jurisdictional agencies will make a final inspection, and will notify the CONTRACTOR in writing of all defective, incomplete or otherwise unacceptable work revealed by the inspection. The CONTRACTOR shall immediately correct all such deficiencies to the satisfaction of the ENGINEER. Verification by NBSD shall occur prior to final acceptance. If a project has not met all requirements for final acceptance by NBSD but has been substantially completed as to be considered eligible to receive a Permit to Operate from NCDENR, then the OWNER may bond the project per NBSD'S requirements.

1.25 GUARANTEES:

A. If, in fulfilling the requirements of this contract, the CONTRACTOR disturbs any work guaranteed under another contract; he shall restore such disturbed work to a condition satisfactory to the ENGINEER, and shall guarantee such restored work to the same extent as it was guaranteed under the other contract.

B. All special guarantees applicable to specific parts of the work that may be stipulated in the contract documents shall be subject to the terms of the general one year guaranty (see General Conditions) during the first year of the life of such special guarantee.

1.26 SHOP DRAWINGS (See also the General Conditions):

A. Shop drawings are original drawings prepared by the CONTRACTOR, or a subcontractor or supplier, which illustrate some portion of the work and show fabrication, layout and setting or erection details. Shop drawing shall also include manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data as required. Shop drawings shall be clearly marked to identify specific materials, finishes, products or models, and shall show all required dimensions and clearances, performance characteristics and capacities, wiring diagrams and controls.

B. The CONTRACTOR shall review and check all shop drawings for accuracy and conformance with the contract documents. The CONTRACTOR'S review shall include verifying field measurements, field construction criteria, dimensions, catalog numbers and similar data. Prior to submission to the ENGINEER, all shop drawings shall be marked, stamped or otherwise certified as approved by the CONTRACTOR, dated and signed or initialed. Any shop drawings not so marked will be returned to the CONTRACTOR without the ENGINEER'S review.

C. The CONTRACTOR shall schedule the submission of shop drawings to allow sufficient time for review by the ENGINEER, corrections and re-submissions by the CONTRACTOR and re-checking by the ENGINEER, as necessary. The ENGINEER will review shop drawings with reasonable promptness. Each shop drawing submitted to the ENGINEER shall be accompanied by a transmittal form supplied by the ENGINEER; all information requested on the form shall be completed by the CONTRACTOR.

D. Initially the CONTRACTOR shall submit six copies of all shop drawings and supporting data to the ENGINEER for review. The ENGINEER will stamp each shop drawing indicating acceptance or otherwise, along with the data and signature or initials. After review, two copies will be returned to the CONTRACTOR, two copies retained by the ENGINEER and two copies forwarded to NBSD. The CONTRACTOR shall revise and re-submit shop drawings as required until acceptance by the ENGINEER. Re-submissions shall be made as specified for the initial submission. Additional changes made on shop drawings other than those requested by the ENGINEER shall be clearly indicated. NBSD reserves the right to reject any shop drawings it determines are not acceptable.

E. The ENGINEER'S review of shop drawings will be only for conformance with the general design concept of the project and for general compliance with the contract documents, and will not include a detailed quantity check or

verification of dimensions. The ENGINEER'S review will not extend to means, methods, techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence or procedure of construction is required by the contract documents) or to safety precautions or programs incident thereto. The review and acceptance of a separate item as such will not indicate acceptance of the assembly in which the item functions. The ENGINEER'S review of shop drawings will not relieve the CONTRACTOR from responsibility for errors or omissions, or for deviations from the contract documents, unless written acceptance is obtained from the ENGINEER for specific deviations. The CONTRACTOR shall notify the ENGINEER in writing of all deviations from the contract documents at the time of submission of shop drawings. NBSD reserves the right to reject any shop drawings it determines are not acceptable. Work which requires submission of shop drawings shall not begin until the shop drawings have been reviewed and accepted by the ENGINEER.

1.27 TEMPORARY UTILITIES:

During construction the CONTRACTOR shall provide all interim electrical power and wiring required for operation of power tools, equipment and machinery and for temporary lighting. Lighting shall be provided where necessary for proper workmanship, inspection and safety. Temporary electrical service shall be installed and maintained by a licensed electrical CONTRACTOR. The CONTRACTOR shall pay all charges for electrical service required for temporary power and lighting.

1.28 UNAUTHORIZED DISCHARGES AND BYPASSES:

During construction, the CONTRACTOR will be held responsible for unauthorized discharges of wastewater and sludge and unauthorized bypasses of treatment units which may result in fish kills, contaminated water supplies, the interruption of the intended use of certain stream segments and other environmental problems caused by such violations. Such violations will be strictly enforced in accordance with all applicable laws and regulations. The CONTRACTOR will be liable for all civil penalty assessments as prescribed for such violations.

1.29 PARTIAL PAYMENTS TO CONTRACTORS:

The CONTRACTOR shall make the following certification on each request for payment:

"I hereby certify that the labor and materials listed on this request for payment have been used in the construction of this work, or that all materials included in this request for payment and not yet incorporated into the construction are now on the site or stored at an approved location; and that all lawful charges for labor, materials, et cetera covered by previous Certificates of Payment have been paid and that all other lawful charges on which this request for payment is based have been paid for in full, or will be paid for in full from the funds received in payment of this request within ten (10) calendar days from receipt of this partial payment from the OWNER."

1.30 CONFLICTS BETWEEN THE DRAWINGS AND SPECIFICATIONS:

Where a conflict exists between the construction plans and these specifications, the content of these specifications shall govern. Any discrepancy found between the drawings and the specifications, and the site conditions or any inconsistencies or ambiguities shall be immediately reported to the ENGINEER, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. Work done by the CONTRACTOR after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the CONTRACTOR'S risk.

CHAPTER 2

SITE CLEARING

2.1 SCOPE: Work consists of all necessary clearing and grubbing as shown on the plans and specified herein.

2.2 CLEARING AND GRUBBING:

2.2.1 General: The CONTRACTOR shall consult with the OWNER and ENGINEER prior to beginning clearing, and a full understanding is to be reached as to procedure. The CONTRACTOR shall then conduct clearing and grubbing operations in strict accordance with these agreements.

A. The CONTRACTOR'S operations shall be conducted with full consideration of all proper and legal rights of the OWNER, adjacent property OWNER'S and the public, and with the least possible amount of inconvenience to them.

2.2.2 Construction Sites: The work shall consist of clearing and grubbing within the limits of construction sites, road rights-of-way and elsewhere as indicated or necessary to complete the work, except pipelines. All trees, stumps,

roots, shrubs and brush shall be removed as required for construction. Stumps and roots shall be grubbed and completely removed. The resulting depressions shall be filled with suitable material placed and compacted in accordance with Chapter 3. Sound trees and shrubs which do not interfere with construction shall remain in place, and shall be adequately protected from damage. Cleared and grubbed material, including debris and rubbish, shall be completely burned or otherwise disposed of as directed by the ENGINEER.

2.2.3 Pipelines: Clearing and grubbing along pipelines shall be done prior to pipe installation, and shall be confined to the right-of-way limits as specified below. Adjacent property outside the right-of-way limits shall be protected against damage. All trees, stumps, roots, shrubs and brush shall be removed as required for construction. Stumps and roots shall be grubbed and completely removed. Sound trees and shrubs which do not interfere with construction shall remain in place, and shall be adequately protected from damage. Cleared and grubbed material, including debris and rubbish, shall be disposed of as directed by the ENGINEER; burning within pipeline rights-of-way will not be allowed.

A. Trees 6-inches and larger in diameter shall be trimmed into normal 63 inch lengths, unless otherwise directed by the property OWNER. The logs shall be neatly stacked along the edge of the right-of-way in accessible locations for the property OWNER'S use.

B. Limits of the pipe-laying operation shall be confined to the right-of way. The width of clearing shall be held to a minimum and shall be no more than specified on the plans, without written consent of the ENGINEER.

2.2.4 Minor Structures: Minor Structures shall be removed and disposed of as directed by the ENGINEER.

2.2.5 Burning: Burning of Cleared Material shall be accomplished in strict compliance with all applicable local, state and federal regulations pertaining to open burning and smoke abatement.

CHAPTER 3

EARTHWORK

3.1 SCOPE: Earthwork shall consist of all necessary site grading, structure excavation and backfill, trench excavation and backfill, and related work as shown on the plans and as specified herein.

3.2 GENERAL: All earthwork shall be confined to the construction area as shown on the plans, and shall be done in an approved manner with proper equipment. Earthwork shall be suspended during rain and inclement weather, or when unsatisfactory field conditions are encountered, unless otherwise directed by the ENGINEER. At all times during construction, the CONTRACTOR shall maintain proper drainage in the construction area, and shall take all measures necessary for erosion and sediment control.

3.2.1 Classification of Earth Work: All excavation will be unclassified, for payment purposes, unless otherwise specified.

3.2.2 Existing Utilities: CONTRACTOR shall take every precaution to protect existing utility services from damage during construction operations. If damage occurs, the OWNER of the utility shall be notified immediately and repairs shall be made promptly at the CONTRACTOR'S expense. All repair work shall be satisfactory to the ENGINEER and the OWNER of the utility. When interruptions of existing utilities occur, temporary service shall be provided as approved by the ENGINEER and OWNER of the utility.

3.3 STRUCTURE EXCAVATION AND BACKFILL:

A. All excavations shall be in compliance with current OSHA regulations. Structure Excavation shall be made to the elevations, slopes and limits shown on the plans. Bottom of excavations shall be level and in firm, solid material; where soft or otherwise unsuitable material is encountered, such material shall be removed and replaced with properly compacted earth material, stone or Flowable Fill, as directed by the ENGINEER. Topsoil and other excavated material suitable for fill or backfill shall be stockpiled on the site for future use. Excess material and material unsuitable for fill or backfill shall be disposed of by the CONTRACTOR. Excavated areas shall be kept free of water during construction. Where necessary, excavations shall be protected by shoring, sheeting, cofferdams or other suitable methods. Where earth will stand, footing trenches may be cut to the exact size of the footings; otherwise, forms shall be used.

1. Unauthorized or excessive excavation shall be corrected by providing properly compacted earth backfill, stone or Class C concrete, as directed by the ENGINEER, at the CONTRACTOR'S expense.

2. Wherever excavation for a foundation extends below the water table or where specifically indicated on the plans, a 12-inch layer (unless otherwise noted) of crushed stone or gravel shall be spread and compacted in the excavation bottom prior to placing the foundation. Crushed stone or gravel shall conform to ASTM C33, Size 57. A non-woven filter fabric, Mirafi 140N or equivalent shall be placed beneath the stone layer.

3. An adequate dewatering system shall be provided at all structure excavations and elsewhere as directed by the ENGINEER. The system shall be capable of removing any water that accumulates in the excavation and maintaining the excavation in a dry condition while construction is in progress. The surface of the ground shall be sloped away from the excavation or piping provided to prevent surface water from entering the excavation. Disposal of water resulting from the dewatering operation shall be done in a manner that does not interfere with normal drainage, and does not cause damage to any portion of the work or adjacent property. All drains, culverts, storm sewers and inlets subject to the dewatering operation shall be kept clean and open for normal surface drainage. The dewatering system shall be maintained until backfilling is complete or as otherwise directed by the ENGINEER. All damage resulting from the dewatering operation shall be repaired by the CONTRACTOR to the satisfaction of the ENGINEER and at no cost to the OWNER.

4. Limit of structure excavation, for payment purposes, shall be 3 feet from the outside wall line of structures. Material removed beyond this limit to facilitate work shall be at the CONTRACTOR'S expense.

B. Backfill around structures shall be placed as soon as possible, but not until construction below finish grade has been completed and accepted, underground piping and other utilities have been properly installed and tested, forms have been removed, and the excavation cleaned of trash and debris. Foundations and walls shall be braced and supported as required to withstand the forces imposed by the backfilling operation. Care shall be taken to protect piping and other utilities during backfill.

1. Backfill shall consist of suitable material from the excavation free of roots, wood, other vegetable matter, trash, debris, frozen material, rocks larger than 4 inches in any dimension, and other objectionable material. Backfill shall be brought to the indicated finish grade and sloped to drain away from walls. Backfill shall be placed in 8-inch layers and thoroughly compacted as specified below. Any subsequent settlement that may occur during the construction period shall be corrected.

2. Excessively wet, porous, spongy or mucky material shall be removed from around structures prior to placing backfill. No such material shall be used for backfill.

3. Unless otherwise directed by the ENGINEER, liquid-retaining structures shall not be backfilled until tested for leakage and accepted. All structures shall be protected against damage or flotation prior to placing backfill.

3.4 SITE GRADING: Site grading shall conform to the lines and grades indicated by the finish contours on the plans. Where topsoil, pavement, aggregate surfacing and other items are shown, rough grade shall be finished to such depth below finish grade as necessary to accommodate these items. All areas where structures are to be built on fill shall be stripped to such depth as necessary to remove turf, roots, organic matter and other objectionable materials.

3.4.1 Excavation: Excavation shall be made to the exact elevations, slopes and limits shown on the plans.

3.4.2 Fill: Material to be used for fill shall be classified as "ML" (low plasticity silts), "SM"(silty sands), or better, in accordance with the Unified Soil Classification System. Fill material shall exhibit a plasticity index of less than 20 and a standard Proctor maximum dry density greater than 90 pounds per cubic foot. Fill shall not contain organic material, debris or rock larger than 6 inches in any dimension.

A. Where fill is to be placed, all existing vegetation, roots and other organic matter down to 12 inches below grade shall be stripped and disposed of as directed.

B. Fill shall be placed in successive layers of not more than 8 inches loose thickness. Each layer shall be spread evenly and compacted as specified below before the next layer is placed.

C. Rock shall not be incorporated in fill sections supporting pavement or structures. Rock shall be evenly distributed. Rock larger than 4 inches in any dimension will not be allowed in the top 12 inches of fills or slopes. Voids between rock and material shall be well filled with suitable fill material, and all rock shall be covered with at least 6 inches of fill material.

D. Where natural slopes exceed 3:1, horizontal benches shall be cut to receive fill material. Slopes of less than 3:1 and other areas shall be scarified prior to placing fill material.

E. Borrow material, as required, shall be obtained from the work site or other acceptable source, at the CONTRACTOR'S expense.

3.4.3 Compaction: Unless otherwise noted, each layer of fill and backfill and the top 12 inches of existing subgrade material in cuts shall be compacted by approved equipment as specified below. The degree of compaction and the density shall be determined by the Standard Proctor test (ASTM D698) or by the Modified Proctor test (ASTM D1557, Method A).

Min. Compaction of Max. Dry Density at Optimum Moisture Content

Fill or cut under structures and backfill adjacent to structures-----95%

Top 8 inches of fill or cut under pavement or aggregate surfacing-----98%

Fill and backfill for highways or shoulders----- 95%

Fill and backfill in other areas-----90%

A. Material too dry for proper compaction shall be moistened by suitable watering devices, turned and harrowed to distribute moisture, and then properly compacted. When material is too wet for proper compaction, operations shall stop until such material has sufficiently dried.

B. Compaction Tests: All compaction tests, including additional tests required due to failure of materials and work to conform to the specified requirements shall be done at the CONTRACTOR'S expense. Compaction tests shall be conducted by an independent testing agency acceptable to the ENGINEER. The CONTRACTOR shall be responsible for correcting all deficiencies in the work at his expense. Compaction testing shall continue until test results are satisfactory to the ENGINEER. Copies of all test results shall be promptly submitted to the ENGINEER.

1. Tests shall be made in randomly selected locations as follows:

Material Frequency

Fill and backfill----- 1 per layer (lift) per 1000 sq. ft.

Subgrade (cuts)----- 1 per layer (lift) per 2500 sq. ft.

3.4.4 Dressing Off: All cuts, fills and slopes shall be neatly dressed off to the required grade or subgrade, as indicated on the plans.

3.4.5 Cleanup: Cleanup of the site shall be made upon completion of grading work, or any major part thereof. Unless otherwise noted, excess or surplus material shall be wasted and dressed off on the site, or adjacent thereto, to the ENGINEER'S satisfaction. Excess or surplus material wasted in off-site spoil areas shall be spread and leveled as directed.

3.4.6 Topsoil Placement: Topsoil shall consist of a natural friable loam, occurring usually in a surface layer 6 to 18 inches thick, and free of roots, grass, weeds, stone and other foreign matter. Topsoil may be obtained from the graded area, if available, and stockpiled for future use. Otherwise, the CONTRACTOR shall provide topsoil from other sources at his own expense. All topsoil shall be acceptable to the ENGINEER. Topsoil shall be placed on the entire graded area as shown on the plans, or as directed by the ENGINEER. Topsoil shall be distributed to a depth of 4 inches, measured loose, and dressed off neatly to finish grade, with all debris removed.

CHAPTER 4

TRENCH EXCAVATION AND BACKFILL

4.1 PIPE BEDDING AND BACKFILL MATERIAL:

4.1.1 General: Select Material shall be earth material from the excavation free of large stones, hard lumps, frozen matter, vegetable matter, debris and other objectionable material. If necessary, suitable material shall be provided by

the CONTRACTOR from other sources at his expense. All material from the excavation unsuitable for bedding and backfill shall be removed and disposed of by the CONTRACTOR. Angular Material shall be crushed stone or gravel conforming to ASTM C33, Size No. 57, with size range of ¼ to ¾-inch. Select haunching material for pipe bedding shall be clean coarse sand, little or no fines, with more than 50% passing a No. 4 sieve and more than 95% retained on a No. 200 sieve. Pipe bedding classes shall be as follows:

A. Class "A" (Bedding Factor - 2.8): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Lay pipe to line and grade on concrete block. place concrete to the full width of the trench and to a height of one-fourth of the outside diameter of the pipe above the invert.

B. Class "B" (Bedding Factor - 1.9): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Angular material shall then be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.

C. Class "C" (Bedding Factor - 1.5): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Select haunching material shall then be carefully placed by hand and compacted to provide full support under and up to a height of one-half the outside diameter of the pipe above the bottom of the pipe barrel.

4.2.2 Trench Excavation: Trenches for pipe and other utilities shall be excavated true to line and grade. Unless otherwise indicated or specified, trenches shall be of a depth to provide a minimum cover of 3 feet over the top of pressure lines and 2 feet over the top of casing piping.

A. Side walls of trenches shall comply with OSHA requirements. Unless otherwise specified, trenches shall be between 12 and 18 inches wider at the top of the pipe than the outside diameter of the pipe, plus sheeting where necessary. Pavement shall be cut 12 inches wider than the required trench width on each side. For gravity sewer lines, maximum trench width up to a level 12 inches above the top of the pipe or shall be as noted on the plans. Shheeting shall be used where necessary.

B. Where soil conditions preclude vertical walls, the trench width shall be as specified above with the upper part of the trench limited to the least possible width greater than that specified. Where excessive trench widths are necessary, or where directed by the ENGINEER, sheeting shall be used to support trench walls.

C. Pressure Pipelines: For pressure pipelines, trench bottoms shall be prepared as follows:

1. Trench bottoms shall be graded to provide uniform and continuous bearing for the pipe along its entire length. Bell holes shall be provided for completion of joints. No ridges, sags or undercutting will be allowed.

2. If approved by the ENGINEER and subject to suitable soil conditions, trenches may be excavated a few inches below the established subgrade and backfilled to subgrade with select material, well compacted and graded to provide uniform and continuous bearing for the entire length of pipe. Bell holes shall be provided for completion of joints.

3. In rock or other unyielding material, excavation shall be made at least 6 inches below the established subgrade and the trench backfilled to subgrade with select material. The material shall be compacted and bell holes provided as specified for ordinary excavation.

4. Where material at subgrade is unstable, soft and incapable of supporting the pipe, trenches shall be excavated below subgrade to a depth as required by soil conditions, and backfilled to subgrade with angular material. The material shall be compacted and graded to provide a stable foundation and uniform bearing for the pipe. Bell holes shall be provided as specified for other types of foundation.

5. Debris encountered in trench excavation for water and other pipelines shall be removed for the overall width of the trench. It shall be removed to a depth of six inches (6") below the bottom of the pipe for pipes smaller than twenty-four inches (24") in size; eight inches (8") below the bottom of the pipe for pipes twenty-four inches (24") to the thirty-six (36") in size; and twelve inches (12") below the bottom of the pipe for pipes larger than thirty-six inches (36") in size, if debris extends to such depth.

NOTE ALL EXCAVATION SHALL BE IN COMPLIANCE WITH CURRENT OSHA REQUIREMENTS.

D. Pipe on Grade Pipelines: For gravity sewer lines, trench bottoms shall be prepared as follows:

1. Trenches shall be excavated below the established subgrade as required to provide for preparation of flat trench bottoms in strict accordance with the trench bedding details as shown. Pipe bedding and backfill shall be Class "C", except Class "B" bedding shall be used for PVC gravity sewer pipe, truss composite pipe, and where specifically noted on the plans or where directed by the ENGINEER.

2. Angular material shall be used for sewer pipe bedding where ground water is encountered or where dewatering of the trench was required to install the pipe. Bedding shall be Class "B" minimum. Excavation shall be to a depth as required to obtain suitable pipe foundation. Select material will not be allowed for sewer pipe bedding under these conditions. Bedding material shall be well compacted and shaped so that the load is supported throughout the entire length of pipe barrel and not at the pipe bells. Bell holes shall be provided for completion of joints. Angular material shall meet the requirements of the NCDOT specification 406.08. Stone size shall be No. 57. The use of fossil limestone will not be allowed.

3. Soft, unstable or otherwise unsuitable material encountered below the normal bedding depth shown on the plans shall be removed and backfilled per Class "A" Bedding requirements. All such unsuitable material shall be disposed of by the CONTRACTOR. The depth of cut below the normal bedding depth shall be kept to a minimum, but shall be as required to provide a suitable pipe foundation as directed by the ENGINEER.

E. Trenches shall be kept free of water during pipe installation. Water shall be removed from trenches and disposed of by the CONTRACTOR to the satisfaction of the ENGINEER.

F. Where required, and as approved by the ENGINEER, sheeting and bracing shall be used to comply with OSHA requirements and to prevent injury to personnel and caving of trench walls. Sheeting and bracing shall be left in place until the trench is refilled to a safe limit. The top portion may then be removed, but the lower portion shall remain undisturbed. A trench box may be used if trench widths do not exceed the maximum indicated in the improved ditch bedding details.

4.2.3 Trench Backfill: Trench Backfill shall progress as rapidly as pipe-laying and testing will permit.

A. Backfill around the pipe and to a height equal to the centerline of the pipe shall be placed by hand in layers not more than 6 inches thick. Backfill shall be as specified above. As fast as the backfill material is placed, it shall be cut under the haunches of the pipe with a shovel and thoroughly compacted with light tamps for the full width of the trench to provide support for the bottom and sides of the pipe. Backfill shall be carried up evenly on both sides. Particular care is required in backfilling PVC gravity sewer pipe to prevent excessive deflection.

B. The remainder of the backfill material shall be placed as specified below. No debris or rocks larger than 6 inches in any dimension shall be used in this portion of the backfill.

1. Under pavement, backfill material shall be placed in layers not more than 6 inches thick and thoroughly compacted to prevent future settlement. Compaction shall be at least 98% of maximum as determined by the Standard Proctor test (ASTM D698) or Modified Proctor test (ASTM D1557, Method A). Rolling with rubber tired vehicles or track type equipment will not be allowed. The top of the trench shall be filled with base for pavement as specified in Section 02575, well mixed and compacted. Excess material shall be promptly removed from the site, and the pavement surface cleaned of objectionable material. CONTRACTOR shall correct any future settlement within the guarantee period.

2. Backfill under pavement cuts shall be tested for proper compaction at the CONTRACTOR'S expense. At least one test shall be performed for each pavement cut; longitudinal pavement cuts shall be tested at increments of 100 linear feet or fraction thereof. Testing shall be performed by an independent laboratory acceptable to the ENGINEER. If compaction does not meet the specified requirements, the CONTRACTOR shall remove and replace backfill and retest at no additional cost to the OWNER. Testing shall be done until test results are satisfactory to the ENGINEER. Copies of all test results shall be promptly submitted to the ENGINEER.

3. In unpaved roads and shoulders, backfill shall be placed in layers not more than 8 inches thick and thoroughly compacted with mechanical tampers. The top 6 inches of the trench shall be filled with well compacted topsoil.

4. For cross-county lines, outfall lines and at other locations where damage to the system or property will not occur, backfill shall be placed in 12-inch layers and compacted with mechanical tampers. The upper portion of the backfill, more than 5 feet above the pipe, may be compacted by rolling with wheeled equipment. Excess material may be mounded on the trench as long as it does not interfere with surface drainage.

C: Tops of trenches shall be flush with existing ground elevation. All ponding areas and settlement below finish grade during the construction period shall be promptly corrected by the CONTRACTOR. Trenches shall be protected against scour due to surface drainage.

D: Backfilling around manholes shall, in general, conform to the requirements for backfilling trenches, except that backfill shall not be placed around manholes until all mortar has properly set.

4.2.4 Dry Boring: Where dry boring of pipe under highways or railroads is indicated, the bore diameter shall be essentially the same as the outside diameter of the pipe to prevent settlement or caving. If voids develop or if the bore diameter is greater than the outside diameter of the pipe by more than 1 inch, the voids shall be pressure grouted or other remedial measures as approved by the ENGINEER shall be taken at the CONTRACTOR'S expense.

CHAPTER 5

BORING AND JACKING

5.1 SCOPE: Boring and jacking of utility pipelines under highways and railroads shall be as shown on the plans and as specified herein.

5.2 GENERAL REQUIREMENTS: Boring and tunneling operations shall be performed in accordance with all requirements of the state department of transportation or the railroad, as applicable, including insurance, inspection, temporary work, watchmen, flagmen, protection of personnel and property, work restrictions, and work scheduling. Unless otherwise specified or directed, the CONTRACTOR shall pay for all costs in connection with meeting these requirements. The CONTRACTOR shall be responsible for repair or replacement of all existing structures and facilities, including settlement of roadways, damaged or disturbed as a result of the work, at no additional cost to the OWNER and department of transportation or railroad, within a period of one year after completion of boring and tunneling operations. All work shall be completed to the full satisfaction of the department of transportation or railroad.

5.2.1 Inspection: Boring and tunneling operations will be subject to inspection by the ENGINEER and by the department of transportation or railroad, as applicable. The department of transportation or railroad inspector will have full authority to stop work if, in his opinion, it may cause damage to the highway or railroad or endanger traffic.

5.2.2 Railroad Right-of-Way: For all work on railroad right-of-way, the CONTRACTOR shall notify the railroad at least 72 hours prior to beginning construction.

5.2.3 Experience: Before starting boring and tunneling operations, the CONTRACTOR shall submit to the ENGINEER an experience record of the proposed boring and tunneling subcontractor. Such record shall include a list of equipment and personnel to be used, and a list of at least five previous successful similar installations under highways or railroads within the past five years. Failure to submit an experience record or submittal of a record not meeting these requirements will be cause for rejection of the boring and tunneling subcontractor.

5.3 MATERIAL:

5.3.1 Carrier Pipe: Carrier Pipe shall be as specified in section 9.2 for ductile iron pipe and section 9.1 for PVC pipe.

5.3.2 Encasement Pipe: Encasement Pipe installed by boring and jacking shall be welded steel pipe conforming to ASTM A252, Grade 2, and shall be the size shown on the plans. Pipe shall be bituminous coated on the outside. Minimum wall thickness shall be as follows:

Diameter (in.)	Thickness (in.)
Under 14	0.188
14-16	0.219
18	0.250
20	0.281
22	0.312

24
0.344
26
0.375
28-30
0.406
32
0.438
34-36
0.469
38-48
0.500

When encasement pipe is installed without a protective coating or cathodic protection, the wall thickness shall be increased a minimum of 0.063 inch greater than the minimum thickness shown above.

5.4 INSTALLATION: Unless otherwise specified or directed, encasement shall be welded steel pipe installed by boring and jacking. CONTRACTOR shall submit complete drawings, details and other data of the proposed method of construction, materials and equipment to the ENGINEER and department of transportation or railroad for review. No open excavation will be allowed within the limits of the encasement without the ENGINEER'S approval. All sheeting, shoring and bracing shall be provided as necessary for the satisfactory and safe performance of the work, and will be subject to the approval of the ENGINEER and in accordance with the requirements of the department of transportation or railroad. All work areas shall be maintained in a suitable dry condition at all times, with methods of dewatering, draining, pumping and disposal of water subject to approval of the ENGINEER and department of transportation or railroad.

5.4.1 Boring and Jacking Encasement: Encasement pipe shall be installed by boring and jacking with welded joints, to the required lines and grades. The CONTRACTOR shall bear the cost of any corrective action required to meet the line and grade requirements shown on the plans. Welding shall conform to the requirements of the American Welding Society and the American Railway ENGINEERING Association for this type of work. The distance to which boring is carried ahead of the pipe shall be not more than is absolutely necessary for installation purposes, and will be subject to approval of the ENGINEER. The work shall be performed so that no voids occur in the earth surrounding the pipe and so that ground settlement adjacent to and within the limits of the pipeline crossing is eliminated. If voids occur or are encountered outside the pipe, grout holes shall be drilled at 10-foot centers in the top of the encasement pipe and the voids filled with 1:3 Portland cement grout applied at sufficient pressure to fill the voids and prevent embankment settlement.

A. If it becomes necessary to abandon an incomplete or unacceptable bore, the abandoned encasement shall be capped and filled completely with 1:3 Portland cement grout. Abandonment procedures shall be completed prior to moving to another boring location. All costs in connection with an abandoned bore, including the construction cost and capping and filling costs, shall be the CONTRACTOR'S expense.

5.4.2 Carrier Pipe Installation: Carrier Pipe shall be installed in a manner to provide proper line and grade. Carrier pipe shall be adequately restrained with mechanical restraints to prevent movement, including floatation. After the carrier pipe is installed, each end of the encasement shall be sealed with rubber casing boots with stainless steel straps.

5.4.3 Casing Spacers: Casing spacers shall be prefabricated stainless steel with polyethylene insulators capable of being securely fastened to the carrier piping. All attaching hardware shall be stainless steel. Spacing of casing spacers shall be per manufacturer's specifications. Refer to Chapter 12 for list of approved spacers.

5.4.4 Casing End Plugs: Casing ends shall be sealed with neoprene rubber boots securely fastened to the casing and carrier pipe with stainless steel bands. Refer to Chapter 12 for list of approved casing end plugs.

5.4.5 Appurtenances: Vents and drains shall be provided where indicated on the plans. Vents shall consist of pipe as noted, and shall be located so as not to interfere with highway maintenance or be concealed by vegetation. Drains shall be provided at the lower end and shall consist of stone as noted on the plans.

CHAPTER 6

ROADWAY REPAIR AND RESURFACING

6.1 AGGREGATE SURFACING: This section covers gravel or crushed stone surfacing for roads, drives and parking areas as shown on the plans and as specified herein.

6.1.1 Materials:

A. Drainage Structures and Pipe Material shall conform to the requirements shown on the plans, and shall be as specified in other sections.

B. Surfacing shall consist of crushed stone or gravel reasonably free from soft pieces, disintegrated particles and vegetable matter. The material shall generally conform to the requirements of the NCDOT, and shall be graded as follows:

Percent by Sieve Size Weight Passing

2 in. 100

1-1/2 in. (SC) 95-100

1 in. 70-100

1/2 in. 50-80

No. 4 30-55

No. 30 12-31

No. 200 6-15

6.1.2 Construction: Surfacing shall be graded to subgrade and compacted as specified in Section 4.2.3. Surfacing shall be finished by fine grading to the required lines, grades and sections, and by recompacting the subgrade with heavy rollers. Surfacing shall be graded to drainage structures.

A. Drainage Structures and Pipe shall be properly installed at the locations shown on the plans.

B. Surfacing shall be installed in accordance with all applicable provisions of the appropriate section of the NCDOT Standard Specifications. Surfacing shall be placed to a compacted thickness of 6 inches, unless otherwise noted.

6.1.3 Completion: Surfacing shall be fully completed, dressed off, and left in good condition at completion of the work.

6.2 CUTTING AND REPLACING PAVEMENT

This section covers cutting and replacing pavement for installation of utilities, and resurfacing of existing pavement as shown on the plans and as specified herein. Existing pavement to be cut for installation of pipe or other utilities shall be replaced with new base and pavement as specified below.

6.2.1 Cutting Pavement: Pavement shall be neatly cut to a straight edge prior to trenching, with the method of cutting subject to approval of the ENGINEER. Pavement shall be cut 12 inches wider than the excavated area on each side. Ragged and irregular edges shall be redone. Concrete pavement shall be sawed with suitable concrete saw cutting equipment.

6.2.2 Trench Backfilling: Backfilling under pavement shall be as specified in Section 3.4. Base for pavement shall be crusher run stone or flowable fill per NCDOT requirements for all secondary highways and non-highway streets, and reinforced concrete for all primary highways. Base shall be placed in accordance with plan or encroachment permit details. Base width shall be as shown on the plans or encroachment permits for the various types of pavement cuts.

A. Crusher run stone shall be graded 1-1/2 inches and down, with fines being added if necessary. Stone shall be well mixed and compacted by tamping and rolling so as to prevent settlement. Crusher run base material shall be placed at the same time that the trench is backfilled. Backfilling to the top of the trench, to be cut out and replaced with base material at a later date, will not be allowed.

B. Base for highway pavement and adjacent drives shall be 8 inches of crusher run stone, stabilized with 5% Portland cement. Base shall be thoroughly mixed prior to compaction.

C. Base for non-highway pavement and adjacent drives shall be 8 inches of crusher run stone, without the addition of cement. Base for secondary roadways shall be flowable fill meeting NCDOT specifications.

D. Concrete base shall consist of 8 inches of concrete, reinforced with No. 4 steel bars placed at 8 inches on center

in the transverse direction and No. 4 tie bars in the longitudinal direction. Concrete shall be designed to produce a compressive strength of 3000 psi at 28 days. Design of mix and source of supply will be subject to approval of the ENGINEER.

6.2.3 Pavement Replacement: Pavement shall be replaced with bituminous plant mix pavement, except that existing concrete pavement shall be replaced with 8 inches of Portland cement concrete. Pavement shall conform to the applicable NCDOT specifications for each type.

A. Pavement shall be repaired within the same week that it is cut. If inclement weather delays pavement replacement, CONTRACTOR shall not cut additional pavement until he has notified the NBSD and received specific permission and instructions.

B. For bituminous pavement, the entire area to be resurfaced (including edges of existing pavement) shall be tack primed with an acceptable asphalt tack coat just prior to placing the new pavement. New pavement surfaces shall be smooth, true to grade and shall provide a smooth transition with existing surfaces. All settlement and damage occurring during construction and the warranty period shall be repaired by the CONTRACTOR.

C. All work on State Highways shall be done in strict accordance with state department of transportation requirements. CONTRACTOR shall familiarize himself with all such requirements. He shall obtain from the OWNER a copy of all required encroachment permits, and shall conform to all requirements and stipulations therein. In case of conflict between the plans and encroachment permits, the encroachment permits will govern.

6.3 RESURFACING OF EXISTING PAVEMENT

Work consists of the resurfacing of existing pavement as indicated on the plans and as specified herein. Unless otherwise specified, all work shall be in accordance with applicable state department of transportation specifications.

6.3.1 General: Proper surface drainage shall be maintained at all times, especially at private driveways. Concrete curbs and other items, where damaged, shall be repaired to the satisfaction of the NBSD and to match existing. Manhole covers and valve boxes shall be raised as required prior to resurfacing. All potholes and other large depressions shall be filled to the satisfaction of the NBSD.

6.3.2 Preparation: Existing pavement shall be thoroughly swept and scraped clean, free from dust and foreign material, and so maintained until the bituminous mixture is laid.

6.2.4 Leveling Course: Where the surface of existing pavement is irregular, it shall be brought to uniform contour by leveling with a bituminous mixture. The leveling course shall be thoroughly compacted until it conforms with the surrounding surface.

6.2.5 Tack Coat: A tack coat shall be applied to existing pavement and to the leveling course before the surface course is laid. Tack coat shall be asphalt cement, emulsified asphalt, or rapid curing type cutback asphalt. Contact surfaces of curbs, manholes and other items shall be painted with asphalt cement before the bituminous mixture is placed against them.

6.2.6 Surface Course: Surface course shall be hot laid asphaltic concrete placed over the leveling course to a compacted thickness of 1-1/2 inch. After compaction, the pavement surface shall be smooth and true to the established crown and grade. Defects shall be neatly cut out and replaced to the satisfaction of the NBSD. Sections of new pavement shall be protected from traffic until they have properly hardened. All settlement and damage occurring during construction and the warranty period shall be repaired by the CONTRACTOR.

CHAPTER 7

GENERAL PIPELINE CONSTRUCTION REQUIREMENTS

7.1 SCOPE

This section describes general requirements applicable to piped utilities.

7.2 CONCRETE

Concrete for piers, blocking, protection and other uses shall be composed of Portland cement, sand, coarse

aggregate, water and approved admixtures, and shall be designed to provide a compressive strength of 3000 psi at 28 days unless otherwise noted. Steel reinforcing bars shall conform to ASTM A615, Grade 60.

7.2.1 Piers: All piers shall be of concrete unless otherwise noted or directed by the ENGINEER. Concrete piers shall be provided as detailed on the plans. Pier foundations shall be of depths as required to reach firm, solid material. Foundation for piers shall be adequate to support the intended load and will be subject to the ENGINEER'S approval prior to pouring concrete.

NOTE

Concrete Thrust Blocking shall be included where mechanical restraints are used. Prior approval must be obtained from NBSD before using thrust blocking.

7.2.2 Thrust Blocking: All fittings, ends, dead ends, hydrants, etc., shall be blocked with concrete having bearing on the undisturbed earth in the side and/or bottom of the trench. Where utilized, the bearing area shall be equal to that shown on the plans, or greater if deemed necessary by the NBSD. A minimum of four (4) mil plastic shall cover the fittings to ensure that no concrete will interfere with removal of the fittings.

7.2.3 Protection: Concrete supports, encasement and other protective work shall be provided at locations as shown on the plans or as directed by the ENGINEER. Protection concrete shall be Class C or 2000 psi concrete.

7.3 MISCELLANEOUS PLANT PIPING

Miscellaneous plant piping shall consist of yard piping, pipe work in structures (except plumbing), equipment piping and other utility piping, fittings, valves and appurtenances at various structures and facilities. Shop drawings of yard piping, pipe work in structures, equipment piping, chemical piping and air piping shall be submitted to the ENGINEER for review.

7.3.1 Materials: All materials and products under this section shall meet Made in America Criteria. Pipe shall be of the type, size and class as shown on the plans. Except where specified in this section, pipe, fittings, valves and appurtenances shall be as specified in other sections.

7.3.2 Yard Piping: Yard piping shall include all waste, water, drainage, sludge, chemical, air and other utility piping and appurtenances from points 3 feet outside structures or buildings to other units of the facility, to points of discharge, to other work, or to the limits shown. Yard piping shall be installed at the locations shown on the plans, and to the position, alignment and grade indicated thereon. Trench excavation and backfill for underground piping shall be as specified in Section 02200.

A. Waste piping (including sludge piping) shall be installed in accordance all requirements of subsequent Sections, including successfully meeting the infiltration or exfiltration test for gravity lines and pressure and leakage tests for pressure lines. All waste piping shall be ductile iron pipe, unless otherwise noted.

B. Water piping shall be installed in accordance with all requirements of the NBSD's "Water System Standards and Specifications", latest revision, including successfully meeting pressure and leakage tests, and disinfection of potable water lines.

7.3.3 Equipment Piping: Equipment piping shall be installed as shown on the plans and shall fit the equipment provided. Piping shall be assembled and installed so as not to put strain on equipment connections. Pipe supports shall be provided as required to prevent vibration and excessive sway. Work shall be done in a neat, substantial and workmanlike manner. All joints shall be watertight and airtight.

7.3.4 Chemical Piping: Chemical piping shall be provided complete with all fittings, valves and accessories. All joints in piping shall be watertight and airtight. Pipe sleeves shall be provided where piping passes through walls and floors, with the space between the pipe and sleeve sealed water tight. Piping in structures shall be adequately anchored and supported. A surge suppressor or other suitable device shall be provided on each metering pump discharge line 30 feet or more in length to minimize surge and water hammer.

A. All exposed chemical piping shall be provided with identification and arrows showing direction of flow. The identification shall be either paint or remanufactured pipe markers suitable for the exposed conditions of each location. The identification shall state the material being handled and pipe service; i.e. "non-potable water, caustic, sludge, etc."

B. All chemical piping shall be tested with clear water, and all leaks and other defects repaired prior to introduction of chemicals into the system. Testing of insulated piping shall be done prior to installation of heating tape and insulation.

Tests may be run concurrently with leakage tests on chemical storage tanks.

7.3.5 Air Piping: Air Piping shall be provided with all fittings, valves and accessories required for a complete installation. All joints shall be airtight. Pipe sleeves shall be provided where piping passes through walls and floors, with the space between the pipe and sleeve sealed watertight. Piping shall be adequately anchored and supported, and shall be provided with remanufactured pipe markers identifying the service.

A: Air Piping shall be tested to 150% of its working pressure, with this pressure maintained for at least 30 minutes. Testing shall be done prior to installation of insulation. All leaks shall be repaired to the satisfaction of the ENGINEER. After testing, piping shall be cleaned, flushed and drained prior to being placed in service.

7.4 CLEANUP REQUIREMENTS: All pipeline rights-of-way and pipe work areas shall be cleaned up and left in a satisfactory condition in accordance with the requirements of Section 3.4 and as specified herein.

7.4.1 Public Right-of-Ways: Cleanup of Work along Highways and Roads shall be made immediately upon completion of the backfill operation. Trenching and pipe laying shall be stopped at any time that cleanup work lags and shall not be resumed until cleanup progress is satisfactory to the NBSD. Final cleanup and condition of the work area shall be subject to approval of the NCDOT Representative, Developer and NBSD.

7.4.2 Cross-Country Pipeline Routes: Cleanup of Work for Cross-Country Locations shall follow immediately upon completion of any major part of the work or when directed by NBSD. Topsoil shall be replaced on all areas disturbed by pipeline work throughout the length of the pipeline. Topsoil may be removed from the line of work and stockpiled for future use, or may be obtained from other approved sources. The right-of-way shall be provided with a grass cover as specified in Chapter 11. The entire right-of-way shall be left in a condition acceptable to the NBSD and property OWNER and be accessible by a standard 2 wheel drive truck.

7.4.3 Final Cleanup: Final Cleanup will meet approval of the NBSD and property OWNER where applicable, with all defects in trench settlement, pavement patches and other deficiencies being promptly corrected.

CHAPTER 8

WASTEWATER TRANSMISSION PIPELINE INSTALLATION

8.1 SCOPE: Wastewater pipelines and appurtenances shall be provided as shown on the plans and as specified herein. Clearing, grubbing, trench excavation and backfill, pipe material, valves, cutting and replacing pavement, and removing and replacing sidewalk shall be as specified in other chapters. All applicable provisions shall be binding upon work covered in this section.

8.2 MATERIAL

All materials and products shall meet Made in America Criteria.

8.2.1 Piping: Pipe and fitting material shall be as specified in sections as follows:

- A. PVC Pipe: Section 9.1.
- B. Ductile Iron Pipe: Section 9.2.
- C. Polyethylene Pipe: Section 9.3.
- D. Valves: Section 9.4.
- E. Fittings, Misc Appurtenances and Specialties: Section 9.5.
- F. Manholes and Associated Appurtenances: Section 9.6.
- G. Sewer Pump Stations and Appurtenances: Section 9.7.
- H. Service Connections: Section 9.8.
- I. General Electrical: Section 9.9.

8.3 PIPELINE INSTALLATION

Piping and appurtenances shall be installed in accordance with the best practice, manufacturer's instructions. Where the pipeline crosses under or is installed on highway or railroad right-of-way, the work shall be done in accordance with such requirements specified in other chapters.

8.3.1 Locations: Piping and appurtenances shall be installed at the locations shown on the plans and to the position, alignment and grade shown thereon. Prior to beginning work at any location, the CONTRACTOR shall consult with the NBSD to determine that all rights-of-way, permits and other legalities are in order. CONTRACTOR shall familiarize himself with all conditions and/or limitations of such rights-of-way or permits, and shall fully comply with all such

requirements. All work shall be confined to rights-of-way or permit limits and any encroachment beyond such limits shall be the CONTRACTOR'S liability.

8.3.2 Installation of Pipe and Appurtenances: Clearing and Grubbing along pipelines shall be as specified in Chapter 2. Trench Excavation shall be as specified in Chapter 4. Trenches for water lines shall generally follow the contour of the ground so as to provide a minimum cover of 36" and a maximum cover of 60", unless otherwise noted. Pipe and appurtenances shall be hauled to the work site and distributed neatly along the trench prior to laying. Pipe shall be carefully handled to prevent damage by using mechanical hoists or other approved methods. All damaged pipe and appurtenances shall be rejected and removed from the work site. Installation shall proceed as follows:

A. Pipe and appurtenances shall be kept clean and open ends securely plugged when pipe laying is not in progress. The inside of pipe, bells and spigots shall be thoroughly inspected and cleaned prior to lowering into the ditch. Care shall be exercised after the pipe is in place to prevent dirt or other extraneous material from getting into the pipe, bells and spigots.

B. Spigots shall be fully seated in bells, and the pipe shall be uniformly bedded on the bottom of the trench for its entire length, with bells laying in previously dug bell holes sufficiently large to allow for proper bedding and jointing. Pipe shall be cut where necessary. After jointing, a reasonable amount of deflection may be made in the joint. Such deflection shall not exceed the maximum allowable amount recommended by the manufacturer for each size of pipe.

C. Pipe on piers or supported from bridge shall be ductile iron unless otherwise noted, and shall be properly installed in accordance with the details shown on the plans. Pipe shall be carefully placed in position to the required line and grade. Joints shall be restrained mechanical joints unless otherwise noted, and shall be watertight and trouble-free. All fittings and connections, including transition pieces, shall be provided as required for a complete installation. All hangers, supports, straps, bracing, anchors and other appurtenances shall be provided as detailed or required for proper alignment and support of the pipe.

D. River crossing pipe shall be laid as shown on the plans. Trenching shall be as shown and shall produce a suitable bearing surface for the pipe throughout the length of the trench. After pipe laying has been completed the trench shall be backfilled. Installation of river crossing pipe shall proceed as follows:

1. Concrete anchor collars shall be constructed in accordance with the plans.
2. Appropriate end of the run fittings shall be provided at each end of the river crossing run to mate with the pipe approaching and leaving the river.
3. A minimum cover of two feet shall be provided over the pipe. When crossing water courses which are greater than fifteen feet (15') in width, the following shall be provided.

A. The pipe shall be ductile iron of special construction, having flexible watertight joints or of fuse butt welded polyethylene with concrete anti-flotation collars.

B. Valves shall be provided at both ends of the water crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding. The valves shall be installed in a watertight manhole or vault.

C. Permanent taps shall be made on each side of the valve on the source side to allow insertion of a small meter to determine leakage and for sampling purposes.

E. Fittings, valves, and other appurtenances shall be installed where shown on the plans or as directed by the NBSD. Fittings shall be well restrained as specified on the plans.

F. Air release valves shall be provided where shown on the plans or directed by NBSD and shall be carefully installed in accordance with applicable portions of these specifications. Valves shall be installed in a watertight vault.

G. Connections to Existing Facilities shall be made where shown on the plans or where directed by NBSD. All connections to existing system shall be performed in the presence of the NBSD Inspector. Connections shall be made with tapping sleeves and valves, except where other type connections are specifically shown.

H. Where an existing water line crosses under the sanitary sewer or within

18 inches above an existing sanitary sewer, both the water and sewer lines shall be constructed of ductile iron pipe centered at the crossing. All replacement of sewer pipe shall be performed in a manner to cause the least interference with the operation of existing pipelines. CONTRACTOR shall take measures to insure that at no time will raw sewage be discharged on the premises.

I. Water lines shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer or sewer manhole. The distance shall be measured edge-to-edge. Where it is impossible to maintain the prescribed 10 feet of separation, NBSD may at its discretion allow deviation from the 10 foot requirement provided both the water and sewer line shall be constructed to water system standards and pressure tested to a minimum of 150 psi in accordance with the Ten State Standards. Prior approval must be obtained from NBSD before proceeding.

J. Water lines crossing house sewers, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer. Where it is impossible to maintain the prescribed 18 inches of vertical separation, both the water and sewer line shall be constructed of ductile iron pipe to water system standards and pressure tested to a minimum of 150 psi in accordance with the Ten State Standards.

K. High point in the force mains shall be marked and air release valves installed at these points. If obstruction are encountered which would require a change in the grade of the work, NBSD shall be notified immediately.

L. On force mains where angular deflections from a straight line or grade are made necessary by vertical or horizontal curves or offsets in ductile iron pipe, the deflection shall not exceed six (6) divided by the nominal diameter (in inches), per lineal foot for pipe less than fourteen inches (14") in diameter, nor four and five-tenths (4.5) divided by the nominal diameter (in inches) per lineal foot for pipe fourteen inches (14") or more in diameter, except for river crossings. The deflection is to be measured between the center lines, extended, of any two connecting joints of pipe. Where deflections in excess of such limits are necessary, special bends shall be provided, or, if authorized by NBSD, shorter lengths shall be used in sufficient number to provide the angular deflection required.

M. Except where necessary to make connections with other lines, pipes shall be laid with the bell facing the direction of laying. For lines of appreciable grade, the joints shall be facing upgrade.

N. Mechanical thrust restraints shall be applied on all pressure pipelines four inches (4') in diameter or larger at all bends, tees, valves, and plugs. Concrete blocking shall also be used.

O. Manholes, pits, or vaults containing valves, air release valves, or other appurtenances in the collection system shall be sealed watertight and shall be located where they are not subject to flooding by surface water. Under no circumstances are drains to be connected to any storm or sanitary sewer system.

P. Backfilling of Trenches shall be as specified in Chapter 4.

Q. Cutting and Replacing Pavement shall be as specified in Chapter 6.

8.3.3 INSPECTION AND ACCEPTANCE

All work shall be subject to inspection and approval prior to final acceptance and payment.

A. Pressure and Leakage Tests shall be as specified in Chapter 10.

B. Cleanup and site restoration shall be as specified in Chapter 11.

C. Closeout documentation, as-built drawings shall be furnished by the ENGINEER to NBSD.

CHAPTER 9

PIPELINE MATERIALS AND APPURTENANCES

9.1 POLYVINYL CHLORIDE (PVC) PIPE for utilities shall be provided as shown on the plans and as specified herein.

9.1.1 Shop Drawings: Catalog cuts and related data for all pipe and fitting material shall be submitted to NBSD for review.

9.1.2 Materials: All material under this section shall meet Made in America Criteria. PVC Pressure Pipe shall be as specified below. Standard laying lengths shall be 20 feet maximum. Fittings and adapters shall conform to the same requirements as for pipe, and shall be compatible with pipe.

A. Pipe for sewer force mains 4 inches through 12" in diameter shall conform to AWWA C900, SDR 18 (150 psi), with pipe made to cast iron outside diameters. Pipe 14" and larger shall conform to AWWA C905, DR 21 (200 psi). Pipe shall have integral bell and spigot joints with rubber ring or gasket. 2 inch and 3 inch diameter pipe shall conform to ASTM D2241, SDR 21 (Class 200), with pipe made from PVC 1120 material. Pipe shall have integral bell and spigot joints with rubber ring or gasket. Refer to Chapter 12 for a list of approved manufacturers.

B. Pipe shall be marked as to the Type, Class or nominal thickness, weight, manufacturer and date of production.

C. Forcemain pipe shall be factory dyed industry standard green to aid in identification. Effluent transmission pipe shall be factory dyed industry standard purple.

D. Pipe fittings 4 inch and larger shall be mechanical joint type utilizing synthetic rubber ring gasket and shall conform to the requirements of ANSI/AWWA C110/A21.10. Schedule 80 glue joint PVC fittings may be used on 2 inch pipe. Refer to Chapter 12 for a list of approved manufacturers.

E. PVC Gravity Sewer Pipe, 4 to 15-inch diameter, shall be Type PSM pipe conforming to ASTM D3034, with integral bell and spigot rubber O-ring gasket joints. SDR 35 is acceptable for depths of 8 feet or less. C900 shall be used for depths greater than 8 feet. Standard laying lengths shall be 13 feet maximum. Gasket fittings and accessories shall be compatible with pipe. Refer to Chapter 12 for a list of approved manufacturers.

9.1.3 Material Testing: Each joint of pressure pipe shall be subjected to and successfully meet a hydrostatic proof test at the factory in accordance with the requirements for each type. Certified test results shall be furnished to the NBSD for each shipment of pipe. Pipe Fittings shall be subject to inspection and testing in accordance with standard manufacturing practice. A. PVC Gravity Sewer Pipe, 4 to 15-inch diameter, shall be tested by the manufacturer for pipe flattening, impact resistance, pipe stiffness, joint tightness and extrusion quality (acetone immersion) in accordance with ASTM D3034. Test certificates showing that pipe conforms to these specifications shall be furnished to the Engineer for each shipment of pipe. PVC Gravity Sewer Pipe shall be installed with all pipe sections assembled in accordance with the manufacturer's instructions to form tight joints. All pipe shall pass the deflection test as specified below.

9.1.4 Installation: Pipe and fittings shall be installed in accordance with the requirements specified in other Chapters and the manufacturer's instructions. Pipeline marking tape and tracer wire, as specified in Section 9.5.4, shall be installed on all pipelines.

A: PVC Pressure Pipe shall be installed in strict accordance with the manufacturer's instructions. Adapters shall be provided as required when connections are made to other types of pipe.

B: Deflection Test: All PVC gravity sewer pipe, 4-inch diameter and larger, shall be tested after installation and backfill by the Contractor using methods and equipment approved in writing by the Engineer. Testing shall be performed at the Contractor's expense using a 5% mandrel acceptable to the engineer and NBSD to insure that initial deflection of pipe does not exceed 5.0%. All deflection testing shall be performed in the presence of the Engineer and NBSD. Contractor shall notify the Engineer and NBSD in sufficient time to insure that the both will be present during deflection tests. Deflection test records shall identify the location and deflection amount at all points where deflection exceeds the specified limit. Such records shall be certified by the Contractor, and shall be furnished to the Engineer prior to acceptance and payment. Pipe with initial deflection exceeding the specified limit will be unacceptable, and shall be re-bedded to the correct deflection and retested for deflection, at the Contractor's expense.

C. Air Testing: Air testing as specified in section 10.4 shall not occur until all dry utilities have been installed.

9.2 DUCTILE IRON (DIP) PIPE: Ductile iron pipe and fittings shall be provided as shown on the plans and as specified herein.

9.2.1 Shop Drawings: Catalog cuts and related data for all pipe and fittings shall be submitted to NBSD for review.

9.2.2 Material: All material under this section shall meet Made in America Criteria. Ductile Iron Pipe shall conform to ANSI/AWWA C151/A21.51, and shall be designed for thickness class 50 unless otherwise noted. Ductile iron pressure pipe shall conform to ASTM A377. Pipe shall have push-on or mechanical joint ends conforming to ANSI/AWWA C111/A21.11, except where flanged or other type ends are shown or specified.

A. Pipe shall be coated on the outside with a standard bituminous coating.

B. Interior surface of pipe shall be lined with cement mortar conforming to ANSI/AWWA C104/A21.4, 45 mil thickness minimum. DIP gravity sewer piping shall be factory lined with a hydrogen sulfide resistant coating specifically designed for sanitary sewer service.

C. Pipe shall be marked as Type, Class or nominal thickness, weight, manufacturer, and date of production.

9.2.3 Material Testing: Each joint of ductile iron pipe, prior to lining, shall be subjected to and successfully meet a hydrostatic test at the factory in accordance with ANSI/AWWA C151/A21.51. Certified test results shall be furnished to the NBSD for each shipment of pipe.

9.2.4 Installation: Pipe and fittings shall be installed in accordance with the manufacturer's instructions and the requirements specified in other sections. Ductile iron pressure pipe shall be installed in accordance with all applicable requirements of ANSI/AWWA C600. Underground pipe and fittings shall be installed using push-on joints or mechanical joints, except where other type joints are specifically noted. Exposed pipe and fittings shall have Class 125 flanged joints except where Class 250 is specifically noted, or other type joints as shown or specified. All adapters necessary for the proper jointing of pipe and fittings shall be provided. Connections to other types of pipe shall be made as detailed on the plans. Underground fittings shall be well restrained as detailed on the plans. Pipe supports, hangers and anchors shall be provided as required for a complete installation. Pipeline marking tape and tracer wire, as specified in Section 9.5.4, shall be installed on all pipelines.

9.3 POLYETHYLENE (PE) PIPE

9.3.1 General: The pipe supplied under this specification shall be SDR 9 high performance, high molecular weight, high density polyethylene pipe, and shall conform to ASTM D 1248 (Type III C, Category 5, P34). Minimum cell classification values shall be 345434C as referenced in ASTM D 3350 - latest edition. All pipe resin shall be manufactured by the same company that manufactures the pipe itself in accordance with these specifications to insure complete resin compatibility and total product accountability. The fittings supplied in this specification shall be molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe. To insure compatibility of polyethylene resins, all fittings supplied under this specification shall be of the same manufacture as the pipe being supplied.

9.3.2 Physical Properties: The pipe shall conform to the physical properties as described herein.

A. Typical Pipe Physical Properties

PROPERTY TEST METHOD UNIT VALUE

Density	
ASTM Method	
gms/cc	
0.955	
Melt Index	
ASTM D 1238	
(190/2.16)	
gms/10	
min	
0.14	
Condition A,B,&C, F-0	
ASTM D 1693	
Hrs	

>5000**
Compressed Ring, F-60
Proposed ASTM
Hrs
>800
Tensile Strength, Yield
ASTM D 638
Psi
3200
Type IV Specimen
(2"/min)
Elongation at Break
ASTM D 638
%
>750
Type IV Specimen
(2"/min)
Vicate Softening Temp
ASTM D 1525
Degrees F
257
Brittleness Temp
ASTM D 746
Degrees F
<-180
Flexural Modulus
ASTM D 3350
Psi
125,000
Modulus of Elasticity
ASTM D 638
Psi
105,000
Hardness
ASTM D 2240
Shore D
64
Coefficient of Linear Thermal Expansion:
Molded Specimen
ASTM D 696
In./in./deg.F
8.3x10⁻⁵
Extruded Pipe
1.2x10⁻⁴
Thermal Conductivity
Dynatech-Colora BTU, In./Themoconduc tor ft./2hrs.deg. F
2.7
Long Term Strength:
73 degrees F
ASTM D 2837
Psi
1600
140 degrees F
Psi
800
Material Cell Classification
ASTM D 3350
345434c
Material Description
PPI recommendation
PE 3408

B. Quality Control: The resin used for manufacturer of the pipe shall be manufactured by the pipe manufacturer, thus maintaining complete control of the pipe quality. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects and shall be identical in color, density, melt index, and other physical properties. The polyethylene resin used shall have all ingredients pre-compound prior to extrusion of pipe, in plant blending is not acceptable. NBSD may request, as part of the quality control records submittal, certification that the pipe produced is represented by the quality assurance testing. Additionally, test results from manufacturer's testing or random sampling by the NBSD that do not meet appropriate ASTM standards or manufacturer's representation, may be cause for rejection of pipe represented by the testing. These tests may include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D 3350, 10.1.9. NBSD may request certified lab data to verify the physical properties of the materials supplied under this specification or may take random samples and have them tested by an independent laboratory.

C. Rejection: NBSD reserves the right to reject any polyethylene pipe and fittings failing to meet any of the requirements of this specification.

D. Pipe Dimensions: Pipe supplied under this specification shall have a nominal IPS (Iron Pipe Size) O.D.unless otherwise specified. The SDR (Standard Dimension Ratio) of the pipe supplied shall be as specified by NBSD.

9.3.3 Construction Practices:

A. Handling of Pipe: Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking should be done in accordance with the pipe manufacturer's recommendations. The handling of the pipe should be done in such a manner that it is not damaged by dragging over sharp objects or cut by chokers or lifting equipment.

B. Repair of Damaged Sections: Segments of pipe having cuts or gouges in excess of 10% of the wall thickness of the pipe should be cut and removed. The undamaged portions of the pipe shall be rejoined using the butt fashion joining method as specified below.

C. Pipe Joining: Sections of polyethylene pipe should be joined into continuous lengths on the job site above ground. The joining method shall be the butt fusion method and shall be performed by the manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, and fusion pressures. Prior approval of equipment and personnel shall be obtained from NBSD before fusion begins. The completed pipe joints shall be guaranteed for five years in writing to NBSD and its CONTRACTOR.

D. End Connections: Special flanged stub ends will be required for each approximate 500 feet line length. The price as quoted shall include any special end configuration and polyethylene ring to hold a standard slip on ANSI flange. NBSD and its CONTRACTOR will determine the final number and condition required.

E. Handling of Fused Pipe: Fused segments of pipe shall be handled so to avoid damage to the pipe. When lifting fused sections of pipe, chains or cable type chokers should be avoided. Nylon slings are preferred. Spreader bars should be used when lifting long fused sections. Care should be exercised to avoid cutting or gouging the pipe.

F. Installation: Trenching, installation, backfill and testing shall be in accordance with NBSD specifications and drawings and special method of installation developed for a specific project. Where specified, pipeline marking tape and tracer wire, as specified in Section 9.5, shall be installed over all pipelines.

9.3.4 Final Testing: After polyethylene piping is installed, backfilled and all air removed, the CONTRACTOR shall apply a hydrostatic pressure of 150 psi min. to the pipe. The test pressure shall be allowed to stand without make-up pressure for a period of time as required by the pipe manufacturer and approved by the NBSD to allow for diameter expansion or pipe stretching to stabilize. After the required equilibrium period the test section shall be returned to the original test pressure. All final testing shall be in conformance with NBSD specifications.

9.4 VALVES

9.4.1 General: Eccentric plug valves shall be used exclusively on sewer force main projects unless specifically authorized by NBSD. Plug valves shall be used for all sizes two inches (2") and larger. All valves shall open left (counter clockwise). All plug valves six inches (6") and larger shall have a 450 foot lbs. gear driven actuator minimum. All buried service valves shall have a 2" square operating nut located at a depth not to exceed 3 feet. Valves with

operating nuts greater than 3 feet deep shall have valve nut extenders provided by the valve manufacturer bringing the operating nut within 2 feet of finished grade. Valves installed in concrete vaults or manholes shall be provided with hand wheel actuators. All valves shall have a cast iron screw type valve box and a four inch (4") thick concrete collar. All valves are to be designed for a minimum working pressure of not less than 150 psi. Refer to Chapter 12 for list of approved manufacturers.

9.4.2 Plug Valves. Plug valves shall be used on all sewer applications unless approved otherwise by NBSD. Plug valves shall be of the non-lubricated eccentric plug type with a resilient seat seal unless otherwise specified and shall be furnished with mechanical joint ends in accordance with ANSI Standard A21.11, unless specified otherwise on the plans. Port area for all valves shall be a minimum of 80% of the full pipe area. Valve bodies shall be of ASTM A-126 Class B cast iron. All exposed nuts, bolts, washers, springs, etc. shall be zinc plated. Resilient seat seals shall be of Buna-N or Neoprene, suitable for use in sewage service. Seats shall be of non-metallic with seat coating thermally bonded and in full conformance to AWWA Standard C550. Valves shall be furnished with permanent corrosion resistant bearing surfaces in the upper and lower journals designated to withstand full rated bearing loads and provide long life in sewage service. Valves furnished shall have their internal wetted surfaces protected by nonmetallic coatings factory applied, thermally bonded and in full conformance to AWWA Standard C550. Nominal valve pressure ratings, body flanges and wall thicknesses shall be in full conformance to ANSI B16.1-1975. Valves shall seal leak-tight against full rated pressure in both directions. Valve seats shall be tested and provide leak-tight shut-off to 175 psi for valves 14" and larger, with pressure in each direction. A hydrostatic shell test at twice rating shall be performed with plug open to demonstrate overall pressure envelope integrity. Valves six inches (6") and larger for direct bury shall have gear actuators with 2" square operating nut and shall be capable of opening valve at rated pressure of 150 psi. All gearing shall be fully enclosed in a suitable housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. A suitable stop shall be set to provide water tight shut off in the closed position at full rated pressure. All exposed nuts, bolts and washers shall be zinc plated. Plug valves for installation in valve pits shall have a 2" square operating nut and all above ground shall have hand wheel operators. Valve actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs, and washer used in buried service shall be electro plated steel. Valves shall be fitted with cast iron valve boxes and cover with fully adjustable tops for all buried valves.

9.4.3 Gate valves. All Resilient Wedge Gate Valves shall comply with all requirements of AWWA C509, latest revision, and with the below listed requirements. All resilient Wedge Gate Valves shall be designed for 250 PSIG working pressure, shall be factory seat tested at 250 PSIG with no leakage past the seat from either side of the disc, and shall be shell tested at 500 PSIG. Minimum body and bonnet wall thickness shall be as set forth in Table 2, Section 4.3.1 of AWWA C509. Body and bonnet wall thicknesses less than the minimum thickness as specified in table 2 shall not be acceptable. Bonnet to body seal shall be effected by a flat neoprene gasket. Bonnet and body flanges shall be fully machined to assure proper sealing of the gasket. End connections shall be flanged in accordance with Class 125, ANSI B16.1 for above ground installation, and for underground installation shall be mechanical joint in accordance with AWWA C110/111 or slip-on for use with cast iron OD pipe. All gate valves shall be of the non-rising stem (N.R.S.) Design and shall open left (counter-clockwise). Valves installed above ground shall be furnished with hand wheels. All buried valves shall be furnished with 2" square operating nuts. All gate valves shall have O-Ring sealed stems with one O-Ring located below the thrust collar and with two O-Rings located above the thrust collar. The thrust collar area between the two lower O-Rings shall be factory filled with a lubricant to provide permanent lubrication of the thrust collar area. Gate valve stems shall be of bronze rolled bar stock and shall have a forged thrust collar. The stem material shall provide 70,000 PSI tensile strength with 15% elongation and a yield strength of 30,000 PSI. Cast stems shall not be acceptable. Stems shall have acme form threads for strength and efficiency. An anti-friction thrust washer shall be provided both above and below the thrust collar for ease of operation. The resilient-seated disc wedge shall be of the resilient wedge fully-supported type. Solid guide lugs shall travel within channels in the body of the valve. The disc and guide lugs shall be fully (100%) encapsulated in SBR (styrene butadiene) rubber. Refer to Chapter 12 for a list of approved manufacturers.

9.4.4 Air Release Valves: Air Release Valves (ARV'S) shall be designed to operate under a working pressure of 150 psi, and shall have been tested at a pressure of not less than 300psi. ARV's shall have a cast iron body and cover and shall have 2" IPS inlet threads. Float guides, bushings, lever pins, and all internal moving parts shall be stainless steel or bronze. ARV's shall be rated for raw sewer use. All air valves shall be located inside and approved 4' by 4' valve box as describe in the details with a. Refer to Chapter 12 for a list of approved Air Release Valves Manufacturers.

9.4.5 Swing Check Valves: The CONTRACTOR will furnish and install swing check valves as shown on the plans and in accordance with these specifications. For valves four (4) inches and larger, bodies and bonnets will consist of cast iron or cast steel and will be designed to allow removal of the clapper arm and disc assembly through the bonnet

opening without requiring removal of the valve from the line. Disc will be of cast iron or cast steel with bronze or alloy disc rings machined into the disc. The seat ring will be bronze or stainless steel and will be threaded for removal with the valve body in line. Clapper arms will be bronze bushed ductile iron. Clapper arm shafts will be manufactured of bronze or high tensile aluminum bronze will be extended through the body for attachment of the weight or spring and will be capable of being field adjusted. Flanged ends will be faced and drilled in accordance with ANSI B 16.1, Class 125. Valves twelve inches and smaller will have a minimum working pressure rating of 175 psi and 350 psi hydrostatic test pressure and valves larger than twelve will have a corresponding pressure of 150 psi and 300 psi. The valves may be operated by lever and weight. Refer to Chapter 12 for a list of approved manufacturers.

9.4.6 Ball Check Valves. Installation of ball check valves must receive prior approval from NBSD. Ball Check Valves shall consist of a gray cast iron class 35 body and cover containing a hollow steel ball with a vulcanized nitrile rubber exterior. The ball check valve shall have one moving part. The valve shall be designed as such that solids, stringy material, grit, rags etc. will not clog valve or require back flushing. The ball shall clear the waterway providing "full flow" equal to the nominal size. The ball shall be resistant to grease, petroleum products, animal and vegetable fats, diluted concentrations of acids and alkalis (pH 4-10), tearing, and abrasion. Flange drilling shall be according to ANSI B 16.1, Class 125. The ball check valve shall be a sinking ball type capable of installation in a horizontal or vertical position. Full access to the ball shall be provided thru a flanged opening. Refer to Chapter 12 for a list of approved manufacturers.

9.5 FITTINGS, MISCELLANEOUS APPURTENANCES AND SPECIALTIES

9.5.1 Pipe Fittings: Pipe Fittings four inches (4") and larger shall be gray cast iron or ductile iron conforming to ANSI A21.10. Cast iron fittings shall be Class 250 for 12-inch and under, and Class 150 for larger than 12-inch. Ductile iron fittings shall be Class 350 for 24-inch and under, and Class 250 for larger than 24-inch. Ductile iron shall conform to ASTM A536, minimum grade 70-50-05. Fittings shall have mechanical joints conforming to ANSI/AWWA C111/A21.11, except where flanged or other type ends are shown or specified. Fittings shall be cement mortar lined in accordance with ANSI 21.4. An exterior coating of bituminous coal tar epoxy shall be applied to a minimum thickness of 5 mil. Fittings for pipe less than 4 inches (4") diameter shall be in accordance with ASTM D-2467 for Schedule Fittings.

9.5.2 Flanges: Flanges for pipe and fittings shall be Class 125 except where Class 250 is specifically noted, and shall conform to ANSI/AWWA C110/A21.10. Drilling and facing of flanges shall be in accordance with ANSI B16.1.

9.5.3 Mechanical Restraints: Restrained Joints for pipe and fittings shall be the ductile iron mechanical joint type, designed for a working pressure of 350 psi for 24-inch and under and 250 psi for 30-inch and larger. Restrained joint pipe and fittings shall be capable of being deflected after assembly. Refer to Chapter 12 for a list of approved Manufacturers.

9.5.4 Pipeline Marking: Detectable marking tape and tracer wire for identification, location, protection and detection of utility pipelines shall be installed over all water lines and force mains. In addition forcemain lines shall have installed above the line every 800 feet a marking pole identifying the line along with a contact number. Refer to Chapter 12 for list of approved Manufacturers. Shop drawings and related data shall be submitted to the ENGINEER for review.

A. Marking Tape: Detectable marking tape shall consist of a metalized foil laminated between two layers of color coded inert plastic film suitable for lasting as long as the pipe and shall be resistant to alkalis, acids and other destructive agents found in the soil. The plastic film shall be imprinted with a continuous message "Caution Sewer Line Buried Below". The message shall be in permanent ink. Marking tape shall be not less than 2 inches wide and not less than 5.5 mils thick with a tensile strength of not less than 120 grams per 1.5 mils. Detectable marking tape shall be the type that can be located by any standard electronic pipe locator. Refer to Chapter 12 for a list of approved Manufacturers.

B. Tracer Wire: Tracer wire shall be installed under all pressure pipelines including service lines in a Continuous fashion and looping up in the valve boxes. Tracer wire shall be stranded strand 12 gauge copper with insulation rated for underground service. Underground splice connections shall be rated for buried service.

Blue – Water Main
Green – Sewer Force Main

C. Valve and Pipeline Markers: Concrete valve markers shall be installed on all valve installations. Pipeline markers shall be installed as directed by the NBSD. Concrete markers shall be a minimum length of 4 feet and shall be provided with a round bronze benchmark disk permanently affixed to the top of the marker.

D. Installation: Marking tape shall be buried at least 12 inches below finish grade and at least 12 inches above the

pipe The tape may be plowed in, placed during backfill or installed in any other manner acceptable to NBSD. Tracer wire to be installed along bottom of pipe and looped up in all valve boxes. DO NOT WRAP TRACER WIRE AROUND VALVE STEM. Concrete markers shall be installed to a minimum depth of 2 feet and the direction and distance to within 1 foot to the valve or pipeline shall be permanently stamped into the bronze disk.

9.5.5 Tapping Sleeves: Tapping sleeves 4" and larger shall be fabricated stainless steel with stainless steel bolts or fabricated steel with fusion bonded epoxy or nylon coating with stainless steel bolts. Tapping sleeves shall have outlet flange counter bored to accept a mating tapping valve per MSS SP-60 for true alignment of tapping valve and tapping machine. Sleeve shall have a stepped stainless steel valve flange complying with AWWA C207 class D, ANSI 316.5, 150 lb. drilling. Refer to Chapter 12 for a list of approved Manufacturers.

9.5.6 Miscellaneous Appurtenances and Specialties: All material and products under this section shall meet Made in America Criteria. Miscellaneous piping appurtenances and specialties shall be provided where shown on the plans and as required for a complete installation. Shop drawings shall be submitted to the NBSD for review.

A. Yard Hydrants: Yard Hydrants shall be ¾" in size and have locking capability and installed with an approved vacuum breaker. Provide a gate valve and valve box in the water line prior to the yard hydrant at the supply main. Inlet line should be buried 12" deep at a location to be determined by NBSD for the installation of a water meter. Refer to Chapter 12 for a list of approved manufacturers.

B: Gaskets: Gaskets for Water Pipe and Fittings shall be vulcanized synthetic virgin rubber free of porous areas, foreign material and visible defects. Gaskets shall be designed to provide a permanent watertight seal at all joints. Rubber gaskets shall conform to all applicable provisions of AWWA/ASTM C111/A21.11. Gasket Lubricant shall be non-toxic, shall not support growth of bacteria, shall not impart taste or odor to water, and shall have no deteriorating effects on gaskets. Lubricant shall be suitable for the intended use, and shall remain in a usable stage throughout the range of temperature in which the pipe is normally installed. Lubricant shall be delivered to the job site in unopened containers bearing the manufacturer's name and trade name or trademark.

C. Mechanical Couplings and Adapters: Mechanical Couplings and Adapters shall be the type and size as shown on the plans, complete with rings, followers, gaskets, bolts, nuts and other items necessary for a complete installation. Couplings and adapters shall be installed in accordance with the manufacturer's instructions to provide permanently tight joints under all reasonable conditions of expansion, contraction, shifting and settlement.

9.6 MANHOLES AND ASSOCIATED APPURTENANCES:

9.6.1 Scope: This section covers the construction of manholes, including frames, covers and steps, as shown on the plans and as specified herein.

9.6.2 Materials: All materials in this section shall meet Made in America Criteria. Shop drawings and related data for manhole material, frames, covers and steps shall be submitted to the NBSD for review.

A. Manhole Material shall be precast reinforced concrete sections with tongue and groove joints and shall conform to ASTM Specification C478, latest revision. The riser sections for manholes shall be made as long as practical to minimize the number of manhole joints. Manhole sections shall be scored or stamped with the date of castings and the date shall appear on the inside of the cone section. Concrete used in their manufacture shall be manufactured with granite stone with a concrete alkalinity of not less than 0.35 and shall have a 28 day compressive strength to not less than 5,000 pounds per square inch and the absorption shall not exceed four percent (4%). Calcium chloride or admixtures of calcium chloride shall not be used.

The minimum wall thickness of the manhole riser section shall be:

- 4' Diameter - 5" min. wall thickness
- 5' Diameter - 6" min. wall thickness
- 6' Diameter - 7" min. wall thickness
- 7' Diameter - 7" min. wall thickness
- 8' Diameter - 8" min. wall thickness

Base riser sections shall be monolithically cast and have minimum bottom thickness of:

- 4' Diameter - 5" min. bottom thickness
- 5' Diameter - 8" min. bottom thickness
- 6' Diameter - 8" min. bottom thickness
- 7' Diameter - 8" min. bottom thickness
- 8' Diameter - 10" min. bottom thickness

1. Manhole interior and riser joints shall be evenly coated with two coats of a factory applied coal tar epoxy coating to a minimum film thickness of 20 mils. conforming to U.S. Corps of Engineers specification C-200. Refer to section 9.6.3, paragraph F: Interior protective coatings.

2. Cone sections shall be eccentric and have a minimum wall thickness of eight inches (8') at the top. Manhole sections shall be scored or stamped with date of casting and the cone section shall show date on the inside.

3. The tongue and groove joints shall not be less than the wall thickness and shall be evenly coated with a factory applied coal tar epoxy coating. Refer to section 9.6.3, paragraph F: Interior protective coatings.

4. Entire exterior surface of manhole shall be wrapped with a 12 inch butyl-tite joint wrap that meets or exceeds the requirements of ASTM C877-01 Type III & C990-01a. See Chapter 12 for approved manufactures.

5. Steps as specified herein shall be cast into the sections and aligned so as to form a continuous ladder with the steps equally spaced vertically at not more than 16 inches on center. Steps shall be embedded in the wall a minimum distance of 4 inches. Each step shall project a minimum of 8 inches from the wall measured from the point of embedment.

B. Frames and Covers: Manhole frames and covers shall be gray cast iron conforming to minimum requirements ASTM A48, Class 35, and shall conform in general to the details for each type shown on the plans. Castings shall be of uniform quality, and free from blowholes, porosity, hard spots, shrinkage distortion and other defects. Frames and covers shall be smooth, well-cleaned by shot blasting and shall remain unpainted. All castings shall be manufactured true to pattern, and component parts shall fit together in a satisfactory manner. Frames shall have a clear opening of 23-3/4". There shall be no holes or perforations in the cover. The frame and cover shall have a rubber gasket that is fitted in a machined groove manufactured in the bottom of the cover. Refer to Chapter 12 for a list of approved manufacturers.

C. Manhole Steps: Manhole steps shall be composite plastic-steel construction. Minimum design live load of steps shall be a single concentrated load of 300 pounds. Steps shall have non-skid top surfaces, and shall be designed so that the foot cannot slip off the end. Steps shall have a minimum cross sectional dimension of 1 inch, and a minimum length of 12 inches. Steps shall be of the drop-front design. Composite Plastic-Steel Steps shall consist of a 1/2-inch deformed steel reinforcing rod encapsulated in a co-polymer polypropylene plastic. Reinforcing rods shall conform to ASTM A615, Grade 60, and polypropylene plastic shall conform to ASTM D2146, Type II, Grade 16906.

D. Resilient Pipe Connections: Resilient pipe connections will be provided in manholes. Such connections shall have a minimum thickness of 3/8 inch and conform to ASTM C923, and shall consist of a natural or synthetic rubber connector complete with stainless steel mechanical devices designed to provide a positive flexible watertight connection.

E. Rain Guards shall be placed under every manhole lid; vinyl guards for manholes outside of paved areas, stainless steel guards for manholes inside of paved areas.

9.6.3 Installation:

A. Precast Concrete Manholes: Each section shall be handled and installed in such a manner and by such means as to prevent damage. All manhole sections damaged during handling and installation will be rejected as directed by NBSD, and replaced at no additional cost to the OWNER. All lifting holes shall be plugged and sealed watertight as recommended by the manufacturer.

1. Base sections shall be installed on a twelve inch (12") firm stabilized foundation of compacted stone embedment so prepared to prevent settlement and misalignment. Pipe openings shall be placed at the exact elevation and location to receive entering pipes. All inlets and outlets shall be cast in or core drilled.

2. Riser and top sections shall be installed level and plumb, and such that all manhole steps are in alignment. Joint sealant shall be of the type specified above. Joints shall be made in accordance with the manufacturer's recommendations, and to insure a watertight installation. Exterior shall receive a 4" wide butyl rubber wrap over the grout area.

3. Entering pipes shall be secured in the resilient pipe connectors, properly aligned, and set to grade. Pipe shall be firmly held in place, and the annular space between the pipe and opening sealed watertight with a non-shrink catalyzed metallic aggregate mortar.

4. Leveling and final grading of manhole frames and covers shall be accomplished by using a maximum of two (2) concrete grade rings. Concrete grade rings shall not exceed four inches (4") in thickness. Grade rings shall be laid in a full bed of non-shrink grout and covered after laying with a smooth coating of non-shrink grout or hydraulic cement a minimum of ½ inch thick. Deviation from this requirement shall require prior approval from NBSD.

B. Invert Construction: Bottoms inverts shall be accurately and properly installed as required for each location. Inverts shall be constructed of cement grout and shall have the same cross-section as the invert of the sewer which they connect. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit. Inverts shall be "U" design with top of the "U" even with the crown of the pipe. Invert piping shall not extend inside of the manhole any further than two inches (2"). Slope of inside of invert bench shall be a minimum of two inches (2") higher than the crown of the pipe. When dissimilar pipe sizes occur, the elevation of the crown of the pipe shall be the same.

C. Mortar Mix: Mortar used in manhole construction shall consist of 1 part Portland cement and 2 parts clean washed sand, with the required amount of potable water added to produce a workable mixture. Sand shall be uniformly graded from fine to coarse, and when dry shall pass a screen having 8 meshes per inch. Mortar shall be used before initial set has occurred. Re-tempering of mortar will not be permitted.

D. Drop Manholes: Manhole drops shall be internal to the manhole sections. Drop piping shall be constructed of sewer grade ductile iron or PVC, properly supported as detailed, and the backfill thoroughly compacted. All Drop manholes to be 5' min inside diameter.

E. Manhole Top Grade: Manhole tops shall be set to the proper elevation as required by the location, or as directed by NBSD.

1. Where manholes are located in streets, roads, drives or parking areas, tops shall be set to conform to the finished grade of the pavement or surfacing and installed to prevent storm water runoff from entering the system.

2. Where manholes are placed in unpaved roads, the tops shall be 4-inches below grade of the road.

3. In cultivated fields, wooded areas and along outfall sewers, manhole tops shall be set approximately 1-foot above ground elevation, unless the line is subject to flooding or other hazards. In such instances, manhole tops shall be set to elevations given by NBSD.

F. Forcemain Manhole Interior Protective Coatings: Protective coating shall be applied to all manhole interiors and joints between sections. Interior coating shall consist of two coatings of coal tar epoxy conforming to U.S. Corps of Engineers Specification C-200, and shall be manufactured by Koppers, Porter, Tnemec, or equal. Coating shall be applied according to manufacturer's recommendations to a minimum film thickness of 20 mils.. Coating shall be applied in two coatings with the primer coat followed by a black top coat. Thinners, solvents and cleaning compounds shall be types as recommended by the coating manufacturer.

9.6.4: Inspection and Acceptance: Manholes shall be true circles of acceptable concrete work with properly corbelled tops, satisfactory inverts, complete interior coatings, and properly placed frames, covers and steps. All leaks in manholes shall be repaired to the satisfaction of NBSD, prior to acceptance.

9.7 SEWER PUMP STATIONS AND APPURTENANCES: This section of Specifications is provided for the purpose of outlining items required in lift stations but is not intended to cover all special conditions or NBSD special requirements.

9.7.1 Site Requirements:

A. Fencing of Lift Station Site

1. Minimum site dimensions shall be as follows:

6' and 8' diameter wetwells - 40 feet by 40 feet. Area to be fenced shall be a minimum of 37 feet by 37 feet.

10' diameter and larger wetwells- 50 feet by 50 feet. Area to be fenced shall be a minimum of 47 feet by 47 feet.

2. Fence Materials:

A. All material shall be Class I Hot-dipped Galvanized Coated. Green Vinyl coated fencing shall be installed for aesthetic purposes.

B. Fabric shall be six (6) feet high, ends barbed, commercial grade nine (9) gauge, two inch (2") mesh installed 3" above finished grade.

C. End, corner, and pull post shall be 3" O.D. schd 40 hot-dipped galvanized steel pipe. Provide water tight closure caps on all posts.

D. Line posts shall be 2-1/2" O.D. schd 40 hot-dipped galvanized steel pipe. Provide water tight closure caps on all post. Top posts shall be 1-5/8" O.D. schd 40 hotdipped galvanized steel pipe.

E. Bottom tension wire shall be 7 gauge spring coil wire.

F. Barb wire shall be 12 gauge barbs, four points pattern on 5 inch centers, Three (3) rows of outward facing barbed wire shall be used and shall be mounted on nonadjustable arms.

G. Gate post shall be 3" O.D. schd. 40 hot-dipped galvanized steel pipe. Provide water tight closure caps on all post.

H. Gate shall be a pair of 6'-0" long (12' total width) 6 feet high sections constructed of 2 inch O.D. pipe. Gate shall be equipped with a prop post center latch and hasp assembly. A ground anchor cast in concrete shall be provided. Gates shall be factory fabricated, coated, and equipped with gate holders. Duck bill backstops shall be provided for swing side of both gate sections.

I. The entire site shall be covered with MIRAFIX 600X filter fabric covered with 4" of crusher run and 2" of clean # 57 stone. This covering should extend a minimum of one (1) foot outside the fenced area. Stone shall be clean No. 57 with no soil or foreign material present.

J. Power pole should be located within or adjacent to the fenced area and located in such a manner so the electric meter can be easily read from outside the fenced area.

L. All power lines within the site shall be underground. No overhead power line will be allowed to cross the site.

M. Site shall be serviced by paved road with top of road above the twenty-five (25) year flood elevation. Road and site drainage shall be approved by appropriate agency.

N. A 3/4" yard hydrant shall be supplied in accordance with Section 9.5.6 with locking capability and with approved vacuum breaker installed on outlet. Inlet line should be buried 12" deep at a location determined by NBSD for the installation of a water meter.

O. A receiving manhole must be located in the fenced area of each pump station for by-pass pumping.

P. A SCADA monitoring system shall be installed at each pump station. Refer to Chapter 12 for approved manufacturers.

Q. A 3" quick connect shall be placed on forcemain line inside of check valve vault.

R. Area light to be provided inside of fence site located in a manner to provide light for control boxes and generator.

S. The access drive to the site shall have a 12 foot paved width with positive drainage and appropriate vehicle turnaround located at the site for high traffic areas. The drive will be approved by the appropriate agency.

T. A standby generator shall be on site with a properly sized automatic transfer switch See Chapter 13 for Generator Specifications.

U. Safety placards shall be placed for pump stations and equipment as required by OSHA and be readily visible.

V. A ultrasonic flow meter is required at all pump stations the read out portion should be mounted on the control panel backboard while the sensing unit will be mounted at least six (6') away from any fittings on the forcemain. See Chapter 12 for approved manufacturer.

9.7.2 Design Considerations:

A. The ENGINEER should submit the following design considerations:

1. Loading calculations indicating pump station service area ultimate flows.
2. Flotation calculation (weight of station without pumps vs. uplift).
3. Cycle time calculation shall be a maximum ten (2-8) cycles/hour and a minimum run time of 1 min. at zero inflow.
4. Provide certification that motor and control circuit will provide 2-8 cycles/hour.

9.7.3 Wetwell Design and Construction:

A. Minimum allowable wet well diameter shall be 6'-0". Concrete shall meet the requirements as specified for manholes in Section 9.6.2. Interior surface of wetwell shall be coated with Koppers 300M coal tar epoxy or approved equivalent. Refer to section 9.6.3, paragraph F: Interior protective coatings.

B. The bottom slab of the wet well shall be set on a 12" base made of crushed stone. All over-excavated area below the wet well bottom shall be filled with angular material or flowable fill as directed by the ENGINEER.

C. Wet well bottom shall be constructed to provide a hopper or fillet bottom. Concrete bricks may be used as filler to form hopper bottom provided minimum of 6" grout cover is maintained.

D. Top of slab shall be one foot (2') above the 100 year flood elevation and shall have a Standard Brass Benchmark set into the slab with elevation stamped on the face of the benchmark.

E. Guide rails shall be 316 Stainless Steel. Guide rails shall be compatible with Flygt guide rail system. All of the metal parts associated with the wet well shall be 316 stainless steel, including guide rail top brackets and intermediate guide rail brackets.

F. Wet well hatches shall be of heavy gauge aluminum with aluminum or 316 stainless steel support bracing and accessories and shall be supplied by the pump manufacturer for the pump specified. Minimum hatch size shall be 36" by 48" double door clamshell style. Larger size hatches may be specified as directed to support larger pumps to meet future demands of other design consideration by NBSD. All hatch support bracing should incorporate a self-locking hinge mechanism to lock in the open position. All hatches shall have a pad-lockable recessed locking mechanism. Hatch opening to the wet well and other vaults or manholes shall be located such to provide direct and safe access to steps that are incorporated in the work. Refer to Chapter 12 for a list of approved manufacturers.

G. Vent pipe shall be a minimum four (4) inches diameter DIP w/MJ fittings and shall contain 1/8" 316 stainless steel bug screen.

H. All bolts, nuts, anchors, washers, and other hardware utilized in the wetwell shall be 316 stainless steel.

I. Each pump station is to be equipped with a U.S.F Fabrication Inc. or equal 2000 lb. minimum stainless steel pump hoist and 2 sockets. The sockets shall be cast into the wet well top aligned with each pump per manufacturer's instruction and shall be located per NBSD's instructions. Stainless steel socket caps shall be provided for each socket. Locking chains shall be supplied on winch sockets.

J. The pump discharge shall be equipped with a pressure gauge assembly within the valve vault consisting of a stainless steel pressure isolator with a 50% mixture of ethylene glycol/water sensing liquid and Buna-N diaphragm, 316 stainless steel fittings and gauge cock, and a 4" glycerin filled phenolic cased pressure gauge. The gauge assembly shall be mounted on either discharge line downstream of the check valves and positioned at a 45 degree angle so as to be easily read from ground level. Gauges shall have a full scale reading in feet of water not to exceed 120% of the shut-off head of the pumps selected.

K. Influent pipe shall terminate a minimum of ½" and a maximum of 3" inside the basin.

L. All ferrous piping in wet well and valve vault shall be coal tar epoxy coated.

M. A 316 stainless trash basket shall be placed in front of the invert entering the wet well and shall be mounted on a 316 stainless steel guide rail system with an access hatch directly above rails for removal of basket.

9.7.4 Pumps and motors (Submersible Stations)

A. Acceptable manufacturers for submersible pumps are shown in Chapter 12.

B. Pump motors shall have a five (5) year written manufacturer's Warranty.

C. Pumps shall be designed to handle peak flow with the largest pump out of service. Minimum design peaking factor shall be 2.5.

D. Motors shall be non-overloading over entire pumping range and have a 1.15 or higher service factor per Minimum Design Criteria for Pump Stations section 2T.

E. Motors shall have Class F (155 degree C) insulation and withstand Class B (130 degree C) temperature rise with a service factor of 1.0 .

F. Motors shall not exceed 1800 rpm's unless recommended by the manufacturer and approved by NBSD.

G. Three phase power shall be required on all motors (3 phase 460 or 230 volts) as recommended by the manufacturer. Add - a -Phase units are not allowed.

H. Unbalanced voltages on motors under load shall not exceed 1.0% when measured at the motor disconnect terminals. Voltage measurements shall be read with an accurate digital volt meter; and readings shall be recorded as part of the final inspection. Systems will not be accepted until unbalance has been corrected.

I. Systems that are metered with a KVA meter supplied by the power company shall have power factor correction to 85%.

J. Approved lightning arresters mounted below the main disconnect are required for all services. Refer to Chapter 12 for a list of approved manufacturers.

K. Pump and motor shall have a minimum of 400 series stainless steel shaft on motors under 10 HP, on motors over 10 HP the shaft may be chrome plated steel.

L. Impeller shall be keyed to shaft and shall be the single vane non-clogging design. The impeller shall be gray cast iron capable of passing a 3" sphere. Impellers shall be trimmed to the design flow and TDH; they shall be dynamically balanced to the manufacturers design specification for the pump supplied.

M. Pump volute shall have replaceable stainless steel wear rings or plates.

N. Seals shall be tungsten carbide to silicon carbide or tungsten carbide.

O. B-10 bearing life shall be a minimum of 50,000 hours.

P. Pump and motor shall have adequately sized stainless steel chain, the length shall reach the top of station plus an additional six feet (6'). Loops at both ends of cables shall be secured with SS clamps.

Q. All piping and fittings shall be DIP Piping within wetwell shall be flanged. All valves shall be resilient seat plug valves open left (counter-clockwise) valve stem operation. Valves located within valve pits shall be square nut actuated.

R. Depth of wet well shall be set to accommodate the following parameters:

1. Float Control System:

A. OFF: Set above the pump impeller

B. LEAD-LAG: Differential minimum of one foot (1').

C. ALARM: Set one foot (1') above the lag setting.

D. INFLUENT PIPE: Set a minimum of six inches (6") above the alarm setting.

S. Pump housing shall be equipped with moisture detection probe and have moisture detection lamp mounted on the control panel. Moisture detection shall cause the motor to shut down and activate the ALARM light. Flygt pumps shall be supplied with two spare Meniscus units for moisture detection and temperature overload.

T. Each pump shall be supplied with a 3/16" SS cable, 18" - 1/4" SS chain, 5/16" SS screw pin shackle, SS thimble, and Nicro press sleeve to fit Grip Eye System by Flygt.

U. Pumps shall mount on dual stainless steel guide rail system compatible to Flygt pumps.

V. Spare parts: Provide one (1) additional pump being equal to the pumps installed in the lift station with electrical cables for inventory.

9.7.5 Grinder Pumps and motors:

A. Allowed usage: It is not the policy of NBSD to allow grinder pump stations. However, under unusual conditions that arise, where normal installation of the standard pump station cannot be implemented, NBSD's management staff will consider such installations after all other possibilities have been exhausted. When approved, the following criteria will be used.

1. Simplex station only – using the approved Zoeller E-6840-C Grinder pump 230volts 1 Phase.

2. No motors smaller than 2 HP.

3. Basin shall be fiberglass in construction and be the approved AK Industries Model Number GB-60-201.

4. All fees and permits shall be paid by the Developer.

5. Control panel shall be CSI Controls RK Series Pressure Activated. Model Number RKSP230CBGDDCSL1MB-28

6. Spare parts: Provide one (1) additional grinder pumps with electrical cables and control box for inventory.

7. Forcemain lines shall be tracer taped and wrapped with #12 solid copper wire from basin to saddle on existing sewer line.

8. Forcemain lines shall have a check valve and ¼ turn ball valve placed on them inside a plastic valve box to be located in right-of-way. See Chapter 12 for approved manufacturers.

9.7.6 Testing and startup:

A. Simplex draw-down test shall be performed by the ENGINEER prior to final acceptance of the pump station. Specifications to include completion of pump station start-up procedures in presence of NBSD's representative.

B. Final basin level and control setup will be performed by NBSD's representative.

C. The ENGINEER shall provide a Certification that the work has been completed in accordance with NBSD's approved plans, specifications, and good engineering practice. The CONTRACTOR shall provide a Certification that all material, suppliers and Subcontractors have been paid and that no lien is in force against the work.

D. CONTRACTOR shall supply a one (1) year written warranty on all work and material except pumps and controls.

E. The developer shall provide NBSD with a 15 foot easement for the length of the forcemain to include the basin for access to pumps and forcemain.

9.7.7 Valve vault:

A. Lift stations where shown on the plans shall be equipped with a valve vault. Valve vault shall have the following minimum size: four & six inch (4"-6") diameter pipe and valves shall be a minimum of six foot by six foot (6' x 6') inside the vault. Larger discharge sizes shall be provided with a valve vault sized to allow proper maintenance on all installed appurtenances.

B. Each pump discharge line shall have a weighted arm, cushioned check valve within the valve vault. One check valve shall be a mirror of the other to facilitate the removal of the shaft. Check valve shall be of the full waterway design for quiet operation and with the flow area through the valve equal to or exceeding the flow area of the pipe to which it is installed, a flanged lever operated plug valves for valves four (4) inches and smaller, and gear actuated, hand wheel operated plug valves for valves six (6) inches and larger and a locking flanged adapter on the discharge side. All other valve vault piping shall be flanged. Dresser coupling or uniflange fitting shall not be used. Refer to Chapter 12 for a list of approved manufacturers.

C. The force main shall have plug valves located on either side of the emergency connection to prevent force main backflow when making repairs in the valve vault and to provide bypass pumping. Plug valves shall have a 2" square operating nut and all bolting on the valve shall be stainless steel. Refer to Chapter 12 for a list of approved manufacturers. The emergency bypass connection shall consist of a tee with the tee turned up and with a plug valve, 90 degree bend centered three feet (3') above finish grade, 4" aluminum female quick disconnect w/ 4" plug.

D. All bolts, nuts, and washers shall be hot dipped galvanized rust-resistant steel within the valve vault.

E. Access covers shall be a minimum of 48"x48" or larger to provide working clearance. Covers shall be a clam shell double door constructed of heavy gauge aluminum with stainless steel or aluminum hardware and accessories. Refer to Chapter 12 for a list of approved manufacturers.

F. 2" or 3" drain from the valve vault to the wet well shall have a trap and a PVC neoprene-faced flapper check valve. Refer to Chapter 12 for a list of approved manufacturers. The bottom of the valve vault shall be sloped to drain to the wetwell.

G. All expansion anchors shall be type 316 stainless steel.

9.7.8 General Electrical and Control panel:

A. General electrical requirements. All electrical work must be done in accordance with Section 9.9.

NOTE: Electrical schematic shall be plastic laminated and affixed inside the control panel door.

1. Pump and motor shall be shipped with non-wicking electrical power cable, over-heat cable, and seal-failure cable, factory installed and tested. Cut ends are to be factory sealed and tagged for shipping. A single power cable is required.

2. Wet well level sensor float hangers shall be a DORS-3 located at the edge of the hatch away from inlet piping and shall be supplied in accordance with the approved manufacturers in Chapter 12. Kellum grips cable supports shall be provided on power cables for pumps 10 HP and larger.

3. Electrical control panels shall be stainless steel NEMA 12 with drip shield rated with minimum 0.080" thick aluminum inner door with 3/4" break around perimeter and aluminum or stainless steel back component panel. Panel shall be of sufficient size to house all control equipment. All panel penetrations for conduit shall be from the bottom.

4. Electrical control panel bracket shall be made of hot-dipped galvanized steel unistrut with 316 stainless steel hardware and shall be adequately grounded.

5. Concrete pad shall be provided for the electrical control panel and incorporate the wetwell and valve vault. There shall be a minimum of 3' of separation from the back of the wetwell to the electrical control panel. Concrete pad shall be a minimum of 4" thick and shall be integral with the wetwell and valve vault top.

6. Underground conduit from junction boxes shall be PVC minimum 2-inches schedule 80. Above ground conduit shall be schedule 40 galvanized conduit. Separate conduit shall be provided for each pump power cable and one conduit for all float wires. All panel penetrations shall be thru the bottom of the panel.

7. Main power source from the electric utility shall have a main breaker housed in a separate locking stainless steel enclosure mounted on the control panel bracket. Main breaker shall have a locking externally mounted lever for controlling the breaker and shall be UL approved for service entrance applications. Voltage shall be clearly labeled on disconnect. A stainless steel enclosed lightning surge arrester shall be mounted under main disconnect and wired per manufacturers instructions.

8. A double throw walking beam transfer switch shall be mounted inside the NEMA-12 main control panel. Transfer switch shall be wired to provide power from either the main power source or from the remote generator receptacle.

10. Lightning arrester shall be mounted in a NEMA 4x stainless steel enclosure under the main disconnect for each phase of incoming service. Lightning arrester shall be protected from over current per manufacturers recommendations.

11. Electrical grounding shall consist of 3 - 5/8" diameter, 10' long copper clad ground rods, set in a 6' triangular spacing.

B. Main Control Panel.

1. Enclosure shall be NEMA 12 stainless steel with drip shield and a single handled three point latch system with padlocking provisions. Screw-type latches will not be accepted.

2. A minimum of the following components shall be installed on a separate hinged aluminum inner door:

A. Pump motor circuit protective breakers with pad lockable lock-out device for each motor.

B. Hand-Off-Automatic (HOA) selector switches shall be non-spring loaded and oil tight.

C. Lead 1-Lead 2-Automatic alternator selector switch.

D. 6 digit elapse time meter without reset for each motor.

E. Single Ammeter with appropriate scale ranges, PUMP1- PUMP2 selector switch and Off-L1-L2-L3 selector switches,

F. 35 HP and larger motors shall have one voltmeter with Off-L1-L2-L3 selector switches.

G. The following indicating lamps:

1. Pump running (green)

2. Seal failure (red)

3. Overheat failure (red)

4. High level Alarm (red)

5. Phase failure (red)

6. Float levels (yellow)

H. Pushbuttons for:

1. Alarm horn silence (externally mounted)

2. Reset motor over temperature

3. Test seal alarm

4. Reset seal alarm

5. Float test for each float

I. 15 amp, 110 volt GFI Duplex Receptacle mounted outside the control panel with a rainproof cover capable of allowing a plug to be inserted and still maintaining it rainproof.

3. A minimum of the following components shall be mounted on the back plate:

A. Fuseless NEMA rated combination motor starters with instantaneous short circuit protection, heavy duty industrial contactors (Definite Purpose

contactors are not acceptable), 3 phase adjustable bimetallic overload protection manufacturer shall be Square D.

B. Control circuit transformers 120 VAC (not required on 230 v, 3-wire systems) with primary circuit breaker and secondary circuit breaker for:

1. Control
2. 15 amp duplex receptacle and yard light

C. Automatic electrical alternation

D. Control relays, plug in 3 pole pin type with indicator lights.

E. Surge suppressor

F. Power terminals and control terminals, each shall be Allen-Bradley or equal with 1/4" flat head set screws.

G. Condensation protective space heater with adjustable thermostat

H. Phase failure relay with 2-second delay trip and 60-second delay on time manufactured by Sycom - model 102A which will monitor:

1. Phase failure
2. Phase reversal
3. Low voltage (Brown Outs)

4. A weather proof alarm horn, 115 volt ac single projector, vibrating type and flashing alarm light, vapor tight with a housing guard, with a minimum of 40 watt light bulb shall be shipped loose and installed remotely or on the side of the panel visible from the entrance drive and 360 degrees. All installations requiring penetration of the control panel shall be made in such a manner and with approved devices that will maintain the panel's NEMA 12 rating. No time delay shutoff of alarm horn or light shall be allowed. Panels shall be factory assembled and shall bear a UL approval label certifying this rating.

Alarm Light shall be on at:

High water level

Alarm light shall flash at:

Seal failure alarm

Overheat alarm

Pump breaker tripped

Phase failure alarm

High water level

Horn shall be on at:

High water level

5. Control sequence shall be designed that panel function is automatically restored after a power failure and manual reset is not necessary.

6. Seal failure relays shall be the electronic type with a maximum of 24 vac, 0.5mA 5VA rated.

7. Control wire to be MTW 90 degree C, #14 AWG. Color code and number all wiring as indicated on the factory wiring diagram. All wiring shall be neatly grouped in plastic wire troughs except wiring from bookplate to the door shall be done in separate bundled harnesses. All wires shall have a wrap-around wire identification number at both ends of the wire as shown in the wiring diagram. All components shall be identified with the same number as shown in the wiring diagram. All door mounted components shall have engraved nameplates fastened to the door with stainless steel rivets. Electrically ground all components to a common ground screw mounted on the removable back panel.

8. All conduits entering the control panels or other enclosures from the wetwell shall be sealed with gas-tight fittings and enter from the panel bottoms. (Meyers type hubs). Three junction boxes shall be located below the gas-tight seals for the pump and control conduits. Refer to Chapter 12 for a list of approved manufacturers.

9. All electrical work shall be performed by licensed personnel in accordance with the National Electric Code.

10. Electrical permit shall be applied for at the Brunswick County Building Codes.

11. A time delay relay to prevent the pumps (duplex) to start simultaneously after power failure.

12. In consultation with the NBSD's management, soft starting is required on all motors 20 HP and larger shall have a soft start motor controller. The controller is to reduce high inrush currents, reduce excessive starting torques and reduce peak demand surges. The controller shall be capable of ramping to full speed from 10 to 90 seconds. The controller shall be equal to Allen Bradley model SMC.

13. All installations shall be in accordance with the National Electric Codes.

14. Electric supply, control, and alarm circuits shall be designed to provide strain relief and to allow disconnection from outside of the wet well. Terminals and connectors shall be protected from corrosion by location outside the wet well or through use of watertight seals. If located outside, weatherproof equipment shall be used.

15. The motor control center shall be located outside and facing toward the wet well with an adequate distance from the wetwell to avoid accidental fall.

16. Pump motor power cables shall be designed for flexibility and serviceability under conditions of extra hard usage and shall meet the requirements of the Mine Safety and Health Administration for trailing cables. Power cable terminal fittings shall be corrosive RES. resistant and constructed in a manner to prevent the entry of moisture into the cable, shall be provided with strain relief appurtenances and shall be designed to facilitate field connection.

17. Provide power and control cables of adequate length to reach the junction box without splicing.

18. Slope conduit from the control panel to the wet well.

19. Lift Station SCADA System shall be provided and mounted to the backboard and be wired into the system so that backup power will be available at all times. (See Chapter 12 for list of approved SCADA Systems).

9.7.9 Spare parts for submersible lift stations:

A. CONTRACTOR shall furnish on or before final inspection each of the following:

1. Seal assemblies for one pump.
2. Bearings; one complete set for one pump.
3. Wear ring for one pump.
4. Two (2) complete sets of record drawings for wet well, electrical, electronic schematics, O&M manuals with factory certified pump curves (20 Hp and larger), copies of all certified test and inspection data.
5. A completed start-up report by the pump manufacturer.
6. One box (2 min) of fuses for each size that is in control panel.
7. One complete set of motor starter contactor kit.
8. One box (4 min) of spare bulbs of each size used in the control panel.
9. Motor starter coil.
10. One spare relay and timer of each type used.

9.8 SERVICE CONNECTIONS:

9.8.1 Sewer Service Lateral Inspection procedures: The intent of these specifications is to ensure that every service lateral connected to NBSD's sewer collection system will perform properly for the life of the building it serves. Inspections will emphasize the following criteria: quality of materials used, grade maintained along the full length of the pipe, access to the pipe in the event that service is needed, conformance to all applicable county codes, and construction techniques.

1. If a preexisting sewer lateral is stubbed out at a lot property line, the contractor must connect to this pipe at an approved grade. No other taps to the gravity main or manholes shall be made without the approval of NBSD. The contractor must verify location and elevation of this lateral before laying out the plumbing plans. NBSD reserves the right to determine the size of the service lateral to any property. NBSD shall also determine the extent of piping that is to be deeded to NBSD for operation and maintenance.

2. The lateral must be constructed of 4-inch or 6-inch SDR-40, ASTM-3034 pvc, gasketed sewer pipe to insure pipe

flexibility. All pipe fittings must be pvc, gasketed fittings made specifically for SDR-40 sewer pipe. No petroleum-based pipe lube can be used.

3. The finished grade of the lateral must be 1/4-inch per foot where possible. NBSD will determine if this grade can be modified. A minimum 1-foot earth cover is required for all lateral piping. Bedding may be required depending on soil conditions.

4. A dual sweep tee with a cleanout plug must be installed at the building for cleaning in both directions and a 4" cast iron cleanout cover with a concrete ring is required at the property line nearest the main. The lateral must be constructed in such a way to reduce the number of bends from the building to the street connection. 90 degree bends will not be allowed. If it is determined that an excessive number of bends has been used, NBSD will require cleanouts to be installed at each bend. All required cleanouts must be turned toward the sewer main and stubbed up to ground level. Maximum distance between cleanout will not exceed 75 feet.

5. When laying pipe, the contractor must start at the lowest point, establish his grade, and lay the pipe uphill. Run the pipe as straight as possible with the bell end uphill. No more than 5% deflection on pipe will be allowed. The start and finish point of the proposed lateral must be verified with a leveling instrument before laying any pipe. The plumber will be responsible for barricading or for marking any open ditches.

6. Any cleanouts located in or within 3' of asphalt or concrete areas such as driveways or parking lots must be constructed of cast iron or ductile iron to include the wye, riser pipe and cleanout plug. A 12"X 12" concrete pad, 6" thick, must be poured around cleanouts in these locations. SDR 26 (heavy walled sewer pipe) may be used in place of ductile iron within 3' of paved areas.

7. Should the potential exist for commercial properties to need a grease trap facility, the owner/developer must incorporate the space requirements in the original site plan. The minimum space requirement is 20' X 20' and the site must be located in line with building discharge lateral and shall be sized according to NBSD's Construction Specifications. Plans and sizing calculations for the installation of any grease trap must be submitted to NBSD by a licensed engineer and approved prior to initiating construction. A cleanout will be installed in the lateral on the discharge side of the grease trap turned toward the manhole.

8. The contractor must call the Operations and Maintenance office at 371-9949 24 hours before the day of inspection on sewer tap inspections for completed taps. We cannot guarantee a specific time for an inspection. The entire lateral from the building to the street connection must be exposed for the inspection; however, in the case of rain, you may cover short sections of pipe to keep it from floating up, providing the bells are not covered. If an inspection fails or is not complete, the plumber is responsible for correcting the problem(s) and calling the Operation and Maintenance office for a re-inspection. The re-inspection will be scheduled according to the above schedule. The inspection form will be left in the contractor's plan tube or at the cleanout at the street. A copy of the approved inspection form will be placed on file for the location in order to have meter set at the location. Suggestions: Install magnetic locator tape on all piping for easy location when covered. Avoid laying pipe shallow in areas where future vehicular traffic is likely. Install cleanout plugs 4" inches above finish grade to allow for sod. It can always be shortened to match the grade of the established lawn. Do not try to cut corners on these specifications because you will be required to correct any deficiencies that are found during the inspections.

9.8.2: Sand, Oil & Grease Interceptors: Sand, oil, grease interceptors shall be provided when, in the opinion of NBSD, they are necessary for the proper handling of liquid waste containing, sand, oil, grease or other harmful ingredients in excessive amounts. All interceptors shall be of a type approved by NBSD and shall be located as to be readily and easily accessible for cleaning and inspecting. All interceptors shall be supplied and properly maintained continuously in satisfactory and effective operation by the Owner at his expense. Sand, oil, and grease shall be removed when approximately 75% of the capacity of the system has been reached. Chemical additives shall not be added to the interceptor system for removal or cleaning of the system without prior approval of NBSD.

A. DESIGN

1. The minimum size shall be 1000 gallons with a minimum of three chambers accessible by approved manhole covers listed in Chapter 12 stamped with Sanitary Sewer.

2. Sizing shall be based on the volume of wastewater through the unit and shall retain 90% of the oil and grease and 100% of the sand; with a solid retention capacity in pounds equal to at least twice the flow capacity in gallons per minute.

3. Restaurants, Hospitals, Nursing Homes and other Commercial Kitchens with varied seating capacity shall be computed utilizing the following:

A. Restaurants:

Size of Interceptor = (D) x (GAL) x (SC) x (Hr/12) x (LF)

where:

D = Number of seats in dining area

GAL = Gallons of wastewater per meal, normally 25 gallons

SC = Storage capacity factor; Minimum of 1.7 On-site disposal = 2.5

Hr = Number of hours open

LF = Loading Factor = 1.25 Interstate Highways

1.0 Other Freeways

1.0 Recreational Areas

0.8 Main Highways

0.5 Other Highways

B. Hospitals, Nursing Homes, Other Commercial Kitchens:

Size of Interceptor = (M) x (GAL) x (SC) x (2.5) x (LF)

where:

M = Meals per day

GAL = Gallons of wastewater per meal, normally 4.5 gallons

SC = Storage capacity factor; Minimum of 1.7 On-site disposal = 2.5

LF = Loading Factor =

1.25 Garbage disposal & dishwasher

1.00 Without garbage disposal

0.75 Without dishwasher

0.50 Without dishwasher and garbage disposal

9.9 GENERAL ELECTRICAL:

9.9.1 Scope:

A. Electrical Work: As indicated on the Drawings, including all items which may be reasonable implied in order to provide a complete and operational system.

B. Permits: Obtain necessary permits and pay associated fees.

C. Utilities: Make necessary arrangements with the utility for power service. Arrange for temporary power as required.

9.9.2 Quality Assurance:

A. Perform all work using licensed electricians.

B. Comply with the requirements of the National Electrical Code and with local codes and ordinances.

9.9.3 Submittals:

A. Submit shop drawings and manufacturer's data on all products.

B. No equipment may be installed prior to submittal approval by the OWNER'S representative.

9.9.4 Products/Materials:

A. Standards: Use only new materials conforming to the standards of Underwriting Laboratories.

B. Wiring: Copper, #12 AWG minimum, type THWN. For runs over 100', use #10 AWG in lieu of #12.

C. Support Channel: Hot dipped galvanized steel or aluminum with stainless steel hardware.

9.9.5 Installation:

A. Install all wiring in conduit. Use galvanized rigid steel for all exposed runs and Schedule 40 PVC for underground conduits embedded in concrete. Use flexible metal conduit for connections to transformers and other vibrating equipment.

B. Provide a separate ground conductor where indicated on the Drawings; the raceway may not be used for grounding.

CHAPTER 10

PIPELINE TESTING PROCEDURES

10.1 SCOPE: All liquid-retaining structures, pressure piping and gravity sewer piping shall be tested by the CONTRACTOR as specified herein and as directed by NBSD. Testing shall be conducted in the presence of NBSD and the engineers representative in a manner to minimize interference with the progress of the work.

10.2 TESTS OF STRUCTURES:

10.2.1 Concrete Structures: Prior to backfill, each cast-in-place or pre-stressed concrete tank, basin or other liquid retaining structure shall be tested by filling the structure with clear water to its intended operating level or a greater level as directed by the NBSD, and letting it stand for at least 24 hours. All wall castings, sleeves and other openings shall be plugged temporarily during the test period.

A. During cold weather, the CONTRACTOR shall take measures to insure that ice does not form; such method shall be submitted, before testing, to NBSD for approval.

B. All exterior surfaces shall be examined for leakage. Leakage will be considered to be within the allowable limits where there is no visible sign of leakage and where water loss does deviate from the original volume during the 24-hour test period. If leakage exceeds the allowable limits, the work shall be repaired by draining the structure and removing and replacing the defective areas, or by other methods as approved by NBSD, and then performing a second leakage test.

1. In cast-in-place structures, hairline cracks that leak shall be enlarged to a V-shaped groove, 1-inch wide at the surface by 1-inch deep, and repaired to the satisfaction of NBSD. Cracks may also be pre grouted if required by NBSD.

2. All repairs to pre-stressed tanks shall be made in strict accordance with the recommendations of the tank constructor.

C. Disposal of water after testing shall be satisfactory to NBSD.

D. Repair and retesting of the structure shall continue until leakage is within the allowable limits and all leaks are repaired to the satisfaction of NBSD.

E. Unless otherwise specified, all expenses of the leakage test, including measuring devices, temporary plugs, repairs and retesting, shall be paid for by the CONTRACTOR at no additional cost to the OWNER. Water for the first leakage test will be furnished by the OWNER at no cost to the CONTRACTOR; water used in retesting shall be paid for by the CONTRACTOR.

F. If any structure fails to pass the leakage test after five times, the entire structure shall be removed and rebuilt at no additional cost to the OWNER; such rebuilt structure shall be subject to all leakage test requirements as specified herein.

10.3 HYDROSTATIC TESTING OF PRESSURE PIPELINES

Each pressure pipeline or valved section thereof shall be subjected to hydrostatic testing in accordance with all applicable provisions of AWWA C600, Section 4, latest edition.

10.3.1 Pressure Test: Unless otherwise specified pressure lines shall be tested to the working pressure but not less than 100 psi or greater than pressure rating of pipe based on the lowest point of the section under pressure. Before applying the test pressure, all air, dirt and foreign material shall be expelled completely from the line through air valves, flushing and other means. The test shall be maintained at full pressure for at least two hours. Pressure

gauges on test apparatus shall be a minimum of 4" diameter with a minimum of 5 psi graduations. All damaged or defective pipe, fittings, joints, valves, hydrants and appurtenances discovered after the pressure test shall be repaired or replaced with sound material, and the pressure test repeated until satisfactory to the ENGINEER and NBSD.

A. Pressure lines shall be tested to 150% of the working pressure but not less than 100 psi. for a period of 2 hours. A Leakage Test for pipelines shall be conducted concurrently with the pressure test. No air test shall be allowed. If the test discloses leakage, the CONTRACTOR shall, at his own expense, locate and repair all defects until leakage is fixed. All visible leaks shall be repaired regardless of the amount of leakage.

B. Water for testing will be furnished by the CONTRACTOR. The CONTRACTOR shall furnish the test pump, measuring devices and all necessary pipe or hose extensions or transportation to the point of use, and shall exercise care in the use of water.

C. If large amounts of water are needed for flushing, the CONTRACTOR must make arrangements with NBSD or other appropriate water system owner to install a meter.

D. All valves within the test section shall be completely opened and closed several times during the test period.

10.4 GRAVITY SEWER TESTING

10.4.1 Air Testing: Air testing of gravity sewer pipelines shall be done in accordance with applicable provisions of ASTM C828. All lines shall pass the air test before they will be accepted by the NBSD. Lines not passing the test shall be repaired and retested as required. Air testing shall not occur until all underground dry and wet utilities have been installed and roads have been subgraded.

A. Air test shall be conducted in strict accordance with the testing equipment manufacturer's instructions, including all recommended safety precautions. No one will be allowed in manholes during testing. Equipment used for air testing shall be specifically designed for this type of test, and is subject to approval of the NBSD.

B. The CONTRACTOR shall furnish an air compressor which will provide at least three hundred cubic feet of air per minute at one hundred pounds per square inch along with all necessary plugs, valves, air hoses, connections and other equipment necessary to conduct the air test. Pressure gauges on test apparatus shall be a minimum of 4" diameter with a minimum of 1 psi graduations and a maximum range of 0-10 psi. Plugs in sewer eighteen inches (18") in size and larger shall be connected by cable for thrust reaction.

C. The sewer section shall be plugged at both ends and air pressure shall be applied until the pressure inside the pipe reaches 5.5 PSIG. When a stable condition has been reached, the pressure shall be bled back to 5.0 PSIG. above the average back pressure of any ground water above the pipe's invert. At this starting pressure, the time and pressure shall be observed and recorded. A minimum of three (3) readings shall be required for each test.

1. If the time of 5 minutes for the air pressure to decrease from the starting pressure 5.0 PSIG passes the pipe shall be presumed to be free from defects. When these times are not attained, pipe breakage, joint leakage, or leaking plugs are indicated and the cause must be determined and corrected. After repairs have been made, the sewer sections shall be retested. This process shall be repeated until all sewer sections pass the air test.

10.4.2 Pipe Deflection Test: All PVC gravity sewer pipe, 4-inch diameter and larger, shall be tested after installation and backfill by the Contractor. Testing shall be performed at the Contractor's expense using a 5% mandrel acceptable to NBSD to insure that initial deflection of pipe does not exceed 5.0%. All deflection testing shall be performed in the presence of the Engineer and NBSD. Contractor shall notify the Engineer and NBSD in sufficient time to insure that both will be present during deflection tests. Deflection test records shall identify the location and deflection amount at all points where deflection exceeds the specified limit. Such records shall be certified by the Contractor, and shall be furnished to the Engineer prior to acceptance and payment. Pipe with initial deflection exceeding the specified limit will be unacceptable, and shall be re-bedded to the correct deflection and retested for deflection, at the Contractor's expense.

10.4.3 Visual inspection: All gravity sewer manholes and pipelines shall be visually inspected by NBSD'S Inspector prior to acceptance. Gravity sewer manholes shall be to final grade, have no visible infiltration, contain properly formed and sloped inverts, and be properly coated as outlined in previous sections. Gravity sewer pipelines shall be of uniform slope with no portion holding water. Repairs to gravity sewer pipelines shall be performed in manner equivalent to new construction. Fernco style couplings or repair bands shall not be used. If NBSD's Inspector suspects that the gravity sewer pipeline does not meet the above stated criteria, a video inspection, at the CONTRACTOR'S expense, may be required.

10.4.4 Camera Inspection: All gravity sewer manholes and pipelines shall be video inspected at the CONTRACTOR'S expense. Copy of inspection tape shall be provided to NBSD for our records. Before the end of the one year warranty on above lines and manholes another video inspection shall be performed at the CONTRACTOR'S expense and a copy of this inspections shall be provided to NBSD.

10.4.5 Soil Compaction Test: All trenches suspected of not meeting the compaction requirements stated previously shall be tested for conformance by a NBSD approved testing laboratory and at the locations and depths requested by NBSD.

CHAPTER 11

GRASSING AND SITE RESTORATION

11.1 SCOPE: This section covers cultivating, fertilizing and planting grass on all pipeline rights-of-way, and on all fill slopes, cut slopes, graded areas and disturbed areas as shown on the plans or as directed by the NBSD.

11.2 GENERAL

A complete permanent grass cover of all areas to be grassed shall be obtained before these areas will be acceptable. All such areas shall be seeded within 30 days after completion of grading. All eroded areas shall be filled and completely covered with grass before being acceptable. An acceptable grass cover is defined as a minimum 2-inch stand with bare spots less than 1 square foot after first mowing.

11.3 FERTILIZING AND GRASSING

11.3.1 General: Material shall be acceptable to the ENGINEER prior to use. Fertilizer shall be delivered in undamaged waterproof bags showing weight, chemical analysis and manufacturer. Lime shall be delivered in bags with a tag or label showing brand or trade name, magnesium carbonate equivalent and other pertinent information. Seed shall be delivered in original undamaged containers showing name of seed, net weight, percentage of pure seed and germination, origin, and date of packaging.

A. Fertilizer: Commercial type 4-12-12 or equivalent, conforming to state law.

B. Lime: Agricultural grade ground limestone, containing at least 34% magnesium carbonate.

C. Seed: Fescue, Bermuda or Pensacola Bahia, as required by seasonal or soil conditions, with at least 90% purity and 80% germination, conforming to state law.

11.3.2 Planting: Topsoil shall be as specified in Chapter 4.

A. Areas to be grassed shall be cultivated to a depth of 4 inches by mechanical tiller, with all clods or clumps broken up and foreign material and debris removed.

B. Fertilizer shall be applied at a minimum rate of 1000 lb./acre, and lime applied at a minimum rate of 2000 lb./acre. Fertilizer and lime shall be thoroughly incorporated into the top 3 to 4 inches of soil, and the surface raked smooth before applying seed. Fertilizer and lime may be applied in one operation.

C. Seed shall be applied evenly by a commercial applicator and raked in lightly.

Seed shall not be sown immediately following rain, when the ground is too dry, or during windy periods. Seeded areas shall be compacted and dressed smooth with a roller or other means acceptable to the ENGINEER. Hydro seeding is an acceptable method of grassing. Minimum application rates of seed shall be as specified below; heavier applications shall be made where necessary to provide an acceptable cover.

Fescue 200 lb./acre

Bermuda 40 lb./acre

Pensacola Bahia 40 lb./acre

D. Immediately after seeding, the area shall be sprayed with asphalt emulsion or covered with a suitable erosion control fabric or other acceptable material. Asphalt emulsion shall be a type specifically designed for mulching of seeded areas. Erosion control fabric shall be manufactured of materials which are biodegradable within 4 to 8 months of outdoor exposure, and shall be applied in accordance with the manufacturer's recommendations.

E. After seeding is completed, seeded areas shall be watered as necessary until an acceptable grass cover is obtained.

11.3.3 Temporary Cover: If areas to be grassed are ready for seeding at a time inappropriate for establishing the permanent grass cover, a temporary cover shall be provided for protection of such areas until such time that the permanent cover can be established. At the appropriate time, the CONTRACTOR shall return to the site and provide the permanent cover as specified above.

A. Temporary cover shall be provided as specified above for the permanent cover, with the following exceptions:

1. Fertilizer shall be applied at one-half the rate specified for the permanent cover.
2. Seed shall be Rye or Sudan Grass applied at rates to provide an adequate and acceptable temporary cover.

B. After temporary seeding is completed, the seeded areas shall be watered until an acceptable grass cover is obtained.

11.3.4 Maintenance: During the period of the guarantee, the CONTRACTOR shall repair all damage due to erosion and other causes, and shall maintain all grassed areas in an acceptable condition. During the maintenance period, grass shall be mowed at regular intervals and watered as required to prevent grass and soil from drying out.

A. Maintenance instructions shall be furnished to the OWNER, and shall include cutting method and maximum grass height, and types, application frequency and recommended coverage of fertilizer and lime.

CHAPTER 12

LIST OF APPROVED MANUFACTURERS

12.1 GENERAL: The following is a listing of manufacturers and model numbers of items approved for use in NBSD systems.

Pipe, PVC pressure National Certainteed
J-M
Diamond
Scepter
North American
Pipe, Ductile Iron American
Griffin
US Pipe
McWane
Sewer service fittings, PVC Harco
Nyloplast
Pipe, PVC Gravity sewer JM
North American
National Certainteed
Diamond
Yard Hydrants Woodford Model W-34
Manhole Frames and Covers USF-195-E-ORS
Forcemain making Poles Blackburn Manufacturing
Models SD-7086K for Sewer Label
TVF-66 Green for marking pole
Hatches and Associated Hardware USF Fabrication Inc.
Halliday
Bilco
Control Panel Backer Board US Plastic Corporation
SCADA System Omni Site.net
Crystal Ball Remote
Monitoring System
Submersible Pumps Flygt
ABS
Grinder Pumps Zoeller
Plug Valves Milliken

Dezurik
Gate Valves Mueller
M&H
American Darling
Check Valves Golden Anderson # 250-D
Manhole Wrap MultiSeal 12" wide Butyl-Tite Wrap
Drain flapper valve (valve vault) Flo-Control
Floats Flygt or approved equal
Grinder Check Valves Danfoss Flowmatic #508
Float Hanger Electric Speciality DORS-3
Air Valves Valvmatic Model # 48-S
Ultrasonic Flow Meter Sonutrack ST-30 GMCO
Mechanical Restraints EBBA Iron
Romac
Smith-Blair
Casing Spacers (SS W/ nylon runners) Cascade
APS
Casing Plugs Cascade
APS
Ball check valves Flygt
Junction boxes, type 4X fiberglass Robroy Ind. J1008hw
Phase failure relays Sycom 102A
Control Relays, 3-pole pin type,
w/pilot light Square D
Motor Starters Square D
Breakers, circuit Square D
Lightning surge arresters
on main disconnect Square D
Generator Tradewinds
Detroit Spectrum

Chapter 13

TECHNICAL SPECIFICATION SECTION FOR SEWAGE LIFT STATION GENERATOR SET/ATS

1. GENERAL

It is the intent of the specification to secure an emergency system that has been prototype tested, factory built, production tested, site tested, of the latest commercial design, together with all accessories necessary for a complete installation as specified herein. The equipment supplied and installed shall meet the requirement of the National Electric Code and all applicable local codes and regulations. All equipment shall be new, unused and of current production by a firm that has its final assembly located in the continental United States. The generating set manufacturer shall have at least twenty-five (25) years experience assembling generating sets. The engine/generator, controls, transfer switch, disconnect shall be complete assembled and wired by the generator manufacture and locally authorized dealer to ensure one-source responsibility for warranty, parts, and service through factory-trained service personnel.

2. SUBMITTAL

Submittal shall include specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimensional drawings, and interconnection diagrams.

3. RATINGS

The standby generator set shall be rated as standby power (defined as continuous operation for the duration of any power outage). Kilowatt ratings for three-phase voltages are based on a 0.8 power factor, single-phase voltages are based on a 1.0 power factor. Ratings are established on 150 feet altitude and 110° Fahrenheit, as manufactured by Tradewinds Power Corp or purchaser-approved equal. Vibration isolators shall be provided between the engine-generator and the steel sub-base, fuel tank or directly to mounting pad. In all applications in sewage lift stations the generator shall perform and starting both sewage pump motors at the same time. Refer to NBSD or the Engineer for sizing generator applications.

- A. Tradewinds /Perkins Power. Sure-Gen
- B. Detroit/Covington Diesel

4. ENGINE

The prime mover shall be a liquid-cooled #2 diesel-fueled engine of 4-cycle design, equipped with the following:

A. Mechanical or electric fuel transfer pump, primary and secondary fuel filters, water separator, and electric fuel shut-off valve.

B. Electronic governor capable of regulating the no load to full load frequency to a .25% maximum, steady state regulation shall be .25%.

C. 12-volt positive engagement solenoid shift-starting motor.

D. 12-volt belt-driven battery charging alternator with solid-state voltage regulation.

E. Positive displacement full pressure lubrication oil pump, cartridge oil filters, dipstick and oil drain.

F. Dry replaceable, dual element "heavy duty type" air cleaner.

G. Unit-mounted radiator, pusher type cooling fan, water pump, thermostat and radiator duct flange (non-enclosed units) shall properly cool the engine and be designed for operation at a minimum ambient temperature of 120° F.

5. ALTERNATOR

The alternator shall be a 4-pole revolving field type with 12 reconnectable leads, self-ventilated and of drip-proof construction. The insulation material shall meet the NEMA standard (MGI-22.40 and 16.40) for Class H. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator with adjustable volts-per-hertz tracking. On application of any load up to the full rated load the voltage dip shall not exceed 12.5% and shall recover to stable operation within two seconds. The alternator shall be capable of sustaining at least 250% of rated current for at least 10 seconds under a 3 phase symmetrical short by inherent design or by the addition of an optional current boost system. The alternator shall be capable of accepting the loads and instantaneous voltage dip when loads are started as specified. The generator shall be directly connected to the flywheel housing and by means of a shaft through a flexible drive plate coupled between the alternator's rotating mass and the engine flywheel for permanent alignment. A ground cable will be installed between the alternator foot and the support crossmember.

6. GENERATOR/CONTROLLER

Generator controller shall be an integral part of the overall weather enclosure and shall have three points of interface so that panel can be removed and replaced quickly as and if required. A separate D/C twist lock receptacle shall be provided for all D/C interfaces to the generator control panel from the generator set. A separate A/C twist lock receptacle shall be provided for all A/C interfaces to the generator control panel from the generator set. A RS 232 connector shall be provided and installed through the control panel box to allow access to the controller without having to remove the controller from the box. This plug-in device will be capable of allowing maintenance personnel to test controller performance without operating the engine. All wire shall be rated for peak A/C voltage and shall be number stamped as indicated in the electrical schematic. The enclosure shall be constructed of .090-gauge aluminum. The microprocessor control board shall be moisture proof and capable of operation from -40° to 85° Celsius. The digital generating set controller shall be provided utilizing microprocessor-based technology and provide:

A. CAN Bus option to connect to standard SAE J1939 engine management systems. Error codes will be displayed in numerical and text format.

B. Comprehensive remote communications via optional RS232 port. Full 2 way communication and panel supports GSM SMS messaging system.

C. Engine instruments: Oil pressure, water temperature, actual engine hours run, charging voltage, battery volts and engine rpm.

D. Generator Instruments: Volts, Hz, Amps, kW, kVA, Power factor.

E. 16 bit micro processor control

F. Optional RS 485 'Modbus' output.

G. LCD 4 line text based backlit display

- H. PC configuration and status monitoring using 5xxx PC software
- I. PIN number front panel programming protection for selected trip points and timers to allow in field adjustments.
- J. Built in exerciser times
- K. Sleep mode to conserve battery life
- L. Automatic and manual operation modes
- M. Six configurable auxiliary inputs for connection to external fault detection equipment-expandable to 14 auxiliary inputs along with three configurable outputs.
- N. Integral load switch control capability
- O. Able to survive 0V for 50mS without internal batteries
- P. Ability to be configured for use with a 16 light remote annunciator. Range is 1000 meters over standard wires (NFPA 110)
- Q. Optional 8 light remote annunciator and 8 dry relay contacts-Fully programmable.
- R. Ability to communicate with Thompson Technologies automatic switch
- S. Enclosure protection IP55 with gasket
- T. Multiple display languages
- U. Auto scroll display
- V. Integral load switch capability
- W. Pre-alarms and shutdowns for generator voltage, frequency and amps.
- X. Adjustable high current shutdown alarm-IDMT curves.
- Y. 4 configurable LED's on front panel-Warnings, shutdowns or Status indicators
- Z. Event log
- AA. Fuel level input with transfer pump control
- BB. Multiple wiring topologies supported-Front panel configurable
- CC. UL, CE and CUL approved
- DD. Generator available LED
- EE. Close generator output LED

The following accessories, as required, shall be installed, and completely wired to ensure that no site installation is required.

A. Battery racks. Battery cables. 12-volt or 24-volt battery(s) capable of delivering the minimum coldcranking amps required at zero degrees Fahrenheit ~ SAE Standard 1-537 for each particular kW rating. The battery rack shall be the welded to the sub-base or fuel tank and shall have two hold down bolts with one cross over strap.

B. Oil and water drain lines shall be installed and extended to the outside of the weather protective enclosure through bulkhead fittings. Each drain line shall include but not be limited to a brass ball valve and flexible lines. The ball valves shall be located on the interior of the package.

C. Engine exhaust silencer shall be coated to be temperature and rust resistant and rated for critical applications. Exhaust noise shall be limited to 85 dba as measured at 10 feet in a free-field environment. Silencer is mounted within the structure of the weather protective enclosure. The silencer is connected to the engine by a stainless steel flexible pipe.

D. The block heater shall be sized properly to carry the correct wattage and voltage for the engine chosen by the generator supplier. This block heater shall also be thermostatically controlled to maintain engine coolant at 90° F (32 degrees Celsius) to meet the start-up requirement of NFPA-99 or NFPA-110 regulations. If the line voltages do not match the required voltages, the manufacturer shall furnish and install the necessary transformer in the transfer switch compartment to convert the primary power source voltage to the voltage and current level required.

E. Automatic float and equalize battery charger with constant voltage constant from no load to full load. Current limited during engine cranking and short circuit conditions. Temperature compensated for ambient from -40 degrees C to +60 degree C, voltmeter and ammeter fused, reverse polarity and transient protected. Optional alarm circuit board to meet the requirements of NFPA-110 for low battery voltage, high battery voltage and battery charger malfunction.

F. A duplex receptacle, GFCI type, is made available to route power from the normal source to the float charger and block heater. The float charger and block heater are connected to the float charger.

G. Remote-stop button.

H. Weather-protective enclosure constructed of marine grade aluminum white powder coat paint finish. The enclosure shall have removable and hinged side panels to allow inspection and maintenance. This enclosure shall be constructed from minimum-.090-gauge aluminum for units up to and including 35kW. Enclosures housing gensets larger than 35kW are constructed of 1/8" thick marine grade aluminum. All enclosures shall have stainless hardware throughout. The enclosure shall have a removable panel at the radiator end to allow access to the interior mounted exhaust silencer and for cleaning of the radiator cooling fins. The sound level of the enclosure without additional material added shall not exceed 78 dBA at a distance of 7 meters.

I. Sound attenuation material added to the enclosure will be constructed of 1-inch adhesive backed foam.

J. The generator set will be fitted with a mainline circuit breaker(s), unless otherwise specified, sized a minimum of 15% above the rated amperage. This breaker will be mounted on the side of the alternator conduit box with rubber anti-vibration mounts.

K. Double wall steel sub-base mounted fuel tank shall be provided adhering to UL code 142 requirements. A fuel level gauge, 4-20mA analog level transmitter and low-level alarm contact shall be provided to annunciate the fuel level on the generator control panel. In addition, there shall be a leak detection switch located in the outer tank to indicate any occurrence on the generator control panel. The fuel tank shall have a lifting eye on each corner constructed of 3/8 structural steel plate. 36 hour run time tank. The tank will be fitted with a fuel drain fitting to remove the diesel fuel from the tank. The fuel tank shall be provided with a lockable fuel fill cap, suction and return pipes. Consideration shall be given in the upper plate design to ensure free and easy access to the hardware that holds the vibration mounts to the top of the fuel tank. At the rear of the tank there shall be an area to allow electrical stub up.

L. Genset is fitted with a fuel/water separator.

7. AUTOMATIC TRANSFER SWITCH

SCOPE

AUTOMATIC TRANSFER SWITCH

This Specification covers the supply of a complete operational automatic transfer switch rated ____Amps, ____Volts, ____Phase, and ____Hz, _ Pole, for installation by others. Three phase systems must be multi-voltage capable. Actual size will be by pump and or amp requirement.

List of Accepted Transfer Switch Manufacturers:

A. Thompson Technology. Sure-Gen, Inc. 910-253-0484

B. Enercon

C. Russell Electric

GENERAL REQUIREMENTS

The unit shall be manufactured in accordance with this specification and applicable UL, CSA, IEC, NEMA, and ANSI standards.

The unit shall be manufactured in a facility, which is registered to an ISO 9001:2000 quality system. Supplier shall be responsible for ensuring the compatibility of all components of the unit.

The unit shall be free of defects in material and workmanship.

RELATED INDUSTRY STANDARDS

UL 1008 Automatic Transfer Switches for Use in Emergency Systems

ENGINEERING SUBMITTALS

The following documentation shall be made available for submission to the project engineer for review/approval purposes on the automatic transfer switch:

Physical Layout Drawing

-Outline dimensions, cable entry/exit locations, interior/exterior component layouts and connection data.

Electrical Schematic

-Internal wiring, customer connection terminals, optional components, controller settings.

Product Data Sheets

-Equipment Ratings.

RATINGS & CONSTRUCTION

AUTOMATIC TRANSFER SWITCH

Rating of the automatic transfer switch shall be _____ AMP, _____ VAC, _____ Hz, _____ PHASE, _____ WIRE. The transfer switch shall comprise of _____ switching poles plus a solid neutral. Fault withstand current rating of the complete assembly shall be _____ Kamps RMS. The interrupting and closing rating shall be equal to or exceed the required withstand rating. This rating shall be obtained with standard upstream over current protection devices.

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The automatic transfer switch must be listed or certified to the following safety standards:

UL 1008 Automatic Transfer Switches For Use in Emergency Systems

The completed assembly shall be mounted in a NEMA 3R enclosure suitable for outdoor application. All materials and parts used in the unit shall be new, of current manufacture, of best industrial grade, and free from defects and imperfections. The transfer switch mechanism shall provide a simple means of manual operation using only components, which are permanently affixed, in the operating position. Transfer switch must be capable of being switched under load in a manual configuration. The unit shall permit manual operation of the transfer switch while the system is energized and carrying rated load. All internal control devices used in the automatic transfer switch shall be capable of being de-energized and isolated from the system by use of an accessible isolation plug for servicing procedures as required. The automatic transfer switch design shall provide front accessible components and wiring for easy serviceability. Power or control connections, which are not readily serviceable while the transfer switch is mounted in its enclosure, are not acceptable. All power contacts used shall operate in a quick-make / quick-break manner, the speed of which shall be independent of supply voltage and / or speed of operation by manual means.

FUNCTIONAL REQUIREMENTS

GENERAL DESCRIPTION

The automatic transfer switch shall automatically transfer the load to the generator supply in the event of a utility supply failure and return the load to the utility supply upon restoration. The automatic transfer switch power switching devices shall be mechanically and electrically interlocked to prevent the utility and generator supplies from being interconnected.

"AUTOMATIC SEQUENCE OF OPERATION"

Note: For specific device settings refer to Section 4.3 "STANDARD "CONTROL FEATURES."

When the voltage on any phase of the utility supply is below preset levels of rated voltage for a preset time delay, a contact shall close to initiate starting of the generator set.

The load shall transfer to the generator supply when the generator voltage and frequency have reached acceptable preset levels and the warm-up time delay has expired.

When the utility supply is restored to above preset levels of rated voltage on all phases, load transfer from generator to utility supply shall be initiated following expiry of the utility return timer.

Once the transfer mechanism operates and opens the generator power switching device, the transfer mechanism shall stop in the neutral position (i.e. with both power switching devices open) for the duration of the neutral delay timer setting to allow load voltage to decay prior to re-connecting the utility supply.

The load shall be re-connected to the utility supply once the neutral delay timer expires and the transfer mechanism continues operation and closes the utility power switching device.

The load shall immediately retransfer to the utility supply (if within acceptable limits) should the generator supply fail prior to expiry of the utility transfer delay.

The generator set shall continue to operate following a load transfer for a cool down delay period, and then a contact shall open to stop the generator set.

An "on load" test mode may be initiated which shall cause a simulated utility failure condition and transfer the load to the generator set. The transfer sequence shall be the same as for a utility power failure except a neutral delay sequence shall occur when transferring from utility to a generator source.

The load shall immediately retransfer to the utility supply (if within acceptable limits) should the generator supply fail during an "on load" test mode.

STANDARD CONTROL FEATURES

The transfer switch shall be rated for use on multiple system voltages.

The transfer switch shall be field configurable to operate on the following nominal system voltages; 208V, 240V, 380V, 480V, 600V. Field selectable single or three phase. Transfer switch control power must be obtained from the source being transferred to. The controls shall not require any connection to external power sources. Transfer switches requiring power from the engine starting (or other) battery are not acceptable.

A control circuit isolation plug shall be provided to isolate all control circuitry inside the transfer switch to facilitate maintenance procedures. When isolated, there shall be no voltage present on the control circuitry.

The transfer switch controller shall be microprocessor based and shall contain all voltage, frequency sensing and timing functions.

Three phase under voltage sensing shall be provided for the utility supply. The under voltage sensor shall be user adjustable from 70-95% of nominal and shall be based on a falling (i.e. drop-out) voltage. The under voltage sensor shall be factory set at 85% nominal voltage. The under voltage sensor shall reset (i.e. pickup) 5% above the dropout setting. The under voltage sensor shall include a transient time delay feature set at 1 second.

Three phase under voltage sensing shall be provided for the generator supply. The under voltage sensor shall be user adjustable from 70-95% of nominal and shall be based on a falling (i.e. drop-out) voltage. The under voltage sensor shall be factory set at 85% nominal voltage. The under voltage sensor shall reset (i.e. pick-up) 5% above the dropout setting. The under voltage sensor shall include a transient time delay feature set at 5 seconds.

Under frequency sensing shall be provided for the generator supply to permit load transfer to the generator supply if within nominal limits. The frequency sensing function shall contain a user adjustable set-point with a range of 70-90%.

The factory setting shall be set at 90% of nominal frequency.

An engine start contact shall be provided which shall close to initiate starting of the engine. The engine start contact shall be rated 5A, 120/240VAC, 5A, 28Vdc resistive.

The following time delay functions shall be provided:

Engine Start-A time delay on engine start shall be provided to delay the engine start signal after failure of the utility source. The time delay shall be user adjustable 0 - 60 seconds, factory set at 3 seconds.

Engine Warm-up- A time delay for engine warm-up shall be provided which permits transfer to the generator supply after generator voltage and frequency exceed acceptable limits. The time delay shall be user adjustable 0 - 60 seconds, factory set at 2 seconds. Utility Return- A time delay for return to utility shall be provided which permits transfer to the utility supply only after stable voltage conditions exist for the specified time period. The time delay shall be user adjustable 0 - 30 minutes, factory set at 2 minutes.

Engine Cool down- A time delay for engine cool down shall be provided which delays the engine stop signal after load has retransferred to the utility source until the time delay period expires. The time delay shall be user adjustable 0 - 30 minutes, factory set at 2 minutes.

Neutral Delay- A time delay for neutral position shall be provided to minimize the effect of out-of-phase transfer due to connected motor load. The time delay shall be user adjustable 0 – 60 seconds, factory set at 3 seconds.

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Provision for local and remote operator-initiated system test modes shall be provided. Test modes shall allow "on load" testing of the generator set.

An automatic plant exercise time function shall be provided for generator testing. A fixed timer shall provide a 7 day off mode and a 20 minute run period. The exercise mode shall be enabled by a door mounted push-button.

Control logic shall be provided for immediate transfer to the utility supply (if within acceptable limits) should the generator set fail during any activated test mode.

Control logic shall be provided for sensing a Transfer Switch Failure condition, and if the alarm condition is activated, the transfer controller shall automatically force a transfer to the alternate source if available.

Pilot lights shall be provided to indicate load on utility status (green) and load on generator status (red). Pilot lights to be long life LED type.

Pilot lights shall be provided to indicate utility source available status (green) and generator source available status (green). Pilot lights to be long life LED type.

Pilot light shall be provided to indicate energized load voltage status of the transfer switch. Pilot light to be long life LED type.

The transfer switch controller shall provide a lamp test function to test all LED lights.

The transfer controller shall provide a user initiated timer bypass feature to allow temporary bypassing of any active timer to reduce unnecessary delays in testing or trouble shooting procedures.

Utility Supply Auxiliary Contact (AUX-U)

An auxiliary contact (qty 1) shall be provided which operates when the utility source is on load. The auxiliary contact shall be supplied with a rating of 10A, 120/240VAC, 5A, 28Vdc resistive, Form C.

Generator Supply Auxiliary Contact (AUX-G)

An auxiliary contact (qty 1) shall be provided which operates when the generator is on load. The auxiliary contact shall be supplied with a rating of 10A, 120/240VAC, 5A, 28Vdc resistive, Form C.

OPTIONAL CONTROL FEATURES

4.3.1.0 FTS4 -Four function Test Switch (Auto, Off, Engine Start Test).

7. PLANT TESTING:

Each generator set shall be tested under varying loads with guards and exhaust system in place. Test shall include:

- A. Load steps of 25, 50, 75 and 100%.
- B. Block load from no load to 75% and 100%
- C. Transient and steady state governing.
- D. Safety shutdown device testing.
- E. Voltage regulation.
- F. Arrangements to witness performance tests or a certified test record shall be available at the request of the purchaser.

8. EXECUTION

The Owner in accordance with the manufacturer's recommendations and all applicable codes shall install the equipment.

Site tests: An installation check. The manufacturer's local representative shall perform start-up and load test. The time and date of the site tests shall be coordinate with the Owner. The tests shall include:

- A. Fuel, lubricating oil and engine coolant shall be checked for conformity to the engine manufacturer's recommendations under the present and anticipated environmental conditions.
- B. Accessories that normally function while the set is in standby mode shall be checked prior to cranking the engine. This: shall include: engine heaters. Solid-state battery charger, generator strip heaters, remote annunciator, etc.
- C. Start-up under test mode to check for exhaust leak and cooling airflow. Test for movement during starting and stopping, vibration during running normal and emergency along with line-to-line voltage and phase rotation while running a known test load.
- D. Automatic start-up by means of simulated power outage to test remote-automatic starting. Transfer of the load and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper systems coordination. Engine temperature, oil pressure and battery charge level along with generator voltage and frequency shall be monitored throughout the test.

9. SUBMITTAL AND WARRANTY

A. Submittal shall include specification sheets showing all standard and optional accessories to be supplied; foundation plan; schematic wiring diagrams; dimension drawings; and interconnection diagrams identifying by terminal number of each required interconnection between the generator set, the transfer switch, and the remote annunciator panel and the load. Equipment shall not be released for manufacture until submittal materials are approved.

B. The manufacturer shall warrant the generating set against all manufacturing defects for a period of three-years or 1,500 hours (maximum of 500 hours per year), whichever occurs first, from the date of system start-up. The warranty period shall commence from the date of system start-up but no later than six months from the date of shipment from the manufacturer.