



DEVELOPER EXTENSION MANUAL

April 2019

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DEVELOPER EXTENSION POLICIES

1 Introduction

It is the policy of the District to provide facilities for the sewer collection and distribution of water within its service areas in accordance with approved land use plans and policies and the District's Comprehensive Plans. The District will not, however, extend facilities to service additional customers, properties, tracts, or subdivisions at the expense of existing District customers.

An applicant (e.g. developer, homeowners association, citizens group, or individual) for an extension is responsible for financing the entire cost of an extension, including adding new facilities or replacing existing system components when necessary for making the extension or improvement, including over sizing water system components as outlined below.

Water and/or sewer system extensions, improvements, or new facilities will be constructed in accordance with the District's Extension Policies, Design Standards, Standard Specifications, and Schedule of Rates and Fees. The District, in which case the District shall have no obligation whatsoever to accept the extension and provide water and/or sewer service to the owner's property, may reject any work not so performed.

All water and/or sewer facilities will be located on public rights-of-way or dedicated easements; will be transferred to the District's ownership for perpetual operation, maintenance, and service responsibilities; and will be subject to initial performance/maintenance bonding requirements.

2 Water Availability

2.1 General

The District will make every attempt to provide sufficient water resources to meet the needs of its current customers and provide for future growth needs. However, development of new water supplies may not keep pace with growth requirements.

During periods when growth demands outstrip available water supply, new service requests will be served on the basis of water availability and time of application for service. New sources will not be considered available to the District until water rights for the sources are granted by the Washington State Department of Ecology.

When the District does not have sufficient water rights to supply all applicants for water availability, non-binding letters of availability will be issued contingent on District acquisition of sufficient water rights to supply proposed development.

2.2 Non-Binding Water Availability

Non-binding water availability letters will be issued upon application and payment of any applicable fees for properties being developed. A legal description of the property to be served must be provided for the water availability application. All fees paid shall be ***non-refundable***.

The non-binding letter will enable a developer to start the platting process with Kitsap County; however, it cannot be used to finalize the plat. Non-binding availabilities will list contingencies, which must be fulfilled, by the developer and the District prior to issuance of a binding commitment. Non-binding water availabilities issued with a water rights approval contingency will not be converted to binding commitments without sufficient water rights being approved by the Washington State Department of Ecology.

NON-BINDING LETTERS OF WATER AVAILABILITY ARE NOT A CONTRACTUAL CONTRACT ON THE PART OF THE DISTRICT TO SUPPLY WATER.

2.3 Binding Commitments for Water Availability

Binding commitments will be issued upon removal of contingencies, payment of any applicable fees, having approved plans and in order of water availability application date. All fees paid shall be ***non-refundable***.

During periods of limited water supply availability, binding water commitments will only be issued for the following categories and order of priority, as water is available:

1. Developed properties, which front an existing water main, single residential connection.
2. General letters of availability written with no expiration date for the property, on which they were written, provided the original project has not changed substantially from that described in the letter.
3. Plats with ***signed*** developer extension Contracts less than **two (2)** years old.

Properties, which are within the annexed boundaries of the District, will be given priority over properties outside the annexed boundaries but within the District's service area.

Issuance of a binding commitment for water will require payment of the general facility fees for each unit, as set forth in the District resolution establishing connection charges. In addition, the monthly "Ready to Serve" charge for each unit, as set forth in the District resolution establishing service charges and fees, must be paid. Binding commitments are valid for a period of **three (3)** years from date of issue. If not utilized in **three (3)** years, or if the ***monthly fees are delinquent*** for ninety (**90**) days, the binding commitment will be revoked. In such case, the fees are forfeited and the availability may only be renewed on a non-binding basis.

3 Annexation

In the event that the premises to be served are located, in whole or in part, outside the District's annexed boundaries, any obligations of the District to provide service are conditioned on the following requirements having first been met:

1. The premises shall be annexed to the District, subject to approval by the Kitsap County Boundary Review Board, in the manner required by law. The annexation shall include a

service area acceptable to the District. At the sole discretion of the District, the District may not require annexation; however, the Developer must agree to pay all surcharges for out of District service.

2. Water and/or sewer service is conditioned upon compliance with Growth Management Act requirements.
3. The Developer shall obtain the signature(s) of the legal owner(s) of premises on the petition for annexation of premises to the District in standard form and obtain the signatures of owners of any adjoining properties that the District or the Boundary Review Board deem necessary or advisable to be included in such annexation.
4. The Developer shall pay any applicable District fees and costs incurred in seeking such annexation.

4 Extension Application

4.1 Application Approval

Requests for extension or improvement of District water and/or sewer system to serve newly developed and/or existing properties shall be made by applicants or their agents using the District's application form (*Developer Extension Contract*). To be considered for approval, the applicant must have a valid water and/or sewer availability letter from the District. The water and/or sewer availability letter will list the requirements for providing service to the property.

4.2 Conditions

The applicant will be notified of the feasibility of the service requested, conditions for construction, and any additional facilities, which will be required to serve the proposed development. The applicant will be required to install all the necessary infrastructure. Examples of water infrastructure include, but are not limited to distribution mains, fittings, valves, fire hydrants, pressure reducing stations, service lines to property, and other appurtenances necessary to serve the proposed development in accordance with the District's current planning. Examples of necessary sewer collection infrastructure include but are not limited to mains, clean outs, manholes, and lift stations. If deemed necessary by the District, the developer will be required to provide technical studies such as hydraulic analysis for the developments fire flow demands and capability of existing sewer lift stations. Additional special requirements such as pump stations, off-site water main upgrades, cross connection control devices or back flow prevention assemblies may also be specified.

4.3 District Review

Plans for the proposed water and/or sewer main extension/development must be submitted to the District and approved prior to execution of a Developer Extension Contract. A plan review fee, as specified in the District resolution adopting service charges and miscellaneous fees will be assessed to compensate for review services.

4.4 Extension Contract

Upon approval of plans for the water and/or sewer main extension, the applicant shall execute a Developer Extension Contract with the District, which will specify the terms and conditions of the extension or system improvement in accordance with the District's standards. A legal description of the property to be served must be submitted by the applicant with the Developer Extension Contract. Extension Contracts will be signed by the applicant and District Commissioners. Construction inspection charges and local facilities charges are due and payable prior to approval of the Developer Extension Contract. Plans for necessary water and/or sewer system extensions and improvements will become part of the Contract.

4.5 Fees and Charges

When submitted to the District for approval, the Developer Extension Contract shall be accompanied by construction observation charges and applicable local facilities charges as set forth in the District's resolutions adopting connection charges and service charges and miscellaneous fees.

Additional charges such as general facility charges, special assessments, and connection charges will be determined by the District and payment will be made in accordance with the terms of the Developer Extension Contract.

4.6 Approval of Application

Each application will be considered by the Board of Commissioners of the District and approved or rejected according to the District's policies. The developer shall be notified in advance of the meeting at which the application will be considered. After consideration by the Board, the application will be accepted, accepted as modified by Contract with the applicant, or rejected. Notice of the Board's action will be mailed to the applicant. If accepted, the applicant will be entitled to proceed with construction of the extension in accordance with the terms of the Contract and District policies.

4.7 Time Limit

The Developer Extension Contract will become void in **two (2)** years if construction has not been completed, unless extended by the District. Thereafter, a new Contract must be entered into for the project to proceed.

4.8 Permits, Easements, and Approvals

All necessary permits, easements, and approvals shall be obtained by the applicant at the applicant's expense. These could include, but are not limited to, state and county road, building, health, and planning agency permits.

4.9 District Responsibilities

In consideration of payment of the Plan Review and Construction Inspection Charges, the District will provide:

- Design review for compliance with District Standards;
- District inspection of water and sewer improvements construction;
- Witnessing of pressure test;

- Taking and submitting water samples for bacteriological testing by the Health District; and
- Updating District system maps, based on the project's record drawings and District collected GIS data.

4.10 Applicant/Developer/Contractor Responsibilities

It is expected that the applicant will extend normal courtesies to the District in giving reasonable notice of the time and place of work to be inspected. In particular, the applicant shall:

Notify the District in writing at least **forty-eight (48)** hours in advance of the time of beginning of construction;

Complete the work, including cleanup, to the point where work complies with the plans and specifications and is ready for acceptance by the District; and

Pay to the District the extra cost of overtime services performed by the District beyond normal working hours, on Saturdays, Sundays, or holidays, in the event such services are required by the applicant. In the event the developer makes a change in the plat or other plan of the proposed development, which requires a change in the design of the water and/or sewer system, the developer shall reimburse the District for any additional expense incurred by the District because of such change.

4.11 Compliance with State Environmental Policy Act (SEPA) or National Environmental Policy Act (NEPA)

If the proposed extension and appurtenances are not exempt from the provisions of RCW 43.21C, the State Environmental Policy Act (SEPA), or the National Environmental Policy Act (NEPA), the Developer, as a condition to performance by District of its obligations under this Contract, must prepare and submit an environmental checklist and worksheet on forms provided by the District in respect to the proposed Developer Extension Project and otherwise comply with the provisions of SEPA or NEPA and procedures of the District for handling projects subject to such acts. The District will then serve as the lead agency in determining the environmental significance of the Proposed Developer Extension Project unless a State, County or City agency having jurisdiction over the project assumes lead agency status. If an environmental impact statement is required, the Developer shall pay all costs of proceedings before governmental agencies in respect thereto including the costs and fees of the Engineer and/or Attorney for the District in participating in any such proceedings.

District assumes no liability or responsibility to Developer for the interruption of the work due to SEPA or NEPA requirements or litigation commenced by third parties against District and/or Developer to delay or stop the proposed project by reason of environmental concerns. Developer agrees to defend, indemnify and hold the District harmless from and against any and all claims, demands, liability and/or judgments as may be made or entered against the District by a third party, including any governmental body or agency, arising from the Developer's project based upon alleged non-compliance with or in violation of SEPA and/or NEPA laws and other regulations in respect to the project. Developer shall reimburse District

for all attorneys' fees and costs and other expenses and fees incurred in connection with any such claims and demands, and in particular, all attorneys' fees, costs and expenses incurred if Developer fails to assume the defense of any such claims or demands or fails to assume all costs of negotiations to settle any such claims or demands.

4.12 Compliance with Endangered Species Act

The listing of Chinook and other species of salmon as endangered or threatened under the Endangered Species Act (ESA) has created the likelihood of future regulations and restrictions that may restrict or even prohibit the District from allowing additional connections or facilities to its water system.

In the event the ESA Restrictions impose conditions on the connections or facilities anticipated under this Contract, which increase the cost of providing such service, such increases shall be the sole responsibility of the property owner.

District assumes no liability or responsibility to Developer for the interruption of the Work due to ESA requirements or litigation commenced by third parties against District and/or Developer to delay or stop the proposed project by reason of environmental concerns.

Developer agrees to defend, indemnify and hold the District harmless from and against any and all claims, demands, liability and/or judgments as may be made or entered against the District by a third party, including any governmental body or agency, arising from Developer's project based upon alleged non-compliance with or violation of ESA laws and other regulations in respect to the project. Developer shall reimburse the District for all attorneys' fees and costs and other expenses and fees incurred in connection with any such claims and demands, and in particular, all attorneys' fees, costs and expenses incurred if Developer fails to assume the defense of any such claims or demands or fails to assume all costs of negotiations to settle any such claims or demands.

4.13 Attorney's Fees in Disputes, Arbitration or Litigation

4.13.1 Third Parties

In the event this Contract is referred by the District to an attorney by reason of any dispute whatsoever which arises with third parties, including governmental agencies, in respect to either the right of a Developer and additional owners to proceed and/or complete the work, and settlement negotiations or arbitration proceedings are commenced, or suit is instituted, with the approval of the Developer, against any such third parties, including governmental agencies and/or suit is instituted against the District by any such third parties, including governmental agencies in respect thereto, the Developer and additional owners shall be responsible for payment of attorneys' fees and court costs incurred by the District in any such proceedings, and the District may require advance deposits periodically from the Developer and additional owners to cover all such costs and attorneys' fees.

4.13.2 Developer

In the event either party hereto commences legal action, including appeals, against the other to enforce the provisions of this Contract or for damages for breach hereof, the prevailing party

shall be entitled to recover its costs and reasonable attorneys' fees in the amount determined by the court.

5 Administrative Procedures

5.1 Financing

Applicants, at their own expense, will install an extension and transfer ownership to the District, under the review and approval provisions stated herein.

5.2 Fee Deposit

The applicant shall pay the District the applicable plan review fee and developer extension fees as set forth in the schedule of fees and charges.

5.3 Performance Bond

When required by the District, a performance bond (or a cash deposit held in a bank savings account in the name of the District) shall be furnished by the developer or its contractor upon a form and in an amount (generally 150% of the estimated costs of the extension) approved by the District. The bond, naming the District as obligee, shall be furnished to the District before any construction activity at the work site begins.

The Performance Bond shall obligate the developer or its contractor to pay all costs of labor performed, and materials and equipment furnished for the work, and shall be for the benefit of all persons furnishing labor, equipment, and materials, whether or not a valid claim exists under Public Works Liens Statutes or the Mechanic Lien Statutes of the State of Washington. The bond shall also guarantee payment to the District of all costs incurred to repair or replace newly installed water and/or sewer facilities, which fail during the **two (2)** years of operation. Further, the bond shall guarantee payment for replacement of any or all of the water and/or sewer mains if the District determines the extension's failure rate is excessive and the water and/or sewer main cannot be reasonably relied upon for long trouble-free life. The District shall be sole judge of the adequate performance.

The bond shall be effective until a period of **two (2)** years have elapsed from the date of the letter of final acceptance of the water and/or sewer facilities by the District. In some cases, a two-year bond may be required because of County rules on road restoration. The acceptance letter will be issued when the facilities have been fully constructed, inspected, and approved by the District.

The Developer may post cash, a letter of credit, or an assignment of funds on deposit with a bank in lieu of a bond, on the same terms and conditions as described above, upon approval of the District.

In no event shall the bond/deposit be waived if the District is requested to approve the extension prior to final plat approval with respect to the Developer's property by Kitsap County. ***See Section 5.12 Maintenance Bond as it applies to performance bonds.***

5.4 Connection Charges

Each lot or service connection included in a water extension will be assessed a Service Installation Fee (if the District installs the meter/service connection), a General Facilities Charge, and, if applicable, a Local Facilities Charge and/or special assessment. All fees and charges are due in full, less any credits, before water will be made available.

Each lot or service connection included in a sewer extension will be assessed a General Facilities Charge, Treatment Capital Charge and, if applicable, a Local Facilities Charge, and/or special assessment. All fees and charges are due in full, less any credits, before water and/or sewer will be made available.

A General Facilities Charge is assessed to compensate for costs the District and its customers have paid for the existing system and for new facilities and system upgrades required to support the addition of new customers. The General Facilities Charge is based on the demand a service will place on the water and/or sewer system.

A Treatment Capital Charge is assessed to compensate for costs the District and its customers have paid for the cost of the wastewater treatment plant and for new treatment facilities and system upgrades required to support the addition of new customers. The Treatment Capital Charge is based on the demand a service will place on the sewer system.

A Local Facility Charge is separate and in addition to the General Facility Charge. The Local Facility Charge would be utilized in an area where the District has invested District funds for the benefit of local properties. The collection of a Local Facility Charge reimburses the District for its investment by properties that derive the benefit.

5.5 Reimbursements (Payback)

If a new water and/or sewer main, which is constructed as an extension is capable of serving properties between the existing system and the applicant's new service(s), the District will enter into a reimbursement or payback Contract with the applicant. The Contract usually will include a reimbursement for new services on both sides of a road or street as they connect to the extended main section, which was paid for by the applicant. The amount of reimbursement normally will be based on the front footage of the property connecting to the extension and the cost per foot to construct the extension.

Reimbursements will normally be paid for a period of **fifteen (15)** years from the time the extension is accepted by the District. In no case will the reimbursement exceed the applicant's actual construction costs of installing the extension main from the existing system to the nearest point of the applicant's lot.

The District will retain a portion of each reimbursement collected for administrative fees.

5.6 Extension Lengths

In order to facilitate further extension of a system in directions where future development may continue, applicants for extensions/improvements normally will be required to extend water and/or sewer mains along **all boundaries of their property, which, are adjacent to a street or**

road. Installation of water main will be in a location approved by the District. In some circumstances, therefore, the applicant will be required to install water main across the street or road from their property.

5.7 Over sizing and Replacement

In order to provide capacity for future customers or improve existing service on an economical basis, the District may require over sizing or replacement of existing facilities in conjunction with construction of an extension or improvement. Over sizing requirements will be determined by the District's approved comprehensive plans.

For extensions that include over sizing for future customers, a separate contract between the District and applicant will address possible credit against general facilities charges or District participation as applicable. District participation on over sizing costs will be determined on a case-by-case basis at the sole discretion of the District Board of Commissioners.

5.8 Liability Insurance

Applicants or their contractor shall provide proof to the District prior to construction and shall maintain during the life of the project, public liability insurance for bodily injury and property damage liability, including, without limitation, coverage for explosion, blasting, collapse, and destruction of underground utilities and blanket contractual liability. Coverage shall protect the applicant, the District, and the District's engineer. The applicant and contractor shall have the District specifically added as additional named insured in the policy(s) at no cost to the District and shall present a policy endorsement to the District as evidence.

The applicant, or contractor shall further agree to indemnify, defend, and to save the District harmless from any and all claims or liability for damages arising from acts or work due to operations. The contractor shall furnish the District, certificates of comprehensive, general, automobile liability and property damage insurance, before commencing work. The contractor shall carry minimum commercial general liability insurance limits of \$1,000,000 bodily injury, including death, and \$1,000,000 property damage protecting against all claims for personal injury or property damage arising during the course of the performance of the contract with a \$2,000,000 annual aggregate. In addition, automobile liability insurance of \$1,000,000 per accident shall be carried.

5.9 Easements and Bill of Sale

The applicant shall obtain all necessary easements and a Bill of Sale transferring ownership of all installed water and/or sewer mains and facilities to the District. The Bill of Sale shall describe lengths and sizes of water and/or sewer mains, and the location in general terms, including the name of the plat if applicable.

The applicant shall furnish the District an affidavit stating that there are no liens filed against the water main construction.

5.10 District Access

During construction, applicants and their contractors will provide access to District personnel (including personnel on contract to the District) as necessary, to ensure compliance with District requirements.

5.11 Final Acceptance

Upon completion of construction, applicants, and/or their contractors, shall notify the District and request a final inspection for approval of the project. If the water and/or sewer main has been installed according to the approved plans and specifications, pressure and bacteriological tests have been passed, and all extension policy conditions have been fully satisfied, the District will issue a Letter of Final Acceptance of the main extension. The date of the letter will begin the period of warranty. The acceptance of the contract work shall not prevent the District from making claims against the applicant for any defective work discovered during the period of the Performance Bond.

5.12 Maintenance Bond

A requirement for final acceptance is that the developer (or contractor) furnish a maintenance bond to the District that shall continue in force from the date of final acceptance for a period of two years. The bond shall be in a form acceptable to the District and shall require the developer (or contractor) and/or the bonding company to correct any defects in labor and materials that arise in said system for a period of two years from the date of acceptance of the system and transfer of title. ***The maintenance bond shall be in an amount equal to 10 percent of the cost of said extension but not less than Two Thousand Dollars (\$2,000).*** The District will release the performance bond upon receipt of an acceptable maintenance bond.

6 Design

All water and/or sewer line extensions shall be designed and installed in accordance with the District's Design Standards. In addition, plans and specifications for system extensions must be approved in accordance with the State of Washington requirements. Further, if fire flow is required, the plan must be approved by the County or City Fire Marshal. In all cases where a County or City road right of way will be used for mains or other improvements, the County or City Road Department must approve the plan.

Project Datum: The site survey shall use North American Vertical Datum 88 (NAVD 88). Design submittals including sewer plan, profile, and pump station elevations shall be based on NAVD 88.

7 General Construction Procedures

7.1 Standards

Construction procedures shall be in full accordance with the District's Standard Specifications for Water Main Construction and the most recent edition of Washington State Department of Ecology's *Criteria for Sewage Works Design*.

Certain other referenced standards used in this specification are from the latest editions of:

- DOE Washington State Department of Ecology
- UBC Uniform Building Code
- UPC Uniform Plumbing Code
- UMC Uniform Mechanical Code
- NEC National Electrical Code
- AWWA American Water Works Association
- ANSI American National Standards Institute
- ASA American Standards Association
- ASTM American Society for Testing and Materials

7.2 Contractor

All construction work shall be performed by a licensed and bonded contractor approved by the District.

8 Design Standards for Water Main Extensions

8.1 General

All extensions to the water system must conform to the design standards of the District and shall meet the requirements of the latest Kitsap County or City of Port Orchard Fire Protection Ordinances and Uniform Fire Codes. In addition, plans and specifications for system extensions must be approved in accordance with the requirements of the Department of Health.

The water system must provide adequate domestic and fire flow supply for the fire protection requirements. If fire flow is required, the plan must be approved by the County or City Fire Marshal.

In all cases where a County or City road right of way will be used for mains or other improvements, the County or City Road Department must approve the plan.

The system must be capable of future expansion and must be constructed of permanent materials.

9 Plans

9.1 General

The developer shall be required submit up to four (4) copies of plans and specifications for the project for District review. The plan review fee must accompany the initial set of plans. District standards will normally be adequate to serve as the technical specifications for the project. The District may require additional specifications if project conditions warrant. Plans and specifications for all projects must be prepared and stamped by a professional engineer registered in the state of Washington, with the exception of extensions for single-family residences. After the reviews, the developer shall be required to submit up to four (4) copies of final version of the plans that will be stamped as approved and used in construction. Additional sets may be required for State, County or City filing after stamped approval by the

District. Construction shall not commence until plans that are approved and stamped by the District, are on site. The plans shall be prepared in accordance with the following criteria:

9.2 Criteria for Plans

9.2.1 Title Blocks:

Each sheet within the set of drawings shall have a title block showing the sheet title, number, date, scale, and revision block.

9.2.2 Rights-of-way:

Right-of-way lines, the boundaries of lots fronting on the street, drainage easements, utility easements, section lines and corners, and temporary construction easements, existing and proposed, shall be shown on the plans. All rights-of-way and easement lines shall be properly dimensioned.

9.2.3 Topography:

All pertinent topographic features shall be shown such as street lines, curbs, sidewalks, shoulders, location and size of storm and sanitary sewer lines, water and gas lines, drainage ditches, utility poles, fire hydrants, high water and frequent inundation levels, and all other features of the area, which may affect the design requirements for the area.

9.2.4 Profiles:

Water line profiles shall be provided when the water lines are to be installed over un-graded terrain. In general, the District will not require profiles of water lines to be installed in streets or other graded terrain where specified depth of cover will be adequate to determine the location of the line in the ground. Elevations shall be shown on the plans, which are adequate to determine the pressure differential in the lines due to change in elevation and for placement of pressure reducing valves if required. Clearances between sewer lines and water mains shall be shown at all sewer line crossings.

9.2.5 Legal Description:

The plans shall include a complete legal description of the property to be served.

9.3 Plan Revisions:

The District shall be informed of all plan revisions, which affect the design of the water and/or sewer system. The District reserves the right to withdraw approval if in the opinion of the District the changes will cause the design of the extension to be below the District's standards.

9.4 Facility Placement:

All water and/or sewer mains and other facilities shall be installed in public rights-of-way or in recorded utility easements dedicated to the District. The developer or his engineer shall check with the District prior to beginning of design of the extension prior to beginning the design of the extension to determine if there is a preferred main location.

9.4.1 Public Rights of Way:

All location of District facilities within County or City right-of-way must be approved by the Kitsap County or City of Port Orchard Public Works Department. District lines located in County or City road right-of-way must comply with franchise requirements outlined in ordinances passed by the County or City Board of Commissioners authorizing such use of the road and right-of-way. Where no ordinance applies, water and/or sewer mains shall be installed so as to be compatible with the existing water/sewer system, the terrain, geology, and the location of other utilities.

Where the water mains are installed in a public right of way, it shall not be located under curbs or sidewalks. It shall be located at the approved location parallel to the centerline of the street or road, if possible. Deviations from standard locations must be documented and receive prior written approval by the District, and be accompanied by accurate record drawings.

9.4.2 Easements:

Normally utility easements will be a minimum of **15** feet in width and piping will be installed no closer than five feet from the easement's edge.

9.4.3 Private Roads:

If it is necessary to install a water and/or sewer main within a private road, the easement shall be the width of the traveled surface plus one foot on either side.

9.4.4 Water and Sewer Line Separation Distances:

Transmission and distribution water piping shall be separated at least ten feet horizontally from waste disposal piping, drain fields, and/or wastewater gravity or forced mains. The bottom of the water main shall be 18-inches above the top of the sewer component. All parallel and crossing installations of water and sewer lines shall be in accordance with provisions of WAC 248-96 (septic systems) and the "Recommended Standards for Water Works" - Ten State Standards. Where local conditions prevent such horizontal and/or vertical separation, closer spacing is permissible where design and construction meet the special requirements of the Department of Ecology criteria for Sewage Works Design.

When crossing a sanitary sewer or force main, it shall be specified that the water main be installed a minimum of two feet above the sewer line with joints a minimum of five feet from the sewer line on each side. Controlled density fill shall be placed over the sewer line.

9.5 Main Layout and Sizing:

The District shall be consulted as to the size of the water and/or sewer main. In general, the minimum size water main, which will be allowed to serve developments, is 8-inch inside diameter, unless otherwise approved by the District. Looped six-inch diameter mains will be allowed within a development if no fire hydrants are connected to the main.

Where dead end mains are allowed in cul-de-sacs, they may be 4-inch diameter from the last fire hydrant to the remaining residences.

In general, dead end water mains are not permitted. Wherever possible, all water line extensions shall form a looped system. Mains must be extended to the far side of a property to be served. For commercial and residential developments on corner lots, the mains must be extended to the far side of both sides of property fronting roads. Commercial developments, which are required to upgrade county roads, will be required to upgrade the water main in the road to the size indicated in the District's Water System Plan.

Sewer mains must be extended to the far side of a property to be served. For commercial and residential developments on corner lots, the mains must be extended to the far side of both sides of property fronting roads. Commercial developments, which are required to upgrade county roads, will be required to upgrade the sewer main in the road to the size indicated in the District's Comprehensive Sewer Plan.

It is the intent of these requirements to ensure that the water pipe sizing will supply the required domestic and fire protection flows while maintaining adequate system pressure under existing and future demand conditions. The District may, at its discretion, require the engineer to submit a hydraulic analysis using established analysis techniques to the desired level of service can be provided by the proposed design.

9.6 Fire Hydrants:

Water line extensions shall include fire hydrants in accordance with Kitsap County or the City of Port Orchard standards. Fire hydrants shall be placed at street intersections wherever possible, and located to minimize damage due to traffic. Hydrants located at intersections shall be installed at the curb return. All others shall be located on property lines between lots. The District may at its option require additional hydrants other than required by County or the City ordinance.

9.7 Water Pressure Requirements:

Water systems shall be designed to maintain a minimum residual pressure of 30 psi at meter outlets under maximum demand flow conditions, excluding fire demand. Unless specifically approved otherwise by the District, water systems shall be hydraulically designed to provide a maximum pressure no greater than 100 psi, with a desired range of 40-90 psi. For water systems requiring fire flow capability, the design shall be adequate to maintain, under fire flow conditions, positive pressure throughout the system and a 20-psi residual pressure in mains supplying fire hydrants in use as per WAC 246-290 requirements. The District may require the engineer to submit a hydraulic analysis showing the required flows and pressures can be met.

9.8 Pipe Cover:

The depth of trenching, installation of pipes, and backfill shall be such as to give a minimum cover of **36-inches** over the top of the pipe. This standard applies to transmission, distribution, and service piping. Backfill and compaction will be in accordance with applicable construction standards identified below. Materials capable of damaging the pipe or its coating shall be removed from the backfill material.

9.9 Isolation Valves:

Valves shall be installed at all crosses and tees. The number of valves at each intersection shall at a minimum equal the number of connecting pipes less one. Lengths of pipe between valves should not exceed **500** feet in school, commercial, or multi-family areas, and **800** feet in other residential service areas. Valves shall be located on tees and crosses at street intersections, or at other locations as determined by the District. If it is necessary to install valves between street intersections, they shall be located on property lines between lots and on fire hydrant tees wherever possible.

9.10 Air and Air-vacuum Relief Valves:

In order to minimize problems associated with air entrainment, air or combined air-vacuum relief valves shall be installed at points of high elevation throughout each system. To prevent freezing, the vault lid and vault cavity will be insulated as directed by the District. These valves shall be installed as per standard specifications and detail drawings.

9.11 Blow-off Valves:

A blow-off valve assembly shall be installed on all permanent dead-end runs and at designated points of low elevation within the distribution system. The blow-off valves shall be installed on public rights-of-way except where a written access and construction easement is provided to the District. In no case shall the location be such that there is a possibility of back siphoning into the distribution system.

9.12 Fire Protection Systems on Private Property:

A double detector check valve installation shall be required on all fire protection systems to private property. The detector check shall be approved for the type of use by University of California and Washington State Department of Health. An OS&Y valve shall be installed on the inlet side along with a 1-inch by-pass. The by-pass shall include a water meter and double check valve assembly.

The property owner is responsible for the fire line from the District main to the fire suppression system.

9.13 Record Plans for the District:

Any deviations from originally approved plans and specifications shall be approved by the District, recorded, and a recorded copy provided to the District. Upon completion of the project, the following will be provided to the District:

1. *one (1) set (copy) of contractor redline drawings of district infrastructure for review.*
2. *two (2) sets of reproducible Mylar;*
3. *a digital format of the record plans in **AutoCAD** that can be referenced into a GIS format is required.*

Record drawings must show all new water facilities and related appurtenances, which, at a minimum, shall include the locations of all mains, fire mains, valves, hydrants, back flow assemblies, and fittings giving sizes and types of each. Record drawings for new sewer improvements shall include all mains, manholes, clean-outs and similar appurtenances, noting actual installed Inverts and Elevations. The drawings shall show the exact location of

water/sewer mains including distances of mains from property lines. The applicant shall make every reasonable effort to assist the District in acquiring all necessary information for record drawings.

10 Mechanical (Water)

10.1 General:

This division covers that work necessary for furnishing and installing mechanical appurtenances and accessories as described in these specifications and as shown on the plans.

All pipe, valves, meters, hydrants, fittings, and special material shall be new, undamaged, and designated for use in potable water systems. All material suppliers shall be bonded sufficiently for the value of material supplied. Material used on water projects shall comply with AWWA Standards, and each project's detailed plans and specifications.

The Contractor shall furnish all materials necessary for the installation of the water system facilities including but not limited to meter boxes and service connection materials.

10.2 Submittals:

Submittal information shall be provided to the District for the following items:

1. *Ductile Iron Pipe*
2. *Ductile Iron Fittings*
3. *Stainless Steel Pipe and Fittings*
4. *Poly Pipe and Fittings*
5. *PVC Pipe and Fittings*
6. *Isolation Valves*
7. *Control Valves*
8. *Fire Hydrants*
9. *Double Check Valves*
10. *Other Mechanical Components*

10.3 Pipe and Fittings:

Provide piping, plumbing, fittings and appurtenances necessary to make all piping systems complete, tested, and ready for operation as specified herein and as shown on the plans. Some fittings that are necessary for proper piping system installation and operation may not have been shown. Provide fittings, pipe and appurtenances necessary, whether shown or not shown on the plans, to complete all piping systems, tested and ready for operation.

All pipe sizes, as shown on the drawings, and as specified herein, are in reference to "nominal" diameter, unless otherwise indicated. All pipes shall meet the District's standard specifications. One type of pipe shall be used throughout entire projects, except as necessary to match existing piping, or as otherwise specified in writing by the District. Where relocation of, or replacement of, existing piping is necessary during construction, materials used shall be subject to the written approval of the District.

10.3.1 Ductile Iron Pipe:

Ductile iron pipe shall be thickness Class 52 and shall conform to standards of ANSI Standard A21.51 (AWWA C-151). All pipes shall have mechanical joints or push on joints in accordance with ANSI Standard A21.11 (AWWA C-111). Gaskets shall be chloroprene. Flanged joint shall conform to ANSI Standard B16.1. Standard thickness cement -mortar lining shall be in accordance with ANSI Standard A21.4 (AWWA C-104).

Restrained joint pipe, where specifically shown on the plans, shall be ductile iron manufactured in accordance with requirements of ANSI A21.51 (AWWA C-151). Push on joints shall be in accordance with ANSI 21.11 (AWWA C-111). Pipe shall be restrained with MJ FIELD LOK® Gaskets the last 100 ft. leading up to any dead end main. Pipe thickness shall be designed in accordance with ANSI A21.50 (AWWA C-150). Standard thickness cement -mortar lining shall be in accordance with ANSI A21.4 (AWWA C-104).

Where Mega-Lug joints are called out on the plans, they shall be Mega-Lug Series 1100, as manufactured by EBAA Iron, or approved equal. **Mega-Lugs shall be used on all mechanical joints.**

When requested, furnish certification from manufacturer of pipe and gasket being supplied that inspection and all of the specified tests have been made and the results comply with requirements of this standard.

10.3.2 Ductile Iron Fittings:

All fittings shall be ductile iron where possible. Steel fittings will not be accepted. Ductile iron fittings shall be short body; cement lined, and have a minimum working pressure of 250 psi. Metal thickness and manufacturing processes shall conform to applicable portions of ANSI Standards A21.20, A21.11, B16.2, and B16.4. Standard cement lining shall be in accordance with ANSI Standard A21.4 (AWWA C-104). Mechanical joint (MJ), ductile iron, compact fittings 3-inches through 24-inches shall be in accordance with AWWA C-153.

Ductile iron flange (FL) fittings shall be in accordance with AWWA C-110, with bolt pattern to match adjacent pipe and 250 psi pressure rating. Gasket material for flanges shall be neoprene, Buna-N, chlorinated butyl, or cloth inserted rubber. Gaskets shall be full-face ring type.

Type of ends shall be specified as mechanical joint (MJ), restrained joint (RJ), plain end (PE), or flanged (FL). Mega-Lugs shall be used on all mechanical joints.

10.3.3 Polyvinyl Chloride (PVC) Pipe

PVC pipe in excess of 2-inches will not be used for new installations. Larger size PVC piping may be used to replace small sections of existing PVC piping in emergencies only. PVC pipe shall conform to the requirements of AWWA C-900 specifications. PVC pipe for distribution pipelines shall be pressure class 200. The pipe shall bear the seal of the National Sanitation Foundation for potable water pipe. All pipe shall be listed by the Underwriters Laboratories, Inc.

PVC pipe shall be made from Class 12454-A or Class 12454-B virgin compounds, as defined in ASTM D1784. Joints shall conform to ASTM D3139 using a restrained rubber gasket conforming to ASTM 3477. Solvent welded pipe joints will not be permitted.

PVC pipe shall be Johns Manville, or approved equivalent.

10.3.4 Galvanized Iron Pipe (GI)

Galvanized iron pipe shall conform to the latest revision of ASTM A-120 or A53; Grade A, Schedule 40, seamless pipe that has been manufactured in the United States. Pipe shall be hot-dip galvanized. Pipe fittings shall be galvanized and threaded.

10.3.5 Flexible Couplings

Flexible couplings shall be as manufactured by Smith Blair or Romac, or equal; MJ sleeve couplings shall be as manufactured by Griffen or U.S. Pipe or equal.

10.3.6 Bolts in Piping

Bolts shall be Cortin A307 grade A, or Plated A307 grade A zinc or chrome plated cast iron. Stainless steel bolts are not allowed.

10.4 Valves and Appurtenances

Valves noted on the plans or in other parts of the specifications shall meet the requirements herein. Valves shall be designed for the intended service. Install valves in strict accordance with manufacturer's instructions and as shown on the plans. Buried valves shall have all operators or valve boxes installed so that wrenches or operators perform freely and without binding or other interference. Bed and backfill buried valves according to the requirements of the pipe to which they are attached. Provide concrete supports for operators where required, as shown on the plans.

10.4.1 Resilient Seat Gate Valves

All gate valves for water lines 2" and larger shall be of the resilient, wedge-type, non-rising stem and shall meet or exceed the performance requirements of AWWA C-509 and be suitable for installation with the type and class of pipe being installed. The wedge shall be fully encapsulated with vulcanized SBR rubber. Valves to be equipped with mechanical joints or flange ends of Class 125 in accordance with ANSI B16.1 unless otherwise specified. Valve opening direction shall be counter-clockwise. Provide fusion epoxy coating and 2-inch operating nut. Gate valves shall be Dresser, Kennedy, or approved equivalent.

10.4.2 Butterfly Valves

Butterfly valves shall be approved for use only where special applications are required. Butterfly valves shall meet or exceed all AWWA C-504 specifications and shall be Class 150-B valves with short body, which are suitable for direct, bury. When they are installed, they shall have a position indicator, which clearly shows the position of the disc. All butterfly valves shall be installed with the operator nut located toward the centerline of the street. All valves shall be equipped with an underground manual operator with AWWA 2-inch square nut, shall open with a counterclockwise rotation, and have mechanical joint or flanged ends of

Class 125 in accordance with ANSI B16.1 unless otherwise specified. All butterfly valves shall be Dresser, Pratt, or approved equivalent.

10.4.3 Check Valves

Check valves, three inches or larger, shall be iron body, iron disc, bronze-mounted, swing type, clearway, quiet closing, lever and spring valves with flanged ends. All valves shall comply with AWWA C-508 specifications.

Check valves, smaller than three inches, shall be bronze body, bronze-mounted, swing type with flanged or threaded ends depending upon installation.

Check valves shall be Dresser, Mueller, or approved equivalent.

10.4.4 Pressure Reducing Valves

Pressure reducing valves shall be diaphragm actuated, single seat, hydraulically operated valves with a single operating chamber sealed by a synthetic rubber diaphragm. Control of the valve shall be from a single direct acting hydraulic pilot valve that is controlled by hydraulic pressure acting on a spring-backed diaphragm. The main valve shall have a single removable seat and a resilient disc. The stem shall be guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. No external packing glands are permitted, and there shall be no pistons operating the main valve or any pilot controls. The pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve, designed to permit flow when controlled pressure is less than the spring setting. The control system shall include a fixed orifice. The diaphragm shall be set to open at any pressure below its preset set point and to close at any pressure above an adjustable dead band, to maintain downstream pressure within 2.5 psi of the pressure set point. Downstream pressure control shall not be based on changing upstream pressures. The valve shall be rated for 250-psi working pressure.

A bypass line of suitable size with isolation valves and pressure reducer will be installed in parallel to the main Pressure Reducing Valve (PRV) to manage low flows and assure continuity of service in event of main PRV failure.

The valve shall be equal to Cla-Val model 90-01 or approved equal.

10.4.5 Tapping Sleeve and Valve

Provide restrained mechanical joint with flanged outlet tapping sleeve with a minimum 150-psi rating. Grade 18-8 type 304 stainless steel and SBR rubber gasket, Romac Style SST, Ford Style FAST, or equal.

The valve shall be 200 psi pressure rated, resilient seated, non-rising stem, AWWA C-509, with flanged by mechanical joint connection. The valve shall have a cast or ductile iron body with AWWA C-550 epoxy coating. The valves shall be M&H style 3751-NRS, or approved equal.

10.5 Fire Hydrant Assembly

Fire hydrants shall conform to AWWA Standard C-502 for post-type, dry-barrel, self-draining hydrants suitable for at least a 54-inch depth. Each hydrant shall have a six-inch inlet, a minimum valve opening of 5 1/4 inches, two 2-1/2 inch hose connections, and a 4-1/2 inch pumper port with a 5-inch **Storz** pumper connection. All ports shall have National Standard Threads or other connection devices consistent with local fire protection authority requirements. All valves and caps shall open counterclockwise, have a 1-1/2 inch flat point pentagon operation, and cap nuts. Hydrants shall be breakaway traffic models.

The configuration of the fire hydrant assembly shall be as shown on the Standard Detail Drawing. The assembly shall have a cast iron tee (with mechanical joint connections to the main) a flanged tee, a six-inch flanged by mechanical joint gate valve with valve box, and a six-inch ductile iron pipe extension. All mechanical joints shall be secured with mega-lugs. Push on pipe joints shall be secured with field lock gaskets. Shackle rods to connect the hydrant to the auxiliary valve at the main are not permitted.

Provide a minimum of seven cubic feet washed gravel surrounding 90-degree bend below hydrant. Gravel shall be 1-1/2 inch minus and be retained on 1/4 inch mesh for drain. Gravel shall be covered with 6 oz. Geotextile Fabric to prevent dirt contamination.

Hydrants added to existing systems will be installed by wet tap.

The hydrant shall have at least an 18-inch clearance between the ground and the lower port, and a 36-inch unobstructed radius around it for operation of a hydrant wrench. The steamer/pumper port shall face the street or the most likely direction of emergency approach.

Hydrants shall be coated with two coats of yellow Rust-Oleum paint or equal in accordance with coating manufacturer's recommendations.

Fire hydrants shall be Mueller, M&H, East Jordan "WaterMaster", or District approved equivalent.

10.6 Blow off Valve Assembly

Two-inch blow off assemblies shall be provided in accordance with the Standard Details at locations shown on the plans or prescribed by the District.

10.7 Miscellaneous Mechanical

10.7.1 Air and Air/Vacuum Release Valves

Provide air and air/vacuum release valve's body and cover fabricated from cast iron. Provide internal parts, including float, seat, needle, linkage, level pins, retaining rings, and screws, fabricated from either stainless steel or bronze. Air release valve shall have 2-inch inlet, 3/32 inch orifice, and shall be designed for operating service to 150 pounds per square inch (psi). Air and air-vacuum relief valve assembly materials shall conform to the Standard Detail.

Air release valve shall be equal to APCO Model No. 55. Air and air-vacuum relief valves shall be APCO Model #142 or #143C for one-inch, or #144 or #145C for two-inch, or approved equivalent.

10.7.2 Gate Valves

Gate valves 2-inches and smaller for steel pipe shall be Crane No. 1320 or equal, with 250 psi pressure rating having non-rising stem, screwed bonnet, solid wedge disc, bronze construction and threaded ends.

Gate valves smaller than two-inches shall be 125 psi

Install valves and fittings in accordance with manufacturer's recommendations and the plans. Verify alignment and adjustments after installation.

10.7.3 Valve Boxes

All valve boxes shall be two-piece cast iron, and equipped with a suitable extension for a 36-inch to 65-inch trench depth. Top sections and lids will be designed for installation in vehicular areas. Lids will be labeled "WATER", and lid tabs will point in the direction of the water main. The valve boxes shall have a design loading meeting AASHTO H-20. All valves and valve boxes will be set plumb with the valve box centered on the valve. Valve box installation shall comply with Standard Detail Drawings.

Cast iron valve boxes shall be Olympic Foundry, Rich Box No. 920 or approved equivalent and must be compatible with the District's system.

10.7.4 Valve Marker Posts

A fiberglass valve marker post shall be furnished and installed with each single or closely grouped combination of valves. Marker posts shall be located as directed by the District. Size of valve and distance (to the nearest foot) shall be stenciled on the face of the post with a 1 ½ inch black painted figure.

Valve marker posts shall be blue in color, 4-inches wide (flat), 72-inches high and beveled top. Carsonite Curve-Flex marker or approved equal.

10.7.5 Hydrant Guard Posts

At locations specified by the District, only on private property, reinforced concrete posts six feet long and a minimum of nine-inches in diameter can be installed at a point that would allow a swing radius of 3', and would in no way block emergency personnel from accessing the ports of the hydrant.

Guard posts are not allowed on city or county right of ways.

If installed on private property for hydrant protection, Hydrant Guard Posts shall be Fog Tite Meter Seal or approved equivalent. Posts shall be coated with two coats of exterior paint, of a High Visibility yellow color as designated by the District.

10.7.6 Warning Tape

Locator tape **WILL NOT** be used as an alternative to wire but will be used in addition to the wire. Continuous metallic tape, brightly colored, 3-inch minimum width, imprinted in 1-inch letters with "Caution Buried Water Line" repeated at not less than 4-foot intervals. Install warning tape above water line approximately 18-inches below the finished grade.

10.7.7 Locating Wire

All pipe shall be laid with one piece of 12 gauge or thicker blue insulated copper wire. The locating wire shall be situated immediately adjacent to the pipe and connected to all valves. Locating wire shall also connect to all service lines and meters. 3M direct bury splice kits shall be used for all splicing. A wire conduction test will be performed by the District prior to approval.

10.8 Backflow Prevention

Backflow prevention devices including Double Check Valves and Reduced Pressure Backflow Assemblies shall be installed according to detailed installation plans prepared by the engineer or the contractor and approved by the District. Installation shall comply with standards of Accepted Procedure and Practice in Cross Connection Control, AWWA, and Pacific Northwest Section. All backflow assemblies shall be approved on the latest approved list of the Washington State Department of Health.

10.9 Service Connections

Water service installations shall comply with the District's Standard Detail. The location and type of corporation stop, meter setters, and locating wire on all individual services must be as indicated on the Standard Detail drawings. In addition, if pressure-reducing valves are required for individual service connections, they will be installed after the meter. Meter sets and yokes will be specified by the District. Where service lines will be installed under curbs, sidewalks or through infiltration pits, may require to be sleeved.

West Sound Utility District specs only single services, separate corps for every hookup.

10.9.1 Service Saddle

Ductile iron body, stainless steel straps, nuts, and bolts, Buna N or SBR O-ring gasket, with iron pipe tap. Saddles 1 ½ inches and larger shall be double strap. Romac 101S, or equal.

10.9.2 Corporation Stops

Corporation stops for one-inch to two-inch service saddles shall be bronze body, male, iron pipe threaded inlet, pack joint (compression) outlet, Ford F1101-3, or approved equivalent conforming to AWWA C-800. **Direct taps for services are not allowed.**

10.9.3 Polyethylene Pipe (Blue Poly)

Polyethylene pipe for service connections shall conform to AWWA C-901, PE 3406, SDR 7 Blue, iron pipe size, 1-inch diameter. Pipe shall have a cell classification meeting ASTM D3350 and a pressure rating of 160 psi.

Joints shall be compression with stainless steel insert stiffener.

10.9.4 Meter Setter

Meter sets shall be installed using a meter setter equipped with a locking angle meter valve and an angle check valve. Meter yoke inlets and outlets shall have multipurpose nuts included during installation.

Meter setters shall be Mueller or Ford with valve 12" rise, or approved equal. If meters need to be raised, Mueller or Ford Meter, re-setter or approved equivalent shall be used.

10.9.5 Meter Boxes

Mid State Plastics Model MSBCF 1118 with DI lid, TRPL hole, 1 ¾" Hole in Lid offset to one side for installation of Touch Read Pad.

10.9.6 Individual Pressure Reducing Valves

Where static water pressure exceeds 80 psi, pressure-reducing valves shall normally be installed after the meter as directed by the District. Individual service pressure reducing valves shall be of bronze body construction with a renewable stainless steel seat, stainless steel integral strainer, and temperature resistant diaphragm. Pressure reducing valves 2-inches and smaller for individual water service lines shall be Wilkins 600 Series or equal.

10.10 Pipe and Fittings Installation

10.10.1 General

Use materials and installation methods in accordance with Uniform Plumbing Code, latest edition, and local codes and regulations, which are applicable. Install ductile iron water mains in accordance with AWWA C600-93 and manufacturer's recommendations. Use types and sizes of pipes as specified herein and/or as shown on the Plans. Where sizes of small pipe are omitted from the Plans and not mentioned in the specifications, use sizes corresponding to code requirements, and as required by equipment and plumbing fixtures and appurtenances. In any event, properly size any un-designated pipe sizes for functions to be performed.

10.10.2 Materials Delivery

Pipe and appurtenances shall be handled in such a manner as to ensure delivery to the trench in a sound, undamaged condition. Particular care shall be taken not to injure the pipe, pipe coating, or lining. Before installation, the pipe and appurtenances shall be cleaned of foreign material and inspected for defects. Valves shall be cleaned of all foreign material and operated before installation to ensure proper functioning.

Pipe shall not be strung out along a trench or shoulder of a road in a manner, which causes a safety hazard to the public.

Rubber gaskets shall be stored in a cool, dark place to prevent damage from the direct rays of the sun.

10.10.3 Alignment

Pipe shall be laid to specified grade and alignment as staked in the field. Alignment deviation shall not exceed 0.5 feet. Replacement of stakes lost or destroyed shall be made at the Developer's expense and in accordance with contract Plans, including modifications specified by the District. All construction staking shall be provided by the Contractor.

10.10.4 Grade

Prior to installation of the water line, all roadways shall be graded to the finished rough grade. The water line shall be installed three (3) feet below finished grade. Any modification of the main or appurtenances required to adjust to grade changes will be at the expense of the Contractor.

10.10.5 Installation

Carefully lay pipe and support at proper lines and grades. Follow piping runs shown on the plans as closely as possible, except for minor adjustment to avoid architectural and structural features. Make minor relocations, if required, in a manner acceptable to the District.

Pipe passing through or under concrete or rock walls or slabs shall be placed in casing.

Keep openings in pipes closed during progress of work.

10.10.6 Polyethylene Encasement

Where shown on the plans, the Contractor shall lay ductile iron pipe with a polyethylene encasement. Pipe and polyethylene encasement shall be installed in accordance with AWWA C105.

10.10.7 Thrust Blocking

All valves, tees, and bends shall be thrust blocked. Only concrete thrust blocking is acceptable for installation of water system facilities. Concrete blocking shall be commercial concrete mix, poured in place against undisturbed soil. All concrete blocking shall have a minimum compressive strength of 3,000 psi. Thrust blocking shall comply with the provisions of Standard Detail Drawings. All fittings, which may come in contact with poured thrust blocks, shall be wrapped in plastic. Form thrust blocking so that bolts, joints, gaskets, and flanges of adjacent joints are clear of concrete and so that bolts and joints can be dismantled without removing concrete.

The District requires thrust blocks on fire hydrants. Each fire hydrant shall be secured with mega lugs in addition to the thrust blocks, making sure that the specifications out lined in the standards and details for fire hydrant installation are followed.

10.10.8 Sanitation Requirements

Extreme care should be used in checking and cleaning all pipe and fittings of dirt, debris and foreign matter during installation. All material shall be kept clean. Plugs shall be used to seal installed water mains when they are to be left for any period of time, including lunch breaks, coffee break, overnight, etc. Material contaminated by petroleum products or questionable chemicals will be rejected. No trench water shall be allowed to enter installed water mains.

During construction, new water mains must be separated from the existing system (e.g. with a gate valve). All new water mains require satisfactory flushing, disinfection, and bacteriological sampling. The final testing shall be performed in the presence of a District inspector.

Only District personnel are permitted to operate valves on the potable water side of a system and at wet taps. The District will fine the contractor for system tampering if unauthorized personnel operate water system valves.

10.11 Water Main Inspection and Testing

Furnish all required personnel and equipment and make all tests required to demonstrate the integrity of finished installation to approval of the District and all agencies having jurisdiction. The Order of operation shall be as follows: 1.) Disinfection shall begin with the installation by putting dry chlorine in the pipe as it is installed; the line shall be filled with District supplied water. Once the pipe is full it will be allowed to “cook” (disinfect) for a minimum of 48 hrs.; 2.) During this time the hydrostatic pressure test should occur, after satisfactory completion of the pressure test and once the line has finished cooking; 3.) The new water system shall be flushed to allow for four (4) complete exchanges within the system. The line should then be at a normal Chlorine level for that area as taken and verified at the nearest district appurtenance; and 4.) Once flushing has been completed, the line shall stand separated for 24 hrs. to allow bacteriological growth, after which samples will be taken by district personnel and delivered to the lab for testing.

10.11.1 Water Main Cleaning

Prior to testing, the inside of each completed pipeline shall be thoroughly cleaned of all dirt, loose scale, sand and other foreign material. Cleaning shall be accomplished by flushing with a minimum velocity of 2.5 feet per second.

The Contractor shall install temporary strainers, temporarily disconnect equipment and take other appropriate measures to protect equipment while cleaning. Cleaning shall be completed after any repairs. Flushing shall allow four complete exchanges of water at flushing velocity.

10.11.2 Water Main Disinfection and Flushing

After preliminary purging of the system, chlorinate entire potable water system in accordance with AWWA C-651-05 and any subsequent modifications thereof for flushing and disinfecting water mains, Standard Specifications Section 7 11.3(12) 4.2-5.2, and in accordance with all other pertinent rules and regulations. Upon completion of sterilizing, thoroughly flush entire potable water system at a minimum velocity of 2.5 feet per second, allowing four complete exchanges of contents. Discharge of disinfection water into a storm drain, drainage ditch or natural channel is prohibited without thoroughly neutralizing the chlorine residual remaining in the water.

After final flushing and before the water pipe is connected to or the system, after 24 hrs. the Contractor shall request that the District arrange to have a sample or samples collected for bacteriological testing. At least one sample will be collected from each branch of the pipe. A

District inspector must be present when samples for bacteriological testing are taken. The District will supply bottles and submit them for testing to a Washington State certified laboratory. Copies of test results shall be retained by the District. A copy of the test results will be delivered to the Contractor for review. The Water pipe will not be connected to the District's mains prior to satisfactory bacteriological testing results. After satisfactory samples have been obtained, if the pressure drops below static in the main, disinfecting and testing procedures will again be required.

If test results are not satisfactory, lines shall again be disinfected, flushed, and tested until two consecutive, satisfactory series of samples are obtained. If the new water pipes are exposed to contaminants or pressure drop after acceptance of a successful bacteriological test the Contractor shall be required to repeat the disinfection process at the District's discretion and the Contractor's expense.

10.11.3 Hydrostatic Pressure Testing

All water mains and appurtenances shall be tested under a hydrostatic pressure equal to **200 psi for 15 minutes with an acceptable fluctuation of ± 5 psi**. Water service lines will be visually inspected for leakage. All pumps, gauges, plugs, saddles, corporation stops, backflow prevention devices, miscellaneous hose and piping, and other equipment shown on the construction plans and that are necessary for performing the test shall be furnished and operated by the Contractor. The pipeline trench shall be backfilled sufficiently to prevent movement of the pipe under pressure. All thrust blocks shall be in place and sufficiently cured to reach design strength before testing. Where permanent blocking is not required, the Contractor shall furnish and install temporary blocking and remove it after testing.

The mains shall be filled with water and allowed to stand under pressure for a minimum of 24 hours to allow the escape of air and/or allow the lining of the pipe to absorb water. The District will furnish the water necessary to fill the pipelines for testing purposes at a time of day when excess quantities of water are available for normal system operation.

Gauges used in the test may be required to be certified for accuracy at a laboratory chosen by the District.

Any visible leakage detected shall be corrected by the Contractor to the satisfaction of the District regardless of the allowable leakage specified. Should the test section fail to meet the pressure test successfully as specified, the Contractor shall, at his own expense, locate and repair the defects and then retest the pipeline.

After the test has been completed, each valve shall be tested by closing each in turn and relieving the pressure beyond. This test of the valves will be acceptable if there is no immediate loss of pressure on the gauge when the pressure comes against the valve being checked. The contractor shall verify that the pressure differential across the valve does not exceed the rated working pressure of the valve. All tests shall be made with the hydrant auxiliary valve open and pressure against the hydrant valve.

Prior to calling out the District to witness the pressure test, the Contractor shall have all equipment set up completely ready for operation and shall have successfully performed the test to assure that the pipe is in a satisfactory condition.

Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants.

The test shall be accomplished by pumping the main up to the required pressure, stopping the pump for fifteen minutes and then pumping the main up to the test pressure again. During the test, the section being tested shall be observed to detect any visible leakage. A clean container shall be used for holding water for pumping pressure on the main being tested. This makeup water shall be sterilized by the addition of chlorine to a concentration of 50 mg/l.

Acceptability of the test will be determined in accordance with Section 7-11.3(11) (WSDOT Standard Specs). There shall not be an appreciable or abrupt drop in pressure during the 15-minute test period. Upon completion of the test, District personnel shall witness the pressure gauge drop to zero ensuring accuracy of the gauge.

10.11.4 Construction Acceptance

Construction Acceptance by the District will not occur until all new mains have been satisfactorily inspected and tested and all punch list items have been corrected.

11 Cross Connection Control Regulations

The District cross connection regulations are set forth in Resolution 703-18. No cross connections shall be created, installed, used or maintained within the service boundaries served by West Sound Utility except in accordance with Resolution 703-18.

W.A.C. 246-290-490 and the latest edition of the Cross Connection Control Manual as published by the Pacific Northwest Section-AWWA shall be used to determine installation requirements.

A Reduced Pressure Backflow Assembly shall be installed to standards directly behind the water meter on ALL commercial buildings and privately owned water mains.

GENERAL DESIGN STANDARDS FOR SEWER EXTENSIONS

12 General Design Standards for Sewer Extensions

All extensions to the sewer collection system must conform to the design standards of the District. In addition, plans and specifications for system extensions must be in accordance with the requirements of the Department of Ecology.

In all cases where a County or City road right of way will be used for mains or other improvements, the County or City Road Department must approve the plan.

The system must be capable of future expansion and must be constructed of permanent materials.

13 Plans

13.1 General

The developer shall submit up to four (4) copies of plans and specifications for the project for District review. The plan review fee must accompany the initial set of plans. District standards will normally be adequate to serve as the technical specifications for the project. The District may require additional specifications if project conditions warrant. ***Plans and specifications for all projects must be prepared and stamped by a professional engineer registered in the state of Washington***, with the exception of extensions for single-family residences. After the reviews, the developer shall submit up to four (4) copies of final version of the plans that will be stamped as approved and used in construction. Additional sets may be required for State, County or City filing after stamped approval by the District.

The plans shall be prepared in accordance with the following criteria:

13.2 Criteria for Plans

13.2.1 Title Blocks

Each sheet within the set of drawings shall have a title block showing the sheet title, number, date, scale, and revision block.

13.2.2 Rights-of-way

Right-of-way lines, the boundaries of lots fronting on the street, drainage easements, utility easements, section lines and corners, and temporary construction easements, existing and proposed, shall be shown on the plans. All rights-of-way and easement lines shall be properly dimensioned.

13.2.3 Topography

All pertinent topographic features shall be shown such as street lines, curbs, sidewalks, shoulders, location and size of storm and sanitary sewer lines, water and gas lines, drainage ditches, utility poles, fire hydrants, high water and frequent inundation Water line profiles shall be provided when the water lines are to be installed over ungraded terrain. In general, the

District will not require profiles of water lines to be installed in streets or other graded terrain where specified depth of cover will be adequate to determine the location of the line in the ground. Elevations shall be shown on the plans, which are adequate to determine the pressure differential in the lines due to change in elevation and for placement of pressure reducing valves if required. Clearances between sewer lines and water mains shall be shown at all sewer line crossings.

13.2.4 Profiles

Sewer line profiles shall be shown and detailed indicating both length and slope of pipe. Water line profiles shall be provided when the water lines are to be installed over un-graded terrain, or in any areas, that potential conflict would arise with existing infrastructure. In general, the District will not require profiles of water lines to be installed in streets or other graded terrain where specified depth of cover will be adequate to determine the location of the line in the ground. Elevations shall be shown on the plans, which are adequate to determine the pressure differential in the lines due to change in elevation and for placement of pressure reducing valves if required. Clearances between sewer lines and water mains shall be shown at all sewer line crossings.

13.2.5 Legal Description

The plans shall include a complete legal description of the property to be served.

13.3 Plan Revisions

The District shall be informed of all plan revisions, which affect the design of the water and/or sewer system. The District reserves the right to withdraw approval if in the opinion of the District the changes will cause the design of the extension to be below the District's standards.

13.4 Facility Placement

All sewer mains and other facilities shall be installed in public rights-of-way or in recorded utility easements dedicated to the District. The developer or his engineer shall check with the District prior to beginning of design of the extension to determine if there is a preferred main location.

13.4.1 Public Rights of Way

All location of District facilities within County or City right-of-way must be approved by the Kitsap County or City of Port Orchard Public Works Department. District lines located in County or City road right-of-way must comply with franchise requirements outlined in ordinances passed by the County or City Board of Commissioners authorizing such use of the road and right-of-way. Where no ordinance applies, sewer mains shall be installed so as to be compatible with the existing water/sewer system, the terrain, geology, and the location of other utilities.

Where the sewer line is installed in a public right of way, it shall not be located under curbs, sidewalks or through infiltration pits. Deviations from standard locations must be documented, receive prior written approval by the District, and be accompanied by accurate record drawings.

13.4.2 Easements

Normally utility easements will be a minimum of **15** feet in width and piping will be installed no closer than five feet from the easement's edge.

13.4.3 Private Roads

If it is necessary to install a sewer main within a private road, the easement shall be the width of the traveled surface plus one foot on either side.

13.4.4 Water and Sewer Line Separation Distances

Transmission and distribution water piping shall be separated at least ten feet horizontally from waste disposal piping, drain fields, and/or wastewater gravity or forced mains. The bottom of the water main shall be 18-inches above the top of the sewer component. All parallel and crossing installations of water and sewer lines shall be in accordance with provisions of WAC 248-96 (septic systems) and the "Recommended Standards for Water Works" - Ten State Standards. Where local conditions prevent such horizontal and/or vertical separation, closer spacing is permissible where design and construction meet the special requirements of the Department of Ecology criteria for Sewage Works Design.

When crossing a sanitary sewer or force main, it shall be specified that the water main be installed a minimum of two feet above the sewer line with joints a minimum of five feet from the sewer line on each side. Controlled density fill shall be placed over the sewer line.

13.5 Submittals

Submittal information shall be provided to the District for the following items:

1. Provide manufacturer's certification and test results, as applicable, for all materials in this specification.
2. Submit a certificate of calibration for the laser used for grade control prior to the start of construction. The certificate shall be issued by the manufacturer, vendor, or service and repair shop. The issuer must be authorized by the manufacturer as qualified to calibrate the laser light device. The certificate shall be issued no more than 60 days prior to start of construction.
3. Color video tape of new sewer.
4. Manhole Coating products and applicator certification.

13.6 Manholes and Cleanout Materials

13.6.1 Minimum Design Criteria

Design loadings for manholes shall be designed for a soil unit weight of 150 lbs. /CF and a live load complying with AASHTO HS 20.

The minimum allowable manhole diameter is 48-inches. Provide larger diameter manholes where required by the District.

The minimum diameter of force main terminal manholes shall be 54-inches or larger if required by the District Engineer.

The minimum allowable manhole depth is **7 feet from the cover to the top of the manhole channeling** unless specifically approved by the District Engineer.

Flow entering a manhole shall not turn more than 90° before exiting the manhole.

13.6.2 Manholes

Provide manholes conforming to ASTM C478. Portland cement shall be ASTM C150 Type II or Type IV. Precast bases may be separate or integral with the riser section.

The District will require pre-channel manhole bases, unless specifically excluded by the District Engineer.

If a manhole liner is specified it shall be a GU Manhole Base Liner as manufactured by Sealcon Liner Systems Ltd, Aldergrove, B.C. (604) 607-7755 with plastic invert and nonskid landing area embedded in concrete and O-ring gaskets for the sewer connection. The liner shall have a 5 mm minimum thickness. The depth of the main through channel shall be equal to or larger than the diameter of the largest pipe. This is typically used in high ground water conditions.

Provide riser heights of not less than one foot. Provide riser sections, which have a preformed opening of a minimum sized to accommodate the pipe to be inserted. Heights of base sections shall be such that openings for pipes are not located at joints.

13.6.3 Grade Adjustment

Provide concrete grade rings meeting the requirements of ASTM C478. HDPE grade adjustment rings shall be used to adjust minor variations in grade or slope that concrete grade rings cannot accomplish. HDPE grade adjustment rings should be equal to Ladtech. Grade adjustment rings shall be limited to a maximum height of 12-inches. In no case shall the "neck-length" (grade rings plus the manhole frame) exceed 18-inches. Interior and exterior of all grade rings shall be sealed with quick setting, polymer modified grout "PATCH ALL" or equal.

13.6.4 Joints

Provide sewage and grease resistant confined rubber gaskets conforming to ASTM C 443. In addition, all joints shall be grout/sealed on all interior and exterior surfaces with quick setting polymer modified material, "PATCH ALL" or equal.

13.6.5 Manhole Steps

Provide manholes with steps that meet the following specifications.

1. Installed by the manufacturer conforming to ASTM D4101 polypropylene encased steel manhole steps with non-slip surface. Steel reinforcing shall be ½-inch minimum diameter ASTM A615, Grade 60.
2. Knurled ¾-inch diameter 316 stainless steel steps. There shall be a 2-inch hook on the embedment end.

13.6.6 Frames and Covers

Manhole frames and covers shall be ductile iron and shall have the word "SEWER" in 3-inch raised letters. Provide 24-inch *hinged* cover with automatic blocking system. Provide EAST JORDAN IRON WORKS hinged manhole covers.

In non-pedestrian areas, cleanouts shall be brought to finished grade and provided with PVC weld-on fittings that form a female threaded opening and a male threaded plug to be used to seal the cleanout. A fiberglass cleanout box shall be brought to finish grade as shown on the Standard Details.

In sidewalk or vehicle areas, the cleanouts shall be constructed in the same manner as described above but also will be finished at road or walkway grade and furnished with a traffic rated frame and cover conforming to Olympic Foundry M1007-DT.

In off-road conditions, the manhole/cleanout frame and cover shall have a concrete collar.

13.6.7 System A Epoxy Coating

When specified, use hydrogen sulfide/sulfuric acid resistant coating, Tnemec Series 120 Vinester lining, 435 PermaGlaze Lining, MotarClad 218 Resurfacer or equal for a System A epoxy coating for manhole and wall protection. This will be required in high hydrogen sulfide environments, or areas that have a high groundwater intrusion issue.

13.6.8 Pipe Connections to Manholes

PVC pipe connections to manholes and other structures shall be approved by the District. Provide one of the following methods for the connection.

1. For New manhole bases that require liners, fiberglass (FRP) manhole base by GU Industries with sewage and grease resistant O-ring gasket conforming to ASTM C443.
2. For NEW and EXISTING manhole bases, waterproof elastomeric boots such as Kor-N Seal I-Wedge Korband by National Pollution Control Systems Inc.

13.6.9 Pipe and Fittings for Drop Connections

The style of drop, type of pipe and fittings for drop connections shall be approved by the District. When ductile iron pipe is used for a drop connection, the fittings shall be the mechanical joint type, except where flanged fittings are shown on the Standard Drawings.

13.7 Manhole Installation

If material in the bottom of the trench is unsuitable for supporting the manhole, excavate below the base and install foundation stabilization material as specified in Division 2 to obtain a suitable foundation.

Install gravel base material under manhole base and compact to comply with the Standard Specifications.

Carefully inspect pre-cast manhole sections to be joined. Sections with chips or cracks in the tongue or groove shall not be used. Clean ends of sections of all foreign material. Provide all

special tools, appliances, and lubricants for the jointing assembly. Joints shall be made in strict accordance with the manufacturer's recommendations.

Install grade rings in conformance with the Standard Details. Lay grade rings in mortar with sides plumb and top level. Seal joints with mortar. Grade rings shall be watertight.

Construct manhole inverts in conformance with detail shown on the Standard Details, with smooth transitions to ensure an unobstructed flow through the manhole. Remove all sharp edges or rough sections, which tend to obstruct flow. Channeling shall be to the spring line of the sewer or above. Benches shall be sloped from the manhole wall toward the channel to prevent the accumulation of solids.

Completed manhole shall be straight, plumb, and the joints shall be watertight. All interior joints shall be coated with a fast setting, quick drying mortar prior to backfill. The District will require additional manhole coatings in situations that indicate potential for infiltration or inflow.

13.8 Corrosion Resistant Manholes

Provide corrosion resistant manholes at force main terminations, as well as two manholes downstream and one manhole upstream. Provide additional corrosion resistant manholes in areas with steep slopes downstream from force main discharges where directed by the District Engineer. Apply all coatings in strict accordance with the coating manufacturer's instructions.

Base sections, risers, eccentric reducers, and flat slab tops of new manholes shall be shop coated. Field apply two or more coats of System A Epoxy to the invert, the finished grade rings, any metallic pipe extending into the manhole, and any damaged shop coated sections. Allow all grout and cement mortar to cure 28 days prior to applying the coating system. Prepare surfaces and apply epoxy in strict accordance with the coating manufacturer's instructions. Coating shall be pinhole free with a minimum dry film thickness of 60 mils. Maintain required temperature and humidity for duration of curing period.

Existing manholes to be coated.

1. Water blast or sand blast (Manufacturers Recommendations) existing manhole surfaces to be coated. Remove all grease, latence, and deleterious materials from the concrete surfaces. Seal off the flow line as required to maintain flows while keeping debris out of the sewer. Dry the manhole surfaces to meet the coating manufacturer's requirements. Apply coating in strict conformance with the coating manufacturer's requirements.
2. If in the sole opinion of the District, the existing manhole surfaces are unsuitable for service as corrosion resistant manholes, replace the manhole with new corrosion resistant manholes at no cost to the District.

13.9 Future Manhole Stub outs

Install stub outs from manholes for future sewer connections as required by the District Engineer. Maximum length shall be 1½ feet outside the manhole wall.

Match the crowns of the pipelines. Provide compacted pipe bedding material around the stub out as specified herein.

Install semi-permanent plugs in the end on stub outs with gasketed joints similar to sewer pipe being used. Plugs shall be capable of withstanding all internal or external pressures without leakage. All plugs to be braced to prevent blow off.

13.10 Connection to Existing Manholes

Submit proposed connection method to the District for approval prior to beginning work. Maintain flows through the manhole during construction without interruption using an approved method.

Excavate completely around existing manholes to avoid unbalanced loading of the manhole. Repair all damage to manhole. Verify all existing invert elevation prior to constructing new line.

Connections to existing manholes shall be core drilled. Report any discrepancies to the District. Re-channel the existing manhole base.

14 Sewer Piping and Fittings

14.1 Minimum Design Criteria

The minimum sewer main size shall be 8-inch diameter. The minimum side sewer (the sewer pipe between the main and the property line) size shall be 6-inch diameter.

Sewer extensions shall incorporate adequate capacity to provide for the future expansion of the system in conformity with the District's comprehensive planning or future needs as determined by the District Engineer.

It is the policy of the District that the Developer extend any wastewater main improvements to the most distant end of abutting and interior rights-of-way or easements unless it is determined by the District, according to its rules and policies, that extension of the wastewater main will not be necessary. Developers owning corner property shall extend the wastewater system to the far ends of both corners of the property unless it is determined by the District, in its sole discretion, extension of the system is not necessary. The wastewater system shall be extended to the far end of the development at depths, whenever possible, which enable the District to provide gravity service to upstream properties.

Sewer Line Depth

1. All lines shall be at a sufficient depth to drain basements. **A minimum of 5-feet of cover over the crown of the sewer is required**, unless specifically exempted by the District.
2. The sewer shall be designed to provide gravity service to upstream properties whenever possible as determined by the District Engineer.

Separation between utilities

1. Water: Comply with Department of Ecology criteria.

2. Storm Sewer: Provide a minimum of 3-feet horizontal clearance. Provide a minimum of 1-foot vertical clearance.
3. Underground Power, Gas, Telephone, and Cable: Provide a minimum of 3-feet horizontal clearance. Provide a minimum of 1-foot vertical clearance.
4. Power, Telephone, Light, and Signal Poles: Provide a minimum of 7.5-feet horizontal clearance.

Sewer grade

1. Provide no additional drop on straight runs through manholes other than the pipe slope.
2. Provide an additional 0.10-foot drop for 90° turns through a manhole.
3. Comply with DOE minimum slope requirements.

14.2 PVC Pipe and Fittings (PVC pipe, 4-inch and larger)

Pipe and fittings shall meet the requirements of ASTM Specification D3034 for 4"-15" SDR 35 and F679 for 18"-27". The pipe shall be colored green for in-ground identification as sewer pipe.

Pipe shall be suitable for use as a gravity sewer conduit. Provisions must be made for contraction and expansion at each joint with a rubber ring. The bell shall consist of an integral wall section with a solid cross-section rubber ring, factory assembled, securely locked in place to prevent displacement during assembly.

All fittings and accessories shall be as manufactured by the pipe supplier or approved equal and have bell and/or spigot configurations compatible with that of the pipe.

Provide factory molded wye fittings with elastomeric gasketed bell end joints. Tapped and solvent welded fittings or fittings strapped to the main sewer are not acceptable. Side sewers shall be connected to the main by means of a wye. A gasketed cap or plug shall be furnished with each wye. The plug or cap shall be banded or otherwise secured to withstand the test pressures to which it will be subjected without leakage.

14.3 High Density Polyethylene (HDPE) Pressure Pipe

Provide high-density polyethylene plastic pipe suitable for use as a pressure conduit shall conform to the following specifications and standards:

1. Base Resin: Conform to all requirements of ASTM D 1248, Type III, Class C, Category 5, Grade P34, with a PPI rating of PE 3408.
2. Cell classification: 345434C per ASTM D 3350.
3. Environmental Stress Crack Resistance: No cracks after 5000 hours as determined by ASTM D 1693, Condition C.
4. Rating: Long-term hydrostatic strength of 1,600 psi and hydrostatic design stress of 800 psi as determined by ASTM D 2837.
5. Working Pressure Rating: 160 psi, SDR 11.

Pipe shall be butt-fused and internal weld seams removed.

14.4 Ductile Iron Pipe and Fittings

Pipe shall be centrifugally cast ductile iron, conforming to AWWA C151. Minimum thickness class shall be as determined in accordance with AWWA C150 but in no case less than Class 52.

Fittings shall be cast iron or ductile iron conforming to the requirements of AWWA C110 or AWWA C153 and rated for not less than 250-psi working pressure.

Joints shall be push-on or mechanical joint conforming to AWWA C111. Bolts for mechanical joints shall be ductile iron or Corten tee head bolts.

Gaskets for mechanical or push-on joints shall be sewage and grease resistant rubber (nitrile or neoprene), conforming to AWWA C111.

Provide one of the following lining systems for corrosion resistance:

1. 40 mil DFT nominal ceramic epoxy lining.
2. 40 mil DFT nominal polyurethane lining.
3. 30 mil DFT electrostatically applied fusion bonded polymer alloy coating.

Provide U.S. Pipe or Pacific States pipe and fittings, or approved equal.

14.5 Corrosion Protection for Ductile Iron Pipe and Fittings

Conduct a soil corrosion survey in accordance with AWWA C105 Appendix A where ductile iron pipe is to be used. In areas where the soil is found to be corrosive, the pipe and fittings shall be encased in polyethylene material. The polyethylene material shall be as specified in AWWA C105 and have a minimum nominal thickness of 0.008 inch. Minus tolerance shall not exceed 10 percent of the normal thickness. Material shall be tubes for straight pipe and flat sheets for fittings.

Additional special corrosion protection of the pipe may be required for construction near salt water or in other locations for the specific construction conditions encountered. Provide protection as required by the District Engineer.

14.6 Trace Wire

12-gauge wire, green in color is the District standard for Sewer Installation. Install on all force mains and side sewers between mains and cleanouts at property line. Use waterproof splices where necessary.

3M direct bury splice kits shall be used for all splices. The kit shall be installed as per the manufacturers' recommendations and specifications; the wires shall be tied in a knot 6" to 8" from the splice. A wire conduction test will be done by the District prior to approval.

14.7 Warning Tape

Use polyethylene film underground warning tape with a metal core. The tape shall be 3-inches wide and green with black and white lettering: "CAUTION SEWER LINE BURIED BELOW"

15 Sewer Pipe and Fittings Installation

15.1 Connection to District Sewers

All sewer extensions shall connect to the District's system at a manhole. Provide a manhole if one is not located at the connection point.

Apartment complexes shall connect to the District's sewer at a manhole. A side sewer service connection to the District's sewer is not allowed. The sewer main connection from the apartment complex shall be a minimum of 8-inch diameter. Side sewers from separate buildings shall join the main at manholes to facilitate grease removal. No more than two side sewers shall connect to a manhole.

Side sewers serving commercial/industrial buildings or facilities, which have the potential of discharging grease, oil, and/or chemicals to the sewer, shall connect to the sewer at a manhole. This includes restaurants, service stations and garages, car washes, photo labs, processing facilities, and any other facility as required by the District.

15.2 Construction Water Removal

Groundwater may be encountered during construction. If construction dewatering is required, the groundwater on the site is to be removed by collection wells and pumping the water to storm drains. Treatment of construction water will meet any applicable regulations prior to discharge. *At no time will construction water be allowed to enter active/existing District mains or mains under construction, except by express written consent of the District.*

15.3 Bedding

Place and compact bedding in accordance with the specifications outlined. Grade the pipe bedding by hand to the line and grade to which the pipe is to be laid, with proper allowance of the pipe thickness. Remove hard spots that would prevent a uniform thickness of bedding. Before laying each section of the pipe, check the grade with a straight edge and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes. Excavate bell holes at each joint to assure uniform support and permit proper assembly of the joint.

Sand and other material that cannot be easily compacted shall not be used for bedding, unless such materials are the specific requirement of the controlling agency.

15.4 Line and Grade

Allowable deviation from design line and grade shall be ½ inch for line and ¼ inch for grade.

Allowable variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of bell and spigot shall not exceed 1/64th inch per inch of pipe diameter.

Measure for grade at the pipe invert, not the top of the pipe.

Establish line and grade for pipe by the use of lasers or other suitable method so that the specified tolerances are not exceeded.

15.5 Laying and Joining Pipe and Fittings

Pipe laying shall proceed upgrade with spigot ends pointing downgrade.

Inspect all pipe and fittings prior to lowering into the trench to ensure no cracked, broken, or otherwise defective materials are being used. PVC pipe with deep scratches shall not be installed. Clean the ends of the pipe to be joined, the inside of the joint, and the gasket immediately before joining the pipe. Assemble the joint in accordance with the instructions and recommendations of the manufacturer of the type of joint used.

After the joint has been made, check pipe for alignment and grade. The trench bottom shall form a uniform and continuous bearing and support for the pipe at every point between joints. Place enough pipe bedding material to secure the pipe from movement before the next joint is installed.

When pipe is laid within a movable trench shield, take all necessary precautions to prevent pipe joints from pulling apart when moving the shield ahead.

Take the necessary precautions to prevent excavated or other foreign material from getting into the pipe during the laying operation. When laying operations are not in progress, at the close of the day's work, or whenever workers are absent from the job, close and block the open end of the last laid section of pipe to prevent entry of foreign material, or creep of the gasket joints.

Take precautions necessary to prevent the "uplift" or floating of the line prior to completion of the backfilling operation.

15.6 Cutting and Dressing Pipe

When cutting or machining of the pipe is necessary, use only tools and methods recommended by the pipe manufacturer.

Ductile iron pipe shall be cut with milling type cutter, rolling cutter, or abrasive saw cutter.

Do not flame cut.

Cut all pipe without damaging the pipe or lining, and so as to leave a smooth end at right angles to the axis of the pipe.

Dress cut ends of pipe by beveling, or as recommended by the pipe manufacturer. Remove sharp edges or projections that may damage the gasket.

15.7 Side Sewer Service Connections

Connect side sewer service connections to the District's existing main by means of a rigid ROMAC fitting. ***Residential side sewers shall not connect to a manhole without written approval from the District.***

Connect side sewer service to new mains with a wye fitting. Tees are not allowed for side sewer connections.

Side sewer service connections shall extend to the street or alley right-of-way line as directed by the District and as shown on the Drawings.

Provide a minimum 2 foot wide compacted pipe base under wyes installed in trenches.

Side sewer service connections in the right-of-way shall be 6-inch diameter or larger.

Install a two-way cleanout on each side sewer at the property line, as shown in the Standard Details. After final grading, the cleanout cap shall be brought to grade and adequately protected for its location.

Install 4-inch diameter two-way cleanouts within five feet of building foundation wall. A removable watertight cap shall be placed at the top of the cleanout, which shall extend above finished grade.

Pipe and fittings shall be of one type of material throughout.

No more than two residential structures shall be connected to the same sewer stub that is at the edge of the right of way.

15.8 Side Sewer Depth and Slope

Construct side sewers to a minimum invert depth of five feet below the floor being served or five feet below the ground surface at the property line or the easement line.

Comply with minimum clearance requirements for water line crossings.
The minimum slope is 2 percent.

15.9 Location Markers

Place a new 2" diameter, Schedule 40 PVC service connection marker and a magnetic tape marker at the end of the side sewer service stub.

Markers shall extend from the bottom of the trench to a minimum of 12-inches above the ground surface.

Stencil the word "sewer" in two-inch high letters and the depth of the side sewer invert below ground.

In traveled areas, cut marker flush with the ground surface.

15.10 Inspections

Do not backfill any side sewers or building laterals until the District has visually inspected and approved the installation.

If any work is covered up without the District's approval or consent, it must be uncovered for examination at the Developer's expense.

15.11 Sewer Main Cleaning and Testing

Tests on the completed installation shall be made as specified below.

15.12 Scheduling

All tests must be observed by the District. Notify the District of the proposed test dates preferably at least **two (2)** days prior to the test.

Testing of sections of the constructed sanitary sewer for acceptance will not be performed until all service connections, manholes, and backfill of the section are completed.

15.13 Cleaning and Flushing

All gravity sewer pipe shall be cleaned and flushed after backfilling and compaction in accordance with Section 7-17.3(2) A of the Standard Specifications. The pipe shall be cleaned and flushed by passing an inflatable rubber ball through the completed section or using a flush truck. Any obstruction such as cemented grout or debris found in the completed section shall be removed. **Do not allow flush water and debris into the existing collection system.**

15.14 Low-Pressure Air Test

All gravity sewers, including all connected side sewers, shall be tested for water tightness in accordance with the provisions of section 7-17.3(2) F of the Standard Specifications. (Pump to 4psi. After 2 minutes, the test shall begin. The pressure shall not drop below 3psi in 5 minutes) No other test procedures will be allowed except by written approval of the Engineer.

15.15 Pressure Testing HDPE Pipe Outside the Trench

If specified by the engineer, pressure testing may be conducted prior to pipe installation. After the pipe has been joined, fill it with water; carefully bleed off any trapped air. Subject the pipe to a hydrostatic test pressure that is 1.5 times the system design pressure for a maximum of 3 hours. During this time, add water periodically to maintain the test pressure; this compensates for the initial stretching of the pipe. The line pressure tightness is determined by visual observation; therefore, it is not necessary to measure the make-up water. Examine every fused joint, any leakage must be repaired and then retested.

NOTE: It shall be the responsibility of the contractor to ensure that appropriate safety precautions are observed during hydrostatic testing above ground.

15.16 Testing HDPE Pipe in the Trench

Fill the pipeline with water after it has been laid; bleed off any trapped air. Subject the lowest element in the system to a test pressure that is 1.5 times the design pressure, and check for any leakage. When, in the opinion of the engineer, local conditions require that the trenches be backfilled immediately after the pipe has been laid, apply the pressure test after backfilling has been completed but not sooner than a time, which will allow sufficient curing of any concrete that, may have been used. Typical minimum concrete curing times are 36 hours for early strengths and 7 days for normal strengths.

The test procedures consist of two steps; the initial expansion and the test phase. When test pressure is applied to a water-filled pipe, the pipe expands. During the initial expansion of the

pipe under test, sufficient make-up water must be added to the system at hourly intervals for 3 hours to maintain the test pressure. After about 4 hours, initial expansion should be complete and the actual test can start.

When the test is to begin, the pipe is full of water and is subjected to a constant test pressure of 1.5 times the system design pressure. The test phase should not exceed 3 hours, after which time any water deficiency must be replaced and measured. Add and measure the amount of make-up water required to return to the test pressure and compare this to the maximum allowance in the table below.

An alternate leakage test consists of maintaining test pressure over a period of 4 hours and then dropping the pressure by 1.0 psi (0.69 MPa). If the pressure mains within 5% of the target value for 1 hour, this indicates there is no leakage in the system.

NOTE: Under no circumstances shall the total time under test exceed 8 hours at 1.5 times the system pressure rating. If the test is not complete within this time limit (due to leakage, equipment failure, etc.), the test section shall be permitted to "relax" for 8 hours prior to the next test sequence.

Air testing is not recommended. Additional safety precautions may be required. (Reference procedure is from PPI Technical Report TR-31 by the Plastic Pipe Institute.)

ALLOWANCE FOR EXPANSION UNDER TEST PRESSURE							
NOMINAL PIPE SIZE	U.S. GALS/100 FT. OF PIPE ⁽²⁾			NOMINAL PIPE SIZE	U.S. GALS/100 FT. OF PIPE ⁰		
	1	2	3		1	2	3
2"	0.08	0.12	0.15	20"	2.8	5.5	8.00
3"	0.10	0.15	0.25	22"	3.5	7.0	10.50
4"	0.13	0.25	0.40	24"	4.5	8.9	13.30
5"	0.21	0.41	0.63	28"	5.5	11.1	16.80
6"	0.30	0.60	0.90	30"	6.2	12.6	19.10
8"	0.50	1.00	1.50	32"	7.0	14.3	21.50
10"	0.75	1.30	2.10	36"	9.0	18.0	27.00
12"	1.10	2.30	3.40	42"	12.0	24.0	36.00
14"	1.40	2.80	4.20	48"	15.0	27.0	43.00
16"	1.70	3.30	5.00	54"	18.0	30.0	50.00
18"	2.20	4.30	6.50	-	-	-	-
ifimin=0.03937 "multiply by 11.53 to convert to liters/100 meters of pipe.							

15.17 Manhole Vacuum Test

All manholes shall be vacuum tested in accordance with ASTM C-1244. All lift holes and any pipes entering the manhole are to be plugged and a vacuum drawn on the manhole equivalent to 10-inches of Mercury (4.9 psi). The valve on the vacuum line shall then be closed and the time required for a drop in vacuum to 9-inches of Mercury (4.4 psi) shall be measured. The manhole shall pass if the time for the vacuum reading to drop from 10-inches to 9-inches of mercury meets or exceeds the values shown in the following table:

Manhole Vacuum Test (Seconds)			
Depth (ft)	Manhole Diameter (inches)		
	48	54	60
8	20	23	26
10	25	29	33
12	30	35	39
14	35	41	46
16	40	46	52
18	45	52	59
20	50	53	65
22	55	64	72
24	59	64	78
26	64	75	85

15.18 Video Televising and Taping

The Developer shall hire a reputable firm skilled in conducting television inspection of sewers.

Conduct television inspection of all pipelines laid that are 8-inches in diameter or greater. At the District's discretion, Developer may be required to televise 4" and/or 6" diameter pipe as well. Television inspection shall occur after backfilling, compaction, flushing and deflection testing of the sewer.

Television inspection of the sewer shall be done with a CCTV color camera recorded in DVD/CD format. A pivot head camera shall be used to record all side sewer laterals.

A copy of the inspection video tapes from all televising operations shall be provided to the District.

Any defects discovered shall be repaired by the Developer.

15.19 Deflection Test of PVC Pipe

All PVC gravity sewer pipe shall be tested for deflection at least 30 days after completion of trench backfill and compaction in accordance with the requirements of section 7-17.3(2) G of the Standard Specifications.

15.20 Infiltration Tests

When the natural ground water table is above the crown of the higher end of the test section, the maximum allowable limit for infiltration shall be four tenths (0.4) gallons per hour per inch of internal diameter per 100 feet of length, with no allowance for external hydrostatic head.

15.21 Test Equipment

Any arrangement of testing equipment that will provide observable and accurate measurements of either air or water leakage under the specified conditions will be permitted. Gauges, air piping manifolds, valves, and graduated containers shall be located above ground.

Air testing apparatus shall be equipped with a pressure release device such as a rupture disc or a pressure relief valve designed to relieve pressure in the pipe under test at 6 psi.

16 Grinder Pump Equipment

16.1 General

This division covers that work necessary for furnishing and installing grinder pumps, discharge piping and appurtenances to comply with these specifications and the District's standard details. For specific installation, standards and specifications see attached Sewer Service Connection Guide *Appendix E*.

The Developer shall furnish and install a complete factory-built and tested grinder pump station manufactured by Environment One Corporation, consisting of a grinder pump suitably mounted in a basin constructed of high density polyethylene or fiberglass, electric quick disconnect (NEMA 4X), pump removal system, shut-off valve, anti-siphon valve, and check valve assembled within the basin, remote electrical alarm/disconnect panel, and all necessary internal wiring and controls.

16.2 Submittals

Submittal information shall be provided to the District for the following items:

1. Submit shop drawings containing catalog cuts, design of modifications required in this section, complete electrical schematics, and motor data.
2. Submit details of field jointing of access ways.
3. Provide a recorded easement for the grinder pump facilities on each property prior to acceptance.

16.3 Warranty

Provide the Developer's standard two-year installation warranty.

16.4 Design Criteria

Provide a minimum of one grinder pump for each lot served. Each simplex grinder pump station shall serve no more than one (1) house and a mother-in-law apartment located on the same lot.

No more than one (1) duplex shall be served by a simplex grinder pump station. A triplex shall be served by a duplex grinder pump station or two simplex grinder pump stations.

Comply with Washington State Labor & Industries requirements regarding intrinsically safe electrical equipment.

16.5 Grinder Pump & Appurtenances

Developer shall furnish an Environment One grinder pump station. Supply each grinder pump with two Environment One identically keyed padlocks prior to acceptance and testing.

Polyethylene pressure pipe shall be used for the discharge piping from the grinder pump. Pipe shall have a base resin rating of PE 3408 with a pressure rating of 160 psi, SDR 11.

16.6 Valves Associated with Grinder Pumps

Plug valves shall be cast iron body, welded nickel or adjustable stainless steel seat, Buna-N coated plug and Buna-N packing. Valves shall be full port opening with drip tight shutoff and mechanical joint or flanged ends.

Valve operator shall be a 2-inch square nut with AASHTO H-20 traffic rated cast iron valve box. Worm gear operated for valves 6-inches and larger.

Valves shall have factory coated. Coat interior metal surfaces and exterior surfaces with 12 mils minimum fusion epoxy per AWWA 550 or 20 mils coal tar epoxy.

Ball valves shall be bronze body, Teflon seat, stainless steel ball and stem with flanged or threaded ends. Provide ball valves with operating handle and drip-tight shutoff.

Ball check valves shall be Schedule 80 PVC with Teflon seats and EPDM O-ring gaskets.

Valve shall be rated at 150 psi @75°F. Provide double union type valve with threaded or socket ends.

Valve box shall be a concrete meter box, equivalent to Fogtite No. 2, or fiberglass meter box rated for H-20 loading. Valve box lid shall have "SEWER" label.

16.7 Grinder Pump Installation

The Developer shall be responsible for removing groundwater to provide a firm, dry subgrade for the structure, and shall guard against flotation or other damage resulting from general water or flooding. The grinder pump station shall not be set into the excavation until the installation procedures and excavation have been reviewed and approved by the District.

The pump station is supplied with a standard 4-inch inlet grommet for inlet piping. Developer shall not insert inlet piping beyond the factory-provided "stop". The basin may not be dropped, rolled or laid on its side for any reason.

Installation shall be accomplished so that 1-inch to 3-inch of access way, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the hole must be large enough to allow for the concrete anchor.

A 6-inch minimum layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8 inch or more than 3/4 inch shall be used as bedding material under each unit. A concrete anti-flotation collar, as detailed on the drawings, and sized according to

the manufacturer's instructions, shall be required and shall be pre-cast to the grinder pump or poured in place. The grinder pump station with its precast anti-flotation collar shall have a minimum of four lifting eyes for loading and unloading purposes. The unit shall be leveled, and filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an 8-inch sleeve is required over the inlet prior to the concrete being poured.

Backfill of clean native earth, free of rocks, roots, and foreign objects shall be thoroughly compacted in lifts not exceeding 12-inches to a final Proctor Density of not less than 85%. Improper backfilling may result in damaged access ways.

The electrical control panel shall be installed and wired to the grinder pump station by the Developer using the factory-supplied length of 6 conductor, 12-gauge TC type cable as shown on the standard drawings. Type TC cable shall be installed in PVC Schedule 40 continuous conduit and burial depth shall comply with local code requirements.

Polyethylene pressure pipe joints shall be flanged, thermal fusion butt welds or made using weld-on compression couplings. Joints in 1¼" and 2" pipe shall be made only at pump basins, valves, fittings and changes in pipe diameter. For pipes larger than 2" in diameter, joints between pipe sections shall be thermal fusion butt-welded. All flanges and fittings shall be thermal fusion butt welded to the pipe. Operators of fusion welding equipment shall be trained by the pipe manufacturer, who shall certify that operators are qualified.

Install warning tape in the trench approximately one foot below finished grade, directly above the pipe.

Install trace wire with all polyethylene pressure or force main and grinder pump discharge piping.

Trace wire shall be a minimum of 12 gauge and Green in color.

16.7.1 Low Pressure Connection to Gravity Sewer

Pressure connection to a gravity sewer shall be allowed with prior approval from the District. Connection of the 1 ¼" HDPE line shall be at the 6" clean out located at the edge of right-of-way per standard detail.

16.8 Startup and Field Testing

Once scheduled with Correct Equipment, a 48-hour notice shall be provided to the District for witness of startup and testing of the pump station. Prior to the testing, the pump station shall be complete (including landscape), the main line isolation valve shall be opened by District personnel, and the installer shall have successfully performed all testing to assure the station operates properly.

(See Appendix E)

17 Pretreatment Systems

17.1 General

Pretreatment systems may be required to reduce, eliminate or alter the nature of a pollutant's properties prior to discharging to the public sewer collection system. Pretreatment systems include grease interceptors, oil/water separators and other units to treat metals, solvents, excessive BOD or TSS and other constituents.

The District reserves the right to evaluate a waste stream prior to connection and require pretreatment to comply with waste discharge criteria and limits established by District Resolution.

17.2 Grease Interceptors

Any business involved in the process, preparation, sale, or packaging of human or animal food requires that an exterior (outside) grease interceptor be installed, on a separate side sewer main. This separate side sewer shall be connected directly, and only to, the food handling areas in the building, with no sanitary connections permitted upstream of the grease interceptor.

Comply with the latest versions of the Uniform Plumbing Code and the Uniform Building Code. The design capacity of the grease interceptor shall be determined by the following formula (from Appendix H, Uniform Plumbing Code):

Interceptor Size = (# Meals @ Peak Hour)¹ x (Waste Flow)² x (Retention Time)³ x (Storage Factor)⁴

¹ *Meals Served at Peak Hour*

² *Waste Flow Rate*

With dishwashing machine.....	6 gallon flow
Without dishwashing machine.....	5 gallon flow
Single Service kitchen.....	2 gallon flow
Food Waste Disposer.....	1 gallon flow

³ *Retention Times*

Commercial Kitchen Waste, Dishwasher	2.5 hours
Single service kitchen.....	1.5 hours

⁴ *Storage Factors*

Fully Equipped Kitchen	
8-hour operation.....	1
16-hour operation.....	2
24-hour operation.....	3
Single Service Kitchen.....	1.5

Precast concrete grease interceptors shall be designed for a soil dead load of 150 lb. /CF and an AASHTO H-20 live load as manufactured by Utility Vault or equal.

17.3 Oil/Water Separators

Oil/water separator design and sizing shall conform to the Department of Ecology's Best Management Practices (BMP) for Stormwater Treatment. The separator shall be an American Petroleum Institute (API) or Coalescing Plate Interceptor (CPI).

Oil/water separators shall be designed for a soil dead load of 150 lb. /CF and an AASHTO HS 20 live load.

Provide a forebay to collect floatables and large settleable solids with a surface area not less than 20 SF per 10,000 SF of area draining into the separator.

17.4 Grease Interceptor & Oil/Water Separator Installation

The building sanitary side sewer shall be connected to the service lateral at least four feet downstream from the interceptor providing the slope of the lateral is 2 percent or more. For laterals with a slope of less than 2 percent, the connection point shall be a minimum of eight feet downstream from the separator, or directly connected to the District main.

Grease interceptors or oil/water separators may be installed in either planter or vehicle areas. In vehicular areas, the unit shall be constructed as to provide H-20 load capabilities. In all cases, the installation site shall provide and ensure ease of access, maintenance, and visual inspection and will be provided with a hinged locking hatch.

Install a manhole where the grease interceptor or oil/water separator discharges into the District's sanitary sewer for monitoring purposes or at an upstream location approved by the District. If physical conditions preclude the installation of a monitoring manhole on the District main, Developer may install, with prior District approval, an Inspection Chamber as manufactured by Pacific North Marketing Ltd., Abbotsford, British Columbia.

Provide a cleanout/inspection tee between the building and the grease interceptor. Locate tee 3 to 5 feet from the building in an accessible location for maintenance equipment.

Install in strict conformance with the manufacturer's instructions. Install unit on a 6-inch layer of compacted gravel base. Grade the base material to provide uniform bearing.

18 Standard Specifications for Water/Sewer Construction

18.1 General

This document outlines the general and specific construction requirements for water/sewer systems operated and maintained by or for West Sound Utility District (District). All references to the District shall mean the District Manager or his authorized representative.

18.2 Standard Specifications

In general, all construction activities and material specifications shall conform to the latest edition of:

1. Applicable Kitsap County rules, regulations, ordinances and standards.
2. Standards of the American Water Works Association, latest revision
3. "Standard Specifications for Road, Bridge, and Municipal Construction", Washington State Department of Transportation/American Public Work Association, (WSDOT/APWA), latest edition (Standard Specifications).
4. Rules and regulations of the State Board of Health regarding the health aspects of Public Water Systems, WAC 246-290, latest revision.
5. Recommendations of the manufacturer of materials or equipment.

18.3 Permits and Licenses

The applicant/contractor shall acquire the required permits for construction within public rights of way. The Developer and/or his engineer shall provide and complete all necessary forms and submit to the County/City/State agencies with the applicable fees.

All construction shall conform to the requirements of the right of way permits.

18.4 Pre-Construction Conference

The District will schedule a pre-construction conference with the applicant, contractor, and affected County/City/State agencies prior to start of construction. The contractor shall submit the following to the District at the pre-construction conference:

1. Material submittals
2. Safety and traffic control plan, if needed
3. Copies of all necessary city, county, and state permits necessary for the conduct of the work. No work will be allowed to proceed without the necessary permits.
4. Evidence of insurance with the District named as additional insured in accordance with Section 5.9 of the Developer Extension Policies. An endorsement to the insured's policy will be considered as evidence of insurance.

18.5 Submittal and Shop Drawings

In accordance with the District's Technical and Standard Specifications, applicants or their contractor shall submit a list of all brands, sizes, types, grades, and standard materials to be used. The District may reject certain brands and will provide approval, disapproval, and/or comment by letter.

Submittal data for each item shall contain sufficient information on each item to determine if it is in compliance with the contract requirements. Items that are installed in the work that have not been approved through the submittal process shall be removed and an approved product shall be furnished, all at the Developer's expense. Shop drawing review will be limited to general design requirements only, and shall not relieve the Developer from responsibility for errors or omissions, or responsibility for consequences due to deviations from the contract documents. No changes may be made in any submittal after it has been reviewed except with written notice and approval from the District. Shop drawings shall be submitted on 8½" x 11", 11" x 17", or 22" x 34" sheets and shall contain the following information:

1. Project Name
2. Prime Developer and Applicable Subcontractor
3. District's Name

Submittals that do not comply with these requirements may be returned to the Developer for re-submittal. Acceptable submittals will be reviewed as promptly as possible, and transmitted to the Developer not later than 10 working days after receipt by the Engineer. Revise and submit as necessary.

Submittals shall contain the following information for all items:

1. Equipment drawings, dimensions, and weights (lift stations only)
2. Catalog information
3. Manufacturer's specifications
4. Special handling instructions (lift stations and pumps only)
5. Maintenance requirements (lift stations and pumps only)
6. Wiring and control diagrams (lift stations and pumps only)

Specific submittal requirements are listed in each section of these specifications.

18.6 Substitutions

The approved Developer Extension Contract, construction plans, and District technical and standard specifications shall be followed. No deviations will be allowed without request for change and approval in writing from the District General Manager or designee. The District reserves the right to order changes, which conform to the District's standard specifications; in the event conditions or circumstances are discovered during construction which indicate changes are prudent. The applicant shall be notified in writing of any changes. Such changes will be mutually accepted.

Deviations from standard locations and/or approved plans must be documented, receive prior written approval by the District, and be accompanied by accurate record drawings.

18.7 Site Control

The Contractor shall be responsible for surveying and staking and will stake out the locations of the permanent easements, temporary easements, rights-of way, and all major facilities shown on the Plans and permits.

Replace all damaged survey monuments in accordance with RCW 332-120.

18.8 Waste Material Control

Adhere to all requirements of federal, state, and local statutes and regulations dealing with pollution. Permit no public nuisances.

Use only dumpsites that are approved by the regulatory agency having jurisdiction and present proof of approval upon request. Obtain any and all permits required by regulatory agencies.

At all times, keep the construction area clean and orderly and upon completion of the work, restore site of all work or equipment storage areas to their original condition. Remove all miscellaneous unused material resulting from the work and dispose of it in a manner satisfactory to the District.

The Contractor shall follow all requirements and guidelines of the Puget Sound Air Pollution Control Agency and other associated agencies.

Use water sprinkling, temporary enclosures, or other methods to limit dust and dirt from rising and scattering in the air. Surface water runoff that is contaminated with site debris, silt, or other material that adversely affects water quality shall be collected and cleaned prior to discharge.

Do not use water to control dust when it may create hazardous or objectionable conditions such as ice formation, flooding, or pollution.

18.9 Spill Response

The contractor shall prepare a spill response plan for approval by the regulatory agency. The contractor shall maintain a copy of the approved spill response plan on site at all times. All necessary materials and equipment necessary to respond to spills shall be kept readily available on site.

18.10 Erosion Control

The contractor shall prepare an erosion control plan for approval by the regulatory agency. The contractor shall maintain a copy of the approved erosion control plan on site at all times.

18.11 Construction Notification

Contractors shall notify the District General Manager a minimum of **forty-eight (48)** hours in advance of construction to facilitate project coordination and notification of affected property owners.

18.12 Construction Shutdowns

Construction under this contract may involve replacement or modification of the existing water and/or sewer system, which must continue to provide service to all buildings and homes during construction. Connections and service changes must be programmed to provide the least possible interruptions of service.

A contractor water main shutdown Contract must be completed if a connection to an existing system involves turning off the water. The contractor shall notify the District at least **five (5)** days in advance of any required shutdowns so that affected customers may be notified. District personnel will notify properties affected by the shutoff.

Prior to any shutdown, all traffic control, materials, fittings, supports, equipment, and tools shall be on the site and all necessary labor scheduled prior to starting any connection work. In general, shutdowns shall not exceed **four (4)** hours in duration unless specifically authorized by the District.

The Contractor may be required to install and maintain temporary water and/or sewer mains and service connections to all houses and other buildings affected by frequent service disruptions caused by construction activities. Installation and maintenance of temporary facilities will be at the Contractors expense. All temporary piping and connections shall be approved by the District and disinfected as specified herein before being put into service.

All work under this Contract shall be conducted in a manner that will minimize shutdowns, open roadways, or traffic obstructions caused by construction. Shutdowns causing damage to adjacent public and private property shall be the sole responsibility of the Contractor.

Planned utility service shutdowns shall be accomplished during periods of minimum use. In some cases, this will require night or weekend work. In such instances, the Developer/Contractor will be required to pay overtime inspection fees.

Coordinate all work so that service will be restored in the minimum possible time, and cooperate with the District in reducing shutdowns of the utility system to a minimum.

No utility interruption will be permitted without the prior approval of the District. Any unauthorized tampering with the water system is subject to fines.

18.13 Connection to Existing Systems

Connections to existing water and/or sewer mains shall not be made without first completing the necessary arrangements with the District. Work shall not be started until all traffic control, materials, equipment, and labor necessary to properly complete the work are assembled on the site. Once work is started on a connection, it shall proceed continuously, without interruption, and as rapidly as possible until complete. No shut-off of mains will be permitted overnight, over weekends, or during weeks with holidays.

Contractors shall acquaint themselves with all aspects of existing systems prior to starting construction on new mains. Pertinent information concerning existing systems may be obtained from District personnel and may be verified from District records. Existing water and sewer mains and service lines shall be located by Contractors prior to beginning work so they may be properly protected and maintained in service, during construction.

Taps from existing mains to new extensions must be made in the presence of designated District personnel. No taps are to be made without District personnel being present.

Only District personnel are permitted to operate valves on the certified, potable water side of a line, including emergencies unless personnel safety is threatened. Exposing a potable water line during construction without the Districts concurrence will result in a penalty being imposed.

18.14 Work on Non-District Rights-of-Way

Work on a state highway, county road, or any other right-of-way not owned by the District, shall conform to the requirements of the authority having jurisdiction over such right-of-way. Contractors are responsible for notifying the proper authorities and acquiring permits before

beginning work on a right-of-way. Contractors will ascertain restoration requirements and determine that schedules of operations proposed are satisfactory to applicable authorities. Work will not be permitted to proceed without evidence of having obtained the required permits.

When county roads are involved, the Contractor must coordinate all trenching and restoration activities with the Kitsap County Department of Public Works and the District. Open cuts must be approved by the Kitsap County Department of Public Works.

18.15 Traffic Maintenance

Contractors shall conduct work so as to interfere as little as possible with public travel. Required traffic control shall be in place prior to commencement of work. Access for firefighting equipment shall be provided at all times, and Contractors shall keep the local fire protection authorities informed of the location of construction operations and fire lanes. Contractors shall also notify the authorities in charge of any municipal, private, or school transportation system at least **48** hours in advance of road closures that will force a change in the regular routing of the transportation system. Contractors shall also provide and maintain suitable detour routes for the system. Road closures will not be allowed without written permission from the Kitsap County Public Works Department, except verbal permission may be used in an emergency. Work which involves State or County road rights of way shall be restricted to the hours between 8:00 AM and 5:00 PM and no work shall be allowed in such right of way on Saturdays, Sundays or Holidays unless authorized by the District.

18.16 Safety

Contractors will be solely and completely responsible for conditions at job sites, including safety of all persons and property during the performance of work. This requirement will apply continuously and not be limited to normal working hours.

18.17 Inspection Requirements

Unless previously authorized by the District, work on water and/or sewer mains shall not proceed without a District inspector being present. The District may refuse acceptance of any water and/or sewer mains installed without a District inspection. To permit scheduling an inspector, the District must receive a hard copy of the construction schedule at least **two (2)** full working days before construction activities covered by the schedule begin. The District must be kept advised of changes to the construction schedule. When significant breaks in construction occur, the contractor must give **two (2)** full working days' notice before resuming work. ***The inspector shall have authority to reject defective material and to suspend any work that is not conducted in accordance with the District's Technical Standards and Specifications.***

All mains shall be inspected by the District or its designated representative before closure of any excavation. Inspectors will be provided by the District or its designated representative. Inspectors will have access to work sites as necessary to keep the District informed of the progress of the work and the manner in which it is being done, to keep records, to act as liaison between the Contractor and the Manager, and to report any deviations from Plans or

Specifications. *Failure of an inspector to call the attention of a Contractor to faulty work or deviations from the Plans or Specifications shall not constitute acceptance of said work.*

Any personal assistance, which an Inspector may give a Contractor, will not be constructed as the basis of any assumption of responsibility in any manner, financial or otherwise, by the Inspector, the Engineer, or the District.

The presence or absence of an Inspector on any job will be at the sole discretion of the District. Such presence or absence of an Inspector will not relieve a Contractor of responsibility to deliver the construction results specified in the contract documents.

District Inspectors will not be authorized to issue instructions or to approve or accept any portion of the work, which is contrary to the Plans and Specifications. Approvals, acceptances, or instructions, when given, must be in writing and signed by the District General Manager or his designated representative. Inspectors will have authority to reject defective material. The failure of an Inspector to reject defective material or any work, which deviates from the contract documents, will not constitute acceptance of such work.

Kitsap County may have an inspector on site when working on County rights-of-way.

18.18 Overtime and Holiday Work

Should a Contractor elect to work more than eight hours per day, or more than five days per week or on holidays during the course of a project, all costs of resulting District overtime/holiday engineering and inspection will be charged to the Contractor at **2.5** times the normal rates.

18.19 As-Constructed and Warranty Records

Prior to final acceptance of the work by the District, the Developer shall deliver a complete set of acceptable as-constructed records to the District. Drawings shall be made on clean, unmarked prints of the project and the final submittal shall be the following:

1. one (1) set (copy) contractor redline drawings for review.
2. two (2) set of reproducible mylar;
3. two (2) set of bond record drawings;
4. a digital format of the record plans **AutoCAD** that can be referenced into a GIS format is required.

The Developer shall provide as-constructed information on all items and work shown on the plans showing details of the finished product including dimensions, locations, outlines, and changes. The information must be in sufficient detail to allow District personnel to locate, maintain, and operate the finished product and its various components.

19 Site Work

19.1 General

This division covers the work that is necessary for providing materials and performing all site work as called for on the approved plans.

19.2 Submittals

Submittal information shall be provided to the District for the following items:

1. Erosion and Sedimentation Control Plan
2. Erosion Control Fence Fabric
3. De-watering Plan
4. Shoring Plan and Calculations
5. Dump Site Permits
6. General Fill
7. Structural Fill
8. Pipe Bedding
9. Trench Backfill
10. Gravel Base Course
11. Crushed Surfacing
12. Paving
13. Compaction Test Results
14. Hydro-seed

19.3 Erosion and Sedimentation Control

All erosion/sedimentation control systems including; fencing, earth berms, grasses, straw, mulch, culverts, drain pipe, outfalls and other items required for this project are the responsibility of the Developer and fall under the jurisdiction of Kitsap County or the City of Port Orchard (depending on the location of the extension).

All erosion/sedimentation control (ESC) systems specified in the approved erosion control plan must be installed prior to commencing any work that could result in off-site storm water or material flows. Erosion/sedimentation controls must remain in place throughout the duration of the construction activities.

The Contractor shall add additional ESC facilities or processes as necessary to ensure that erosion and sedimentation problems do not occur. The Contractor shall inspect the ESC facilities daily and maintain the systems as necessary to prevent off-site drainage.

19.4 Dewatering

The Developer is to determine the scope, type, size, quantity, method of installation, operation, and removal of the dewatering system necessary to keep all excavations de-watered to an elevation below the base of the excavation sufficient to stabilize the soils in the excavation and the surrounding areas, and to prevent flotation of partially completed structures.

The Contractor shall control groundwater and surface water to prevent the softening of the bottom of excavations, or formation of quick conditions or boils during excavation. Ground water shall be lowered to 3 feet below the base of the excavation at all times. Determination of unsuitable soil conditions for supporting the improvements shall be determined by the District Engineer. When the dewatering system does not meet the specified requirements, and as a consequence there is a loosening or disturbance of the foundation soils, instability for the

slopes, or damage to the foundation or structures occur, the Developer shall at its own expense, supply all materials, labor, and equipment, and perform all work required for the restoration of foundation soil, slopes, or structure to the satisfaction of the Engineer.

It is solely the Developer's and the Contractor's responsibility to meet all regulatory requirements governing the disposal of dewatering flows and to prevent damage to adjacent property. Disposal of these waters into existing District sewer mains or trunk lines is strictly prohibited. Drainage of water through the pipeline under construction is also prohibited. All dewatering wells installed by the Contractor shall be removed and backfilled in accordance with applicable Federal and State regulations.

19.5 Construction Access

The Contractor shall provide for all temporary site access for District personnel and shall maintain vehicular site access at all times.

19.6 Clearing and Grubbing

Clearing and grubbing shall be performed by the Contractor to remove and dispose of unwanted debris, vegetative matter, and other items noted on the construction drawings within the construction limits and shall conform to Section 2-01 of the Standard Specifications.

19.7 Excavation

The Contractor shall excavate as necessary to construct the improvements shown. Excavation includes utility excavation, structural excavation, and grading excavation.

Grading excavation shall be to the finished rough grade of the roadway or easement and shall be completed prior to utility excavation. Grade staking, when required, will be done by the owner's engineer prior to installation of the mains.

Utility excavation shall be performed to the depths necessary to complete the construction work shown. Utility excavation shall be performed in accordance with the Standard Specifications, Section 2-09, with a minimum cover of 36-inches.

The base of the excavation shall be examined by the District to determine if it is suitable for backfilling. The District will evaluate the stability of the base of excavation by determining if all significant organic soils or other unsuitable materials have been removed. Excavation required by the District that is beyond the depth shown shall be performed by the Contractor per direction of the District.

All excavated material shall be removed from the site unless approved as backfill material by the District. Approval of material as backfill will be made the moment before placement of the material as backfill. Weather conditions may make previously excavated material unsuitable for backfill requiring the material to be removed from the project site.

If the trench soil is unsuitable for trench backfill, as determined by the Inspector, the Contractor shall remove and dispose of unsuitable material and backfill the trench with approved backfill. The Contractor will keep the District informed of the disposal site of all unusable material

removed from the project. New or refuse material must not be dumped on neighboring properties.

Excavation within County rights of way areas shall be in accordance with the Kitsap County Department of Public Works Right of Way Permit.

19.8 Shoring

Where shoring, sheet piling, sheeting, bracing, lagging, or other supports are necessary to prevent cave-ins or damage to existing structures, it shall be the responsibility of the Contractor to design, furnish, place, maintain, and remove supports in accordance with applicable laws, codes, and safety requirements including Chapter 296-155 of WAC, A Safety Standards for Construction Work, Part N, Excavation, Trenching, and Shoring@. Design, planning, installation, and removal of sheeting, shoring, piling, lagging, and bracing shall be accomplished in such a manner as to maintain the undisturbed state of soil below and adjacent to excavation. Failure to maintain shoring in accordance with the submitted shoring plan will result in shut down of the job by the District until required shoring is in place.

19.9 Hazardous Content of Fill Material

All imported fill material shall be free of hydrocarbons (e.g. gasoline, diesel oil, etc.), pesticides, herbicides, and other hazardous volatile organic compounds (VOCs) and synthetic organic chemicals (SOCs). If required, the Contractor shall provide certification to the District that the fill is free of these chemicals.

19.10 General Fill

All fill required for this project that is not specifically defined as another type shall be “General Fill”.

General fill shall be free of organics, debris, and other deleterious materials. General fill shall conform to Section 9-03.10”Aggregate for Gravel Base” of the Standard Specifications. The moisture content of the material and weather conditions at the time of placement will be used to determine the suitability of native materials for backfill as general fill. All general fill shall be compacted in uniform layers not to exceed 12-inches in loose thickness and compacted to at least 95 percent maximum dry density based on the ASTM D-1557 test procedure.

19.11 Structural Fill

All fill placed below and against building components, building structures, vaults, manholes, handholds, slabs, sidewalks, and drives shall be ”Structural Fill”.

Structural fill shall be free of organics, debris, and other deleterious and conform to Section 9-03.12 (2), “Gravel Backfill for Walls” of the Standard Specifications. The District shall determine if native on-site materials are suitable for use as structural fill. The moisture content of the material and weather conditions at the time of placement will be used to determine the suitability of native materials for backfill as structural fill. Structural fill shall bear on a firm base and be placed in uniform layers not exceeding 12-inches in loose thickness. The backfill area must be free of standing water and the sub-grade soils must be stable. Each layer of

structural fill shall be compacted to at least 95 percent of its maximum dry density based on the ASTM D-1557 test procedure.

19.12 Pipe Bedding

All fill placed below and around buried utilities shall be “Pipe Bedding”. Pipe bedding shall be placed when the trench base is deemed unsuitable by the District.

Bedding material shall surround the pipe and conduits to the limits shown on the construction drawings and provide uniform support along the entire length without allowing concentrated loading at joints or bells. Bedding material shall conform to Section 9-03.12(3) of the Standard Specifications. All bedding material shall bear on firm sub-grade and be compacted to at least 95 percent of maximum dry density based on the ASTM D-1557 test procedure.

19.13 Trench Backfill

Unless the trench is backfilled with Control Density Fill, all fill material placed above the pipe bedding in a trench shall be “Trench Backfill”.

Trench backfill shall be placed and compacted above the pipe bedding to finish grade elevations in un-restored areas or to sub-grade elevations in restored areas. Trench backfill shall consist of a well-graded sand or sand and gravel mixture conforming to Section 9-03.12 (2), “Gravel Backfill for Walls” of the Standard Specifications and have less than 5 percent passing the U.S. No. 200 sieve based on the fraction passing the 3/4 inch sieve. Trench backfill shall bear on a firm base and be constructed in uniform layers not exceeding 12-inches in thickness. Each lift shall be compacted in uniform layers not to exceed 12-inches in loose thickness and compacted to at least 95 percent maximum dry density based on the ASTM D-1557 test procedure. The District shall determine if native on-site materials are suitable for use as trench backfill.

Finished backfill shall leave all existing drainage ditches, culverts, and other appurtenances in a useable condition equal to or better than their original condition.

19.14 Gravel Base Course

All fill placed under paving and next to native material shall be “Gravel Base Course”.

Aggregate for gravel base course shall conform to Section 9-03.10 of the Standard Specifications.

19.15 Gravel Top Course

All fill placed under paving and next to paving material shall “Gravel Top Course”.

Aggregate for gravel top course shall conform to Section 9-03.09(3) of the Standard Specifications.

19.16 Paving

Cement concrete pavement, sidewalks, and curb shall be Class B concrete (3,000 psi) as specified in the concrete section of these specifications. Construction shall comply with Section 5-05 of the Standard Specifications.

Asphalt concrete pavement shall comply with Section 5-04 of the Standard Specifications and the Kitsap County utility permit for the work. Finish, place, spread, and compact Class B asphalt concrete pavement to the thickness shown on the construction drawings or specified in the utility permit. The minimum compacted thickness of asphalt concrete pavement shall be 2-inches.

All paving shall be inspected and approved by the agency issuing the utility permit.

19.17 Compaction Testing

The Contractor shall arrange, at his own expense, for in place density testing to be performed at intervals not less than every 500 linear feet of pipe run and where required by the District. At a minimum, density tests shall be performed at 50% of the trench depth and at the surface of the trench. Other depths of the trench may be required by the District.

The Contractor shall excavate to the depths required to perform the tests and shall provide sheeting, shoring, and bracing of the trench as necessary. Backfill, in all sections where density requirements are not satisfied, shall be removed from the trench, re-compacted, and re-tested until conforming to specifications.

A certified independent testing laboratory acceptable to the District shall perform density testing. All test results shall be submitted directly to the District.

The District shall have the right, but not the obligation, to perform such additional density testing, as the District deems necessary. If the tests show that the density requirements are not satisfied, the Contractor shall reimburse the District for all costs for the tests, and shall remove the unsatisfactory backfill from the trench and re-compact and retest it until conformance with the specifications is obtained.

All compaction shall meet the approval of the agency issuing the utility permit.

19.18 Surface Restoration

Roads, driveways, shoulders, landscaping and all other areas removed, broken, caved-in, settled or otherwise damaged as a result of construction work, shall be repaired and/or resurfaced to match the existing surface or landscaped areas.

Existing shoulders and gravel surfaces shall be restored with like, crushed rock surfacing. Existing lawns shall be re-sodded after proper backfilling and settling. Existing landscaping, fences, mailboxes, ornamentation, etc. shall be restored as close to original conditions as possible. Private driveways, walks, and other surfaced areas shall be repaired, patched, or resurfaced as required to match the original surface condition.

Contractors shall furnish and install new asphalt surface at all locations where the existing asphalt surface or asphalt driveway has been removed or damaged by construction work. Trenches shall be backfilled with select granular material approved by the Engineer. It shall be mechanically tamped to 95 percent compaction in six-inch lifts. The top four-inches shall

consist of two-inches of crushed surfacing top course and two-inches compacted depth of asphaltic concrete, Class B.

20 Concrete

20.1 General

This division covers that work necessary for furnishing and installing all concrete as described in these specifications and shown on the plans.

20.2 Submittals

Submittal information shall be provided to the District for the following items:

1. Concrete design and admixtures
2. Special placement procedures for hot or cold weather
3. Schedule of surface finishes
4. Control Density Fill design mix

Concrete performance mixes shall be submitted to the engineer for approval a minimum of two weeks prior to placing any concrete. The performance mix shall include the amounts of cement, fine and coarse aggregate, water and admixtures, as well as the water cement ratio, slump, concrete yield and substantiation strength data in accordance with ACI 318-95, Chapter 5. The use of a performance mix requires batch plant inspection, the cost of which shall be paid by the Contractor. Review of mix submittals by the District indicates only that information presented conforms generally to contract documents. Contractor or supplier maintains full responsibility for special performance.

20.3 Control Density Fill (CDF)

At least ten (10) days before placing CDF, the Contractor shall submit a mix design for the material to be used. The mix design shall include trial laboratory and testing data with cylinder breaks performed at 7, 14, and 21 days. The mix design shall be approved by the agency issuing the utility permit.

CDF shall be proportioned to be a non-segregating, free flowing, self-consolidating, low shrink slurry.

The Contractor and its supplier shall determine the materials and proportions used to meet the requirements of these Specifications. The mix design shall be prepared for the range of aggregate gradations that are expected to be used.

The unconfined compressive strength at 28 days shall be 200 psi (± 50 psi) as per ASTM D4832.

Contain CDF in trench sections using bulkheads or fill materials to confine the flow of material. Take appropriate precautions to prevent pipe displacement and/or flotation.

CDF shall be placed in lifts not exceeding 6 feet in height, with a time interval of not less than 1 hour between lifts.

Provide steel plates to span trenches and prevent traffic contact if necessary. No traffic or construction equipment shall be allowed on CDF for at least 24 hours after placement or until the material is hard enough to prevent rutting or damage. Work shall not proceed unless plates are on the jobsite.

20.4 Concrete Materials

Concrete shall be mixed, conveyed, and proportioned in accordance with UBC section 1905. The performance mix shall include the amount of cement, fine and coarse aggregate, water, and admixtures as well as water cement ratio, slump, concrete yield, and sustaining strength data in accordance with these specifications, the minimum requirements of the 1997 Uniform Building Code, Section 1905, and the requirements of ACI 318-99.

Materials shall conform to the following standards:

- Cement: ASTM C-105
- Coarse Aggregate: ASTM C-33
- Fine Aggregate: ASTM C-33
- Admixtures: ASTM C-494
- Air entraining Admixtures: ASTM-260

Water used in concrete shall be potable.

Fly ash may be substituted for up to 15% of the required cement.

20.4.1 Thrust Blocking, Driveways, and Sidewalks

Cement: ASTM C-105

Coarse Aggregate ASTM C-33

Fine Aggregate: ASTM C-33

Admixtures: ASTM C-494

28-day strength: 3,000 psi minimum

Cement content: 5.5 sacks/CY minimum

Water/Cement ratio: 6 gals/95 lb. sack maximum

Fine aggregate ratio: 45% max by weight

Coarse aggregate limits: 7/8 inch maximum

Entrained air ratio: 3% minimum to 5% maximum

Slump: 4-inches maximum

Provide concrete blocking at all fittings, and horizontal of vertical angle points. Conform to Standard Details for General Blocking, Vertical Blocks, and Deadman Blocking. All fittings to be blocked shall be wrapped with 4-mil polyethylene plastic. Concrete blocking shall be properly formed with plywood or other acceptable forming materials and shall not be poured around joints. The forms shall be stripped prior to backfilling. All blocking must be inspected by the District prior to backfill.

The District does use thrust blocks for fire hydrants. Each fire hydrant shall be in addition secured with mega lugs. For mains crossing other pipes, the District will require additional restraints.

21 Special Construction (Pipeline Casings)

21.1 General

This division covers the boring and jacking of pipeline casings and the installation of carrier pipe.

21.2 Submittals

Submit the following for review:

1. Casing pipe drawings, details, and thickness calculations
2. Carrier pipe placement method and equipment
3. Utility crossing permits

21.3 Quality Assurance

The boring contractor shall have regularly engaged in work of this nature for at least 5 years.

21.4 Other Utilities

No other utilities are allowed to be placed inside the casing without the prior express written consent of the District and a satisfactory hold harmless Contract.

21.5 Casing Pipe

Provide welded steel pipe of the minimum diameter and thickness approved by the District. The casing ID shall be at least four-inches larger than the carrier bell OD. Provide pipe of sufficient wall thickness and axial strength to withstand the forces encountered during the jacking operation, but in no case less than 3/8 inch. The casing shall be designed to withstand all imposed loads plus a corrosion allowance of 1/4 inch.

Fabricate the pipe in conformance with ASTM A 252; Grade 2 except the hydrostatic test is waived. Provide tapped grout holes at the top of the casing at reasonable intervals. Install plugs in the tapped holes.

21.6 Joints

Weld sections of casing pipe with a continuous circumferential weld. Provide stress transfer across the joints capable of resisting the jacking forces involved.

21.7 Casing End Seals

Seals shall be 1/4 inch (minimum) thick, pull on style end seals fabricated from EPDM synthetic rubber with stainless steel bands and clamps. End seals shall be as manufactured by PSI Industries or approved equal.

21.8 Carrier Pipe Skids

Provide custom-engineered skids/isolators to isolate the carrier pipe from the casing. The insulator shall consist of a PVC insulating liner (90-mil minimum thickness), 12-inch wide, 12-gauge (minimum) steel bands with steel risers and glass reinforced plastic or ultra-high molecular weight runners. The skids shall be designed to properly support the pipe filled with water. The runners shall be designed so that the carrier pipe joints clear the casing by two-inches. The ferrous components of the insulator and steel bands shall be shop coated with a minimum of 10 mills PVC heat fusion coating. All miscellaneous hardware including stud bolts, washers, and nuts shall be 316 stainless steel. Skids shall center the pipe in the casing. Provide skids as manufactured by PSI Industries, Cascade Manufacturing Co., or approved equal.

The minimum number of required skids is 3 per pipe length for the entire length of the casing.

21.9 Sand

Unless specifically required by the District, sand shall not be used in a casing for filling between the casing and carrier pipe. In those instances where the District does require sand, it shall be clean and 90-100 percent will pass the No. 4 sieve. Not more than 5 percent will pass the No. 200 sieve. Sand shall be free from clay and organic material.

21.10 Casing Excavation and Installation

Prior to installing the casing, thoroughly investigate the locations of existing utilities. The contractor shall pothole the casing location to verify that there are no interferences.

Equip the leading section of casing pipe with a jacking head securely anchored to prevent any wobble or variation in alignment during jacking operation. Make every effort to avoid loss of ground outside the jacking head. If excessive ground loss occurs, stop excavation and fill void with grout.

The casing shall be installed in such a manner that it is not damaged or deflected to reduce its true circular diameter.

21.11 Tolerances

A maximum horizontal and vertical tolerance of three-inches per 100 linear feet of jacked casing is permitted.

21.12 Grouting

After jacking is completed, fill voids by pumping grout through grout holes in the casing at any locations of ground loss and elsewhere where voids are suspected. Plug grout holes after grouting. Take care to avoid over-pumping grout and disturbing the improvements the casing was jacked under.

21.13 Carrier Pipe

All pipe installed in casing shall have restrained joints.

Protect pipe as necessary during installation to insure against damage. Install the carrier pipe with the skids located not more than two feet from each end of the pipe joints. The skids shall be adequate in number to hold the pipe to grade, and not less than two skids shall be installed on each section of pipe. Provide skids within 6-inches of each end of the casing.

After installation and testing of the carrier piping, carefully fill the remaining space in the casing with pneumatically placed sand unless directed by the District to leave the casing unfilled. Take care to avoid floating the carrier pipe.

Install casing end seals and secure in place with stainless steel bands. Make seals watertight.

STANDARD SPECIFICATIONS FOR SEWER LIFT STATION

22 Site Work for Sewer Lift Station

22.1 General

This division is supplemental to Division 2 of the District's standard specifications. Provide site grading, all weather access road, sidewalk, landscaping, security fencing and site lighting.

22.2 Submittals

Submittal information shall be provided to the District for the following items:

1. Structural Fill
2. Pipe Bedding
3. Trench Backfill
4. Gravel Base Course
5. Crushed Surfacing
6. Paving
7. Compaction Test Results

22.3 Other Utilities

Before any excavation, thoroughly investigate the locations of underground utilities. Forty-eight (48) hours prior to beginning any underground excavation, notify Utilities Underground Location Center at 811 for location of existing utilities.

Pothole existing utilities where crossings occur prior to trenching and determine if there are interferences. If interferences are found between the existing utilities and the proposed sewer improvements, submit Drawings of the proposed remedy.

22.4 Fencing

Provide an 8-foot high security fence around the entire pump station site, including three rows of barbed wire on top.

Provide a 4-foot wide personnel gate and a 14-foot wide vehicle gate.

The District at its sole discretion may agree to modifications in the fencing to accommodate individual site conditions, including the possibility of eliminating the fence or the barbed wire from the fence.

22.5 Access Road

Provide an all-weather access road for servicing the pump station, valve vault, and emergency generator building. The road shall be designed to meet the following requirements:

1. The road shall be designed suitable for an AASHTO H2O loading.
2. The minimum road width shall not be less than 12 feet.
3. A level turnaround/maintenance vehicle area not less than 40 feet by 40 feet shall be located abutting the wet well, valve vault, and emergency generator building. The level area shall

be located so that the District's hoist truck and vactor truck and diesel fuel truck can access the equipment for maintenance and refueling.

4. The maximum grade on the access road to the pump station shall not exceed 6 percent without written approval of the District.

22.6 Asphalt Concrete Access Road

Asphalt concrete pavement shall comply with Section 5-04 of the Standard Specifications. Provide a minimum of 3-inches of compacted asphalt concrete. The maximum compacted depth of any one lift shall not exceed 3-inches.

22.7 Concrete for Lift Station Structures

This division is supplemental to Division 3 of the District's standard specifications.

Provide a precast concrete wet well for a submersible pump station and precast concrete valve and meter vaults.

The minimum wet well size shall be sized to provide a minimum operating volume between lead pump start and stop of 2.5 times the pump's rated capacity assuming six pump starts per hour. In addition, the wet well shall be sized to provide storage above the operating level for that portion of the contents of the force main that can be drained back into the wet well.

The wet well diameter shall be sized to comply with the pump manufacturer's minimum clearance requirements.

22.8 Concrete Submittals

Submit shop drawings for favorable review of all materials and equipment specified herein.

Submit the following calculations stamped by a civil District Engineer registered in the State of Washington for favorable review:

1. Wet well sizing calculations.
2. Buoyancy calculations in areas of high groundwater.

22.9 Concrete Design Criteria

Pre-cast concrete manholes shall conform to ASTM C-478. The rubber gasket joint shall conform to ASTM C-443. Additional reinforcement shall be provided within the pre-cast concrete structure at all penetrations, openings, joints, and connections. The additional reinforcement shall be provided to prevent damage during shipping, handling and installation. All damaged units shall be rejected.

Pre-cast vaults shall conform to ACI 318-99 and be constructed to the equivalent dimensions and functional characteristics of the specific product identified on the construction drawings. Pre-cast vaults shall be constructed to withstand anticipated construction loads that occur during transport, handling, and placement as well as the anticipated design loads.

Design loads shall include the anticipated soil pressures (150 lb. /ft³ min.), hydrostatic loads, and H-20 vehicular load rating.

22.10 Finishes

22.10.1 General

This division covers that work necessary for providing all materials, equipment, and labor to coat all items in accordance with these specifications.

Coating shall be done strictly in accordance with manufacturer's instructions and in a manner satisfactory to the District. The dry film thickness listed in the "Materials" section of this Division must be met, regardless of the applied film thickness or number of coats.

Carefully observe all safety precautions stated in the manufacturer's printed instructions. Provide adequate ventilation and lighting at all times.

Bring all materials to the job site in the original sealed and labeled containers of the paint manufacturer. Materials shall be subject to inspection by the District. In addition, provide one unbroken gallon container of each type and color of paint and each type of solvent and thinner used.

22.10.2 Submittals

Before beginning any painting or coating, submit a list of coatings and manufacturers intended for use for review by the District. Include the application each coating is intended for, any surface preparation, number of coats, method of application, and coating thickness. Provide Material Safety Data Sheets for all materials to be used including solvents. Submit this information in accordance with the requirements regarding shop drawings included herein. Provide a schedule of coating operations and inspection timing. Coating inspections will be scheduled based upon Developer-provided schedule, update schedule weekly or as necessary.

22.10.3 Surface Preparation and Application

Prepare surfaces in accordance with the recommendations of the manufacturer of the coating to be applied to the surface, or the surface preparation requirements of these specifications, whichever are stricter.

Coatings shall only be applied during weather meeting the recommendations of the coating manufacturer. Air and surface temperatures shall be within limits prescribed by the manufacturer for the coating being applied, and work areas shall be reasonably free of airborne dust at the time of application and while coating is drying.

Developer shall take any and all measures necessary to prevent over-spray. Should over-spray occur, the Developer is responsible for all costs associated with any damage that occurs as a result of over-spray.

Materials shall be mixed, thinned and applied according to the manufacturer's printed instructions.

22.10.4 Coating Quality

The paint and paint products mentioned in these specifications are intended as a *standard of quality*. *Substitutions may be considered* but must be approved by the District prior to application. Offers for substitutions will not be considered which decrease film thickness, solids by volume or the number of coats to be applied or which propose a change from the generic type of coating specified herein. All substitutions shall include complete test reports to prove compliance with specified performance criteria. Paint application shall be in strict accordance with manufacturer's printed instructions except that coating thickness specified in paint schedule herein shall govern.

22.10.5 Waste Products

At least 10 days prior to starting any surface preparation activities, submit a waste handling plan to the District Engineer for review and approval. This plan shall outline the wastes generation expected, the collection and containment methods, transportation methods, and disposal procedures. Information required in the plan includes, but is not limited to, surface preparation methods, surface preparation materials (i.e., types of abrasives, collection and containment methods for paint chips, spent abrasive materials, waste characterization procedures, and proposed transportation methods).

Provide a copy of the hazardous or dangerous waste manifests for any wastes designated as being or containing hazardous or dangerous constituents in accordance with the applicable federal, state, and local regulations, including, but not limited to, 40 CFR 261 and 262 and WAC 173-303-070. In addition, provide a certification(s) of acceptance from all disposal sites to which any waste materials have been transported.

The District will have the right to approve or disapprove of the transportation and disposal methods and the disposal site selected by the Developer.

Make arrangements for disposal, subject to submission of proof that the District(s) of the proposed site(s) has a valid fill permit issued by the appropriate governmental agency. Submit intended haul route plan, including a map of the proposed route(s). Provide watertight conveyance for liquids, semi-liquids, or saturated solids that tend to bleed during transport.

Cleaning and disposal shall comply with all federal, state, and local pollution control laws. Provide acceptable containers for collection and disposal of waste materials, debris, and rubbish.

The DEVELOPER is responsible for repairing any damage due to overspray or spills.

22.10.6 Substitutions

Substitutions of the coatings of other manufacturers shall be considered only if equivalent systems of coatings can be provided and only if a record of satisfactory experience with the system in equivalent applications is available.

22.10.7 Materials

Wood & Plywood,

One coat Tnemec Series 36, 2 to 3 mil DFT

Two coats Tnemec Series 28, 2 to 3 mil DFT per coat

Gypsum Wallboard

One coat Tnemec Series 51-792 PVA Sealer, 2 mil DFT

One coat Tnemec Series 66 Hi-Build Epoxoline, 3 to 5 mil DFT

One coat Tnemec Series 73 Endura Shield III, 3 to 5 mil DFT

Metals (Exterior)

Surface preparation SSPC-SP-6 (commercial blast)

One coat Tnemec Series 66 Hi-Build Epoxoline, 3 to 5 mil DFT

One coat Tnemec Series 73 Endura Shield III, 3 to 5 mil DFT

Note: Do not coat aluminum or stainless steel unless otherwise noted on Drawings.

Metals (Interior)

Surface preparation SSPC-SP-6 (commercial blast)

One coat Tnemec Series 66 Hi-Build Epoxoline, 3 to 5 mil DFT

One Coat Tnemec Series 66 Hi-Build Epoxoline, 3 to 5 mil DFT

Note: Do not coat aluminum or stainless steel unless otherwise noted on Drawings.

Ductile Iron Pipe and Check Valves

*Pipe shall be emptied of water for a **minimum of 12 hours prior to surface preparation and painting.** Pipe shall not be filled with water until coating is dry.*

Non-submerged pipe and valves in check valve vault surface preparation SSPC-SP-6 (commercial blast) color “near black”

Submerged pipe in wet well surface preparation SSPC-SP-10 (white blast) color “gray-white”

One coat Tnemec Series 66 Hi-Build Epoxoline, 3 to 5 mil DFT

One Coat Tnemec Series 66 Hi-Build Epoxoline, 3 to 5 mil DFT

Concrete Wet Well and Check Valve Vault (Exterior Below Grade)

Surface preparation - clean and dry. Follow manufacturer’s recommendations.

One coat Tnemec Series 46H-413 Hi-Build Tnemec-tar, 16-20 mil DFT

Concrete (Exterior Above Grade)

Surface preparation - clean and dry. Follow manufacturer’s recommendations.

One coat Prime-a-Pell 200

One coat Conformal Clear - 125 square feet/gallon

Saturate without wash-down

Concrete Wet Well Interior

The interior of the concrete wet well, and concrete overflow structures, shall be coated with a Tnemec Series 435 PermaGlaze Lining, MotarClad 218 Resurfacer or equal for a System A epoxy coating. Comply with manufacturer’s recommendations for surface preparation and application. Completed coating thickness shall be 80 mils.

Concrete Valve Vault Interior

Interior Concrete Coat interior concrete floors, walls, and ceiling.

Surface Preparation: Follow manufacturer's recommendations for preparation and coating.

Allow 28 days cure time for concrete, or until passing the ASTM D 4263 Plastic Mat Test.

Surface shall be clean, dry, and free of contaminants.

Primer: Tnemec Series 66 Hi-Build Epoxoline, applied at 4.0-6.0 mils dry film thickness (DFT) Finish: Tnemec Series 73 Endura Shield III. Applied at 3.0 to 5.0 mils dry film thickness

22.10.8 Coating Inspection

The District shall inspect and approve all surface preparations prior to application of any coating. Provide 24-hour notice prior to surface inspection needs.

For metals exposed to exterior atmospheric conditions, first coat of paint or primer must be placed within four (4) hours of passing inspection. Bare steel must be re-blasted and re-inspected if not successfully coated within this four-hour time frame, at the DEVELOPER's expense.

Use the Pictorial Surface Preparation Standards for Painting Steel Surfaces (VIS-1) by the Steel Structures Painting Council (SSPC) as a visual standard for inspection of surface preparation of metal surfaces.

Each coat shall be inspected prior to application of the next coat. Areas found to contain runs, overspray, roughness, streaks, laps, sags, or other signs of improper application shall be repaired or recoated in accordance with the manufacturer's recommendations. Finish coats shall be uniform in color and sheen. Surface preparations and coatings not inspected and approved by District will be uncovered for inspection and approval at no additional cost to the District.

The completed coating shall produce a minimum dry film thickness in accordance with the specifications as determined by the micro-test thickness gauge or comparable instrument. In areas where this thickness is not developed, sufficient additional coats shall be applied to produce it.

Developer shall inspect the completed coating on metal surfaces in the presence of the District for pinholes and holidays with a tinker and razor or other low voltage (under 100 volts) holiday detector. Areas found to contain pinholes shall be repaired or recoated in accordance with the manufacturer's recommendations. Provide 72-hour notice to District prior to performing test.

22.10.9 Compatibility of Coating

The Developer shall be responsible for compatibility of all paint and coating products.

22.10.10 Acceptance of Coatings and Painted surfaces

Acceptance of the completed coatings shall be based on the proper application and proper preparation of the coated surfaces, and a finished product that does not contain runs, drips,

surface irregularities, overspray, color variations, scratches, pinholes, holidays, and other surface signs that detract from the overall appearance of the finished project.

23 General Lift Station Specifications

This division covers that sewer lift station work necessary for furnishing and installing electrical equipment, including standby emergency generator and automatic transfer switch.

The requirements set forth in these specifications shall be considered minimum requirements. The District reserves the right to change, or delete any of the requirements, or add additional requirements, either generally from time to time or on a project-by-project basis as the District deems necessary.

23.1 Scope of Work/Required Submittals

The work for each pump station shall consist of the following items:

1. Two submersible non-clog sewage pumps (each sized to handle the design flow which includes the contributing basin as determined by the District)
2. Concrete wet well
3. Valve/meter vault(s), piping, valves, force main, flow meter, pressure gauges, and accessories
4. Controls
5. Telemetry
6. Automatic transfer switch
7. Diesel powered emergency generator
8. Load bank
9. Building housing the controls and emergency generator
10. Site work including fencing
11. Miscellaneous work required to provide a fully operational pump station.

With the Board of Commissioner's approval, as an option to providing an emergency generator, a pump station serving less than 25 persons or less than 10 ERUs (at ultimate buildout of the pump station's service area) may provide the following:

1. An approved connection for a mobile generator
 2. Onsite wet well storage equal to the longest power outage in the last 10 years.
- Pump stations serving a total development of one or two ERUs shall conform to the District's grinder pump station specifications. Provide submittals of each item specified in this division to District Engineer for approval. Submittal information shall be provided to the District for the following items:
- Utility Meter Enclosure
 - Pump Control Panel
 - Motor Starter Unit
 - Transformer Circuit Breakers
 - Conduit and Fittings
 - Outlet and Junction Boxes
 - Electrical Handhole

- Wire and Cables Switches and Receptacles
- Float Switch Flood Switch Autodialer
- Engine Generator Submittals (see below)
- Automatic Transfer Switch

Submittals are required for all items installed on this contract. Submit 4 copies of each submittal to:

West Sound Utility District
2924 SE Lund Avenue
Port Orchard, WA 98366
Attn: Operations Manger

Submittal data for each item shall contain sufficient information on each item to determine if it is in compliance with the contract requirements.

Items that are installed in the work that have not been approved through the submittal process shall be removed and an approved product shall be furnished, all at the Developer's expense.

Shop drawing review will be limited to general design requirements only, and shall not relieve the Developer from responsibility for errors or omissions, or responsibility for consequences due to deviations from the contract documents. No changes may be made in any submittal after it has been reviewed except with written notice and approval from the District.

Shop drawings shall be submitted on 8½" x 11", 11" x 17", or 22" x 34" sheets and shall contain the following information:

Project Name

Prime Contractor and Applicable Subcontractor

District's Name

Submittals that do not comply with these requirements may be returned to the Developer for re-submittal. Acceptable submittals will be reviewed as promptly as possible, and transmitted to the Developer not later than 10 working days after receipt by the District Engineer. Revise and submit as necessary.

Submit the following items stamped by a professional District Engineer registered in the State of Washington in a single submittal package for favorable review by the District:

1. Calculations

- a. Hydraulic calculations
- b. Wet well sizing and operating levels
- c. Wet well buoyancy (in areas of high groundwater)
- d. Thrust restraint calculations
- e. Combination air valve sizing (when required)

2. Drawings

- a. Site plan - pump station, valve vault, emergency generator building, piping, power, fencing, access, site improvements
- b. Plan & profile - Pump station & valve vault with operating levels
- c. Plan & profile - Emergency generator & controls building

- d. Electrical - single line diagram
- e. Electrical - elementary/control diagram
- f. Electrical - power and lighting plan with conduit and wire sizing
- g. Combination air valve vault detail - where required
- h. Plan & profile - Force main
- i. Plan, Sections, & Elevations - emergency generator/control building

In addition to the submittals specified above, submit shop drawings where called for in the individual specification sections.

23.2 Codes and Standards

Provide all electrical work in accordance with latest edition of National Electrical Code, National Electrical Safety Code, Washington State Electrical Code, and local ordinances. If any conflict occurs between government adopted code rules and these specifications, the codes are to govern. All electrical products shall bear a label from a certified testing laboratory recognized by the State of Washington. Recognized labels in the State of Washington are UL, ETL, and CSA-US.

16.4 Identification of Listed Products. Electrical equipment and materials shall be listed for the purpose for which they are to be used, by an independent testing laboratory. When a product is not available with a testing laboratory listing for the purpose for which it is to serve, the inspection authority may require the product to undergo a special inspection at the manufacturer's place of assembly.

23.3 Permits/Licenses and Fees

The Developer shall acquire and pay for all necessary permits, which may include:

Right-of Way Permit (Kitsap County Department of Public Works)

Street Use Permit (City of Port Orchard)

Building Permit (City of Port Orchard, Kitsap County)

Environmental Permits

Department of Labor & Industry (Electrical Permit)

Conform to the requirements of these permits and all other permits issued for this project.

All Fees associated with all permits, inspections and utility service connections are the sole responsibility of the Developer.

23.4 Nameplates and Identification

Provide engraved nameplates indicating load served, voltage, and phase for every circuit breaker, panel board, motor starter, disconnect switch, and fused switch. Provide a name tag for each piece of equipment and for each circuit and/or control device associated with the equipment. Name plates shall be phenolic-engraved and shall clearly identify the associated component. Color shall be black background with white letters. Tags shall be securely attached.

Identify each wire or cable at each termination and in each pull box, using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each

electrically different conductor shall be uniquely numbered. Identify panel board circuits using the panel board identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as approved by the District Engineer. Identify each wire or cable in each pull box with plastic sleeves having permanent markings. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

23.5 Service and Metering Standards and Codes

Work involving service installation shall be done in accordance with Electrical Power Provider standards and the National Electric Code. Service equipment shall be listed and labeled by UL as "suitable for use as service equipment".

Utility Meter Enclosure. Meter enclosure shall be a Circle AW and as required to meet the requirement of the Electrical Power Provider. Developer shall coordinate with the Electrical Power Provider serving utility on the type of metering required and shall provide all labor and material necessary to meet Electrical Power Provider requirements.

Service Disconnect Switch Circuit Breaker Type. Circuit breakers shall be molded case thermal-magnetic type and meet molded case circuit breaker specifications adopted by the District. Acceptable Switch Manufacturers: Cutler/Hammer, General Electric, Siemens, Square-D, or Westinghouse.

Ground Electrode System. The grounded conductor and ground bus shall be connected to the grounding electrode system via the grounding electrode conductor as indicated on system one-line diagram, and the equipment enclosure plan and elevation views. The system shall be as indicated in Section 250-VII of the National Electrical Code.

23.6 District Standard Locks & Keys

All devices requiring locks, including but not limited to doors, gates, access hatches, convenience hatches, etc. shall have locks provided and cored to match District standard lock and keys. If construction cores are utilized during the project, Developer shall provide District with construction key(s) for all temporary locks.

23.7 Operation & Maintenance Manuals

Three complete sets of O&M Manuals approved by the District shall be supplied to West Sound Utility District two weeks prior to startup. A draft copy of the O&M Manual shall be submitted to the District for review of a minimum of four weeks prior to startup.

The manuals shall be bound in identical hardcover 3-ring binders with the pump station name, volume number, and set number clearly shown on the outside of each cover.

The manuals shall be divided into sections and subsections as necessary to describe each component of the complete pump station and organized in a manner similar to this

specification. An overall table of contents shall also be provided. The O&M Manuals shall cover but not be limited to the following subjects:

1. Summary sheets with equipment item, manufacturer, serial number, nameplate data, local representative (name, address, telephone number), and maintenance schedule.
2. Start up
3. Normal operation
4. Emergency operation
5. Normal shut down
6. Operator safety
7. Lubrication
8. Maintenance
9. Parts identification with a complete parts breakdown for all equipment
10. Recommended spare parts

23.8 Lift Station Installation, Startup and Acceptance

Factory representatives shall inspect and certify in writing the proper installation and lubrication of their respective equipment prior to startup, witness the startup test, and make the necessary adjustments to the equipment for satisfactory operation. Startup testing shall be witnessed by District personnel. Schedule all pertinent testing with the District Inspector. The representatives shall also be responsible for instructing the District's personnel in the operation and maintenance of the station.

The Developer shall be responsible for correcting and/or replacing all damaged and defective or missing items. Submit Manufacturers affidavits for the following equipment:

1. Pumps and motors
2. Control panels
3. Emergency generator and automatic transfer switch
4. Instrumentation

Schedule training sessions with the District at times agreed upon by the District.

23.9 As-Constructed (Record) Drawings

Prior to accepting the system, the Developer shall deliver a complete set of acceptable "As-Constructed" drawings to the District. Drawings shall be made on clean, unmarked prints for this project in accordance with the following standards.

Submitted as-constructed drawings shall be (2) full-size (D-size) set on Mylar and an electronic copy of all record drawing files on CD-ROM in AutoCAD 2000 format or later.

24 Electrical/Control Panel

24.1 General

Furnish an electrical/control panel for automatic control of a duplex pumping station in a stainless steel enclosure. Panel to be designed for control of at least two submersible pumps. The control panel shall be supplied by the pump supplier to insure compatibility and proper pump protection. *The electrical/control panel shall be designed for three phase, 480-volt incoming power.* The panel shall be UL 913 industrial control labeled.

24.2 Enclosure

The electrical/control panel shall be completely fabricated, and instruments installed and wired in the manufacturer's factory (where possible). All wiring shall be completed and tested prior to shipment. All external connections shall be by way of numbered terminal blocks. Panel cutouts for instruments and devices shall be cut, punched or drilled and smoothly finished with rounded edges.

Enclosures shall be no larger than shown on the Drawings to accommodate the available space provided.

Control equipment panels shall be enclosures conforming to the requirements of the National Electrical Manufacturers Association (NEMA).

- In addition to the NEMA standards, the panels shall conform to the following requirements: Minimal metal thickness shall be 12-gauge pre galvanized steel.
- All doors shall be rubber-gasketed with continuous full-length hidden hinge and key locking latch mechanism.
- Enclosure shall be provided with stainless steel pad lockable vault handles with roller rods providing 3 point latching system.
- Two screened and gasketed louver vents with stainless steel rainproof covers. One vent shall be equipped with a cooling fan and thermostat to maintain the environmental conditions required for the equipment to be installed.
- Enclosure shall be equipped with an integral heater and thermostat to maintain the environmental conditions required for the equipment to be installed.
- Enclosure shall include back pans for mounting proposed equipment.
- Enclosure shall be provided with an interior swing door.
- Enclosure shall be provided with a light and switch.
- Enclosure shall be provided with a 15-amp receptacle.
- Enclosure shall have a drip shield mounted on the front of the panel that conveys water away from the front of the panel to the side.
- Enclosure shall be a Hoffman or equal.

24.3 Motor Starters and Overloads

Motor starters shall be open frame, *across the line* NEMA rated with individual overload protection in each leg. Motor starter contact and coil shall be replaceable from the front of the starter without removing from its mounted position. Overload heaters shall be block type, utilizing melting alloy spindles, and shall have visual trip indication. Overload shall be sized for the full load amperage draw of the pumps. Definite purpose contactors, fractional size starters and horsepower rated contactors or relays shall not be acceptable.

24.4 Circuit Breakers

Circuit breakers shall be indicating type, providing "on-off-trip" positions of the operating handle. When the breaker is tripped automatically, the handle shall assume a middle position indicating "trip."

24.5 Control Power Transformer

A control power transformer shall provide 120 volts for the external level sensing circuits if required) and other pilot circuitry. Fuse or circuit breaker shall protect the primary and secondary of the control power transformer. The panel will incorporate a separate motor thermal protection circuit for each pump motor. The circuit shall be manually reset after a stator thermal overload but automatically reset after a power failure.

24.6 Operator Interface Devices General

This section covers all components required in a motor control center, pump control panel, control panel, or remote control station that require operator interface devices and control relays. All control relay components shall be mounted on DIN rails. Terminals shall be provided for all incoming and outgoing.

24.7 Selector Switch

Units shall be 30.5 mm NEMA type 4/4X/13, corrosion-resistant/watertight/oil-tight, type selector switches with contacts rated for 10 amperes continuous at proper operating voltage. Units shall have standard size, black field, legend plated with white markings as indicated. Operators shall be black knob type. Units shall have the number of positions and contact arrangements and spring return function if any) as shown. Units shall be single-hole mounting, accommodating panel thicknesses from 1/16 inch minimums to 1/2 inch maximum.

24.8 Pushbuttons

Units shall be 30.5 mm NEMA type 4/4X/13, corrosion-resistant/watertight/oil-tight, type push buttons with momentary contacts rated for 10-ampere continuous at proper operating voltage. Button color shall be as specified in control panels and shall have a full guard. Unit shall have standard size legend plated with black field and white marking as indicated, contact arrangements shall be as shown:

24.9 Indicating Pilot Lights

Indicating pilot lights shall be 30.55 mm NEMA type 4/4X/13, corrosion resistant/watertight/oil-tight, full voltage, push-to-test, high visibility 28 chips LED type. Pilot lights shall be rated for the proper operating voltage. Appropriate lens caps shall be provided as shown on Drawings.

24.10 Terminal Blocks

All wires between panel-mounted equipment and other equipment shall be terminated at terminal blocks. Switches shall be terminated at the terminal blocks with crimp-type, pre-insulated, ring-tongue lugs. Lugs shall be of the appropriate size for their terminal block screws and for the number and size of the wires terminated. All wires shall be labeled with the circuit number and common function.

Terminal blocks shall be one-piece, molded, plastic blocks with screw-type terminals and barriers rated for 300 volts.

Terminals shall be double-sided and supplied with removable covers to prevent accidental contact with live circuits.

Terminals shall have permanent, legible identification, clearly visible with the protection cover removed.

24.11 Relays

Relays for control, alarm and report-back functions shall be supplied as required to provide external keying and control switching. Relays shall be 120-volt A.C., or 12- or 24-volt D.C. as shown on the Drawings. Relays shall be plug-in type with dust covers and shall be interchangeable with one another. Relays of different voltage rating shall not be interchangeable. One spare relay of each type shall be provided. Contacts shall have NEMA rating designations of A150 and P150 (10 amps at 120 volts, 60 Hz, and 5 amps at 120 volts, D.C.). All relays shall have LED indicators to signal when the coil is energized. Provide adjustable time relays on all alarm and shut down circuits to prevent nuisance tripping of other alarm points. Time delay relays for these functions may not be shown on the Drawings; however, provide as required on all circuits.

Signal circuit switching shall be accomplished with analog signal switching relays and shall be provided to switch either 4 to 20 MA D.C. or 1 to 5V D.C. signals. Units shall have double-throw dry circuit contacts in a break-before-make configuration rated for 15VA minimum. The number of poles and coil energization voltage shall be as shown on Drawings. Signal switching relays shall be sealed to prevent entry of contamination in the form of dust, dirt, or moisture.

24.12 Wireways

All wires in the control panel shall be color coded by voltage. Power supply wires shall be isolated from the control wires. Control wiring is to be run in wire channels and not simply tied together.

24.13 Solid-State Control Switchboard

A self-contained solid-state control switchboard device to operate two (or more pumps and two alarms shall be included. The unit will display status information for pumps, pump fault, mode of operation, next to start and level alarms. Controller shall permit all essential operating parameters to be adjusted via the front key pad including setting levels; time delays; sensitivities; pump alternation; hand-off-auto; and fault resets. The unit will accept level information from MultiTrode conductance control (10 level sensor). Included with this device shall be the following functions:

An electronic alternator providing automatic alternation of the pumps under normal operating conditions and allowing both pumps to operate simultaneously if there are high inflow conditions.

24.14 Wet Well Level Indication

Improved pump station efficiency by automatically changing the pump start levels to suit demand. Accomplished by setting a start frequency for the station. For instance, if four station

starts per hour have been set and the LEAD pump is called earlier than 15 minutes from the last pump operation, then the controller will automatically increase the level at which the pump starts, up to the next sensor.

24.14.1 Redundant Floats and Level Alarm

A series of redundant backup float switches will operate on a separate relay system. They will be a series of **1. Low float** (shuts pumps down), **2. Off/Stop float** (shuts off normal pumping operation), **3. On/Run float** (turns on pumping operation), **4. Lag float** (calls for second pump to run to supplement current pump running), **5. High level alarm/float** (calls for both pumps and alarms thru the dialer. If the high float switch activates, both pumps will be turned “on” *(a separated start time delay relay will be included so that both pumps do not start simultaneously)*). A high water level float shall be provided for alarming on a high water condition. A high-level alarm contact shall be wired to the remote alarm system. A low water level float shall be provided for alarming on a low water condition, and low-level contacts shall be wired to the remote alarm system.

If the low-level float switch is activated, the solid-state system will be bypassed and both pumps will be turned off.

24.15 Maximum pump off time

If no pump has activated within the set time the Lead pump will be run. Operator selectable run time and run interval from 15 minutes to 10 hours. Set for 60 minutes.

24.16 Random duty start delay

This function delays the start of the Lead pump by a random amount from zero to a selectable maximum time. Helps keep wet well clean.

24.17 Interrupt delay

Ability to select a delay to prevent any pump starting within a certain period of another pump starting or stopping. Used to prevent water hammer problems.

24.18 Lead lockout on consecutive starts

This function helps to detect failure of the Lead pump by detecting repeated starts of the Lag pump.

24.19 Start/Stop delay

Programmable start and stop delays for all pumps and level alarms. Hand-Off-Auto (H-O-A) selector switches for each pump.

24.20 Run lights

Lights to show that a pump is running pump failure and high water in lift station shall be included in the station.

24.21 Wet Well Alarm

A high and low wet well water alarm shall be provided. Provide an RS 232 communications link.

24.22 Redundant Floats and Level Alarm

A high and low float switch will operate on a separate relay system. If the high float switch activates both pumps will be turned "on" (a separated start time delay relay will be included so that both pumps do not start simultaneously). A second high water level float shall be provided for alarming on a high water condition. A high-level alarm contact shall be wired to the remote alarm system. A second low Water level float shall be provided for alarming on a low water condition. A low-level alarm contact shall be wired to the remote alarm system. If the low-level float switch is activated, the solid-state system will be bypassed and both pumps will be turned off.

24.23 Multismart Intelligent Pump Station Controller

The following additional functions will be provided via a solid-state **MultiSmart Intelligent Pump station supervisor**. Included in the functions of the MultiSmart Intelligent Pump station supervisor will be the features:

- Elapsed time meters.
- Pump starts counters.
- Motor protection to include over-current, under-current, phase fail and rotation, ground short protection.
- Monitor 3-phase volts, all three legs. Include a data logging capability for supply volts and a time stamp for the data. Provide temporary or permanent pump lockout based on supply volts.
- Automatic motor insulation test (meggering) of each pump motor with an automatic lockout if a pump motor resistance falls below a set value.
- Pump flow data logger. Provide last flow, flow rate, total flow and total pumped for station. Continually update flow data and provide data via display panel and via RS232 connection.
- Data logger of events. Log, time stamp and display all faults, including non-critical, critical, seal fail, delay fault, under current, over current, starts per hour exceeded, motor insulation and low flow.
- Provide battery backup for station supervisor.
- Provide an autodialer and phone modem for remote annunciation of alarm conditions listed on Drawings. Station supervisor to include security system as part of the program to prevent unauthorized access.
- Autodialer and Remote Monitoring System: The required system shall be a **MISSION Communications Model M800 RTU** with the associated service or equivalent. The Developer shall provide all necessary equipment, software, programming, setups, training, testing and coordination for providing a fully operating autodialer system. As part of the purchase of the MISSION equipment, the Developer shall pay for three years of monitoring services. The District will provide the necessary information to the Developer for setting up the account. The Developer is responsible for coordinating with the District and the provider of this service during the account setup process.

- Control panel intrusion switch with key disable switch will also be required.

24.24 Alarm warning light on outside of enclosure

24.25 Wiring Diagrams

Wiring diagrams shall be provided at a centralized location in the electrical enclosure. The diagram shall show the exact devices inside the unit and shall not be a generic diagram. The supplier of the equipment shall have the capability to provide revisions to electronic files of wiring diagrams at a local office. The wiring diagrams must be provided with product submittals in order to be considered for review. Supplier shall provide a disk copy of all drawings in AutoCAD format.

One (1) Complete set of weatherproof Wiring diagrams located in door pocket of enclosure.

24.26 Wire and Control Relay Identification

All control wire in the electrical enclosure shall be marked with shrink type wire markers on both ends of wire. All control relays provided in the enclosure shall be permanently labeled. The label for the control relays and wiring shall match the wiring diagrams.

24.27 Disconnects

Provide disconnects of proper rating in all cases where shown, and provide additional disconnects if required by code. Provide enclosures suitable for the environment where they are installed.

24.28 Overcurrent Devices

Provide overcurrent devices, being fused disconnects or molded case circuit breakers, as shown on the Drawings. Provide a spare set of fuses in all cases where fusible switches are employed. Devices shall have ratings as shown, except where changes in requirements makes it necessary to provide ratings better suited for the load. Developer shall be responsible for checking ratings of motor overload elements for proper size.

Overcurrent devices shall be NEMA rated.

24.29 Circuit Breakers

Molded case circuit breakers shall be quick-make and quick-break type. They shall have wiping type contacts. Each shall be provided with arc chutes, individual trip mechanisms on each pole. Two and three pole breakers shall be common trip. All breakers shall be calibrated for operation in an ambient temperature of 40 degrees C, and automatically derate itself so as to better protect its associated conductor. Molded case circuit breakers shall be trip-free. Each breaker shall have trip indication independent of the ON or OFF positions. All ratings are to be clearly visible.

Where indicated on the drawings and in the combination motor starter/motor control center schedule, furnish instantaneous magnetic trip only circuit breakers for motor short circuit protection. The magnetic trips shall be adjustable and accessible from the front of all these circuit breakers.

Breakers shall have lugs UL listed for both copper and aluminum.

Breakers shall have the interrupting rating and trip rating indicated on the drawings.

Breakers covered under this specification may be installed in switchboards, panel boards, motor control centers, combination motor starters, and individual enclosures, fuses and circuit breakers shall be installed in their respective enclosures and locations in such a manner as to insure tight connections so as to preclude arcing and overheating.

25 Conduit and Fittings

25.1 Conduit

Rigid or intermediate galvanized conduit shall be used throughout, except in areas where other material may be used as indicated below:

- EMT may not be used inside the building above-grade for lighting and receptacle circuits and where not subjected to physical damage and corrosive atmosphere. A ground wire shall be provided in all EMT conduit.
- Flexible conduit shall be used for final connection to motors and vibrating equipment. Jacketed flex with threaded fittings shall be used outside and in wet corrosive atmosphere.
- Rigid galvanized conduit installed in a corrosive atmosphere such as a sewage manhole or lift station shall be PVC coated, internally and externally. The PVC coated conduit shall have a polyvinylchloride coating and shall be bonded to the galvanized outer surface of rigid steel conduit. The bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the plastic. The thickness of the PVC coating shall be a minimum of 0.035" (35 mil) (40 mil nominal).

All Spare conduits shall contain one 3/16 inch diameter nylon pull rope.

25.2 Fittings and Clamps

Use threaded fittings for all rigid and intermediate conduit.

Support all conduit raceways as required by NEC. Conduit clamps shall be on the one-hole type of hot-dip galvanized malleable iron. Clamp backs and nesting backs shall be of similar material and finish. Conduit clamps and hangers installed in corrosive areas and those exposed to weather or moisture shall be stainless steel.

25.3 Outlet and Junction Boxes

Use cast boxes with threaded hubs for all rigid and intermediate conduits. All boxes shall be of proper size to accommodate devices, connectors, and number of wires present in the box.

25.4 Hand Holes and Vaults

Hand holes and vaults: Pacific International Pipe and District Engineering, Inc. (PIPE Inc), or approved equal. Handhole and covers shall be H2O wheel load rated. The covers for electrical handholes shall be labeled "Electrical" with a weld bond.

Conduits entering handholes shall have grounding bushings installed and the conduit ends shall be sealed with Dotti Handifoam sealing compound. Where conduits enter through sides of handholes, the penetration shall be made watertight.

26 Wire and Cables

26.1 Conductors

All electrical conductors shall be in accordance with the National Electrical Code (NEC). Conductors shall be 600-volt class sized for the current to be carried.

Conductors shall be copper:

- Sizes AWG No. 14, 12, and 10 shall be solid except in control panels; all larger conductors shall be stranded.
- Type THHN/THWN, 90 degree C or higher rating dry or wet for No. 8 and smaller feeders and branch circuits; in all areas except as noted otherwise.
- Type XHHW-2, 90 degree C dry or wet for No. 6 and larger feeders and branch circuits.

Conductors used for power circuits shall not be smaller than No.12. Control conductors shall be No. 14, unless otherwise specified in this section.

26.2 Connectors

Utilize Ideal Industries' "Wing Nut" or 3M Company's "Scotchlock" pre-insulated connectors for splices and taps in conductors No. 10 AWG and smaller. For No. 8 AWG and larger conductors, utilize T&B compression connectors. Compress using recommended die and tools.

26.3 Signal Conductor

Signal conductor cable shall be individually twisted, shielded pairs per ASTM B-8 for all instrumentation wiring. Conductors shall be tinned copper with color-coded 105 degree C rating, with PVC insulation and individual conductor jacket of nylon. The cable shall have an overall PVC jacket. The insulation system shall be rated for 300 volts. Signal cable installed to outside sensors shall be rated for outdoors and below grade applications. Signal wire shall be Beldon or equal.

26.4 Color Coding

Provide for service, feeder, branch, control, and signaling conductors. Color shall be green for grounding conductors, and white for neutrals. Where neutrals of more than one system are installed in the same raceway or box, other neutrals shall be white with colored stripes (except green). The color of underground conductors in different voltage systems shall be as follows:

- 480/277 volt, three-phase
- Phase A, brown Phase B, orange Phase C, yellow

26.5. Wire Description

Refer to the one-line diagram in the Drawings for a description of conductors required by feeders shown on the diagram. All other power wiring shall be sized per National Electric Code, based on the amperage capacity of the breaker from which it is used.

26.6 Installation

Conduct a megger test on all branch circuit, feeder and service entrance conductors and submit results to the District Engineer.

27 Switches and Receptacles

27.1 General

Standard wall switches shall be single- or double-pole, standard or three-way, as shown on the drawings and shall be AC quiet type rated 20 amp, 125/277 volt with screw terminals. Wiring devices shall be ivory colored for general use and brown when installed in service areas or dark finished walls. Approved manufacturers are:

- *Manufacture SwitchReceptacle*
Arrow Hart 1991 Series 5252 Series
Bryant 4901 5252
General Electric 5951 4060
Hubbel 1221 5252
P&S 20AC1 5252

Provide GFCI, 20 amp, 125 volt receptacles with push to test button for periodic testing by simulation of a ground fault where identified on the Drawings.

27.2 Plates

Scope: Provide plate for each wiring device or outlet. Device plated receptacles in the valve vault and backflow preventer enclosure shall have weatherproof plates with a hinged cover and shall be Sierra Electric WP series or equal.

Plates for devices in the equipment enclosure shall be of metal, of the same manufacture as the conduit fittings and specifically suited for the device and fitting used.

27.3 Outdoor All-Weather Outlet Covers

Receptacles located in underground vaults, outdoor enclosure, or outside exposed to the weather elements shall be provided with a weather protective outdoor outlet cover. Outdoor outlet cover shall be equal to BWF Manufacturing Inc. Guardian Series. Cover shall have a NEMA 3R rating.

27.4 Position of Outlets

Install symmetrically all receptacles, switches, and outlets shown on the trim, and where necessary, set the long dimension of the plate horizontal or gang in tandem.

28 Grounding

Service and equipment grounding shall be per Article 250 of the National Electrical Code. Verify that a low-resistance ground path is provided for all circuits so an accidental contact to ground of any live conductor will instantly trip the circuit.

29 Intrusion Alarm Switch

29.1 General

Furnish and install intrusion alarm switches on the valve vault, control panel and any other locations as shown on the Drawings. All components shall be suitable for installation in the environment where installed.

29.2 Features

The switch shall be two-pole side plunger type switch with one normally open and one normally closed set of contacts. The switch shall be a Type C and NEMA rated. Provide with a standard box plug-in and connecting cable of significant length to reach a junction box located near the switch.

29.3 Installation

Mount the switch as shown on the Drawings to detect the opening of the door or gate. Connect to the normally open contacts so that the switch is closed when the door is closed and open when the door is open. A factory provided cord should be of significant length to reach from the device to a junction box.

29.4 Acceptable Manufacturers

The intrusion switch shall be Square D, Type C, Class 9007 or equal.

30 General Installation

30.1 General

Install all materials in accordance with electrical code, UL listing requirements and manufacturer's instructions. Secure to structure without play.

Penetrations: Must be provided such as to retain fire ratings. Grout all raceway penetrations.

Clean up: Continually remove debris, cuttings, crates, cartons, etc. Carefully clean wiring devices, cover plates, light fixtures, etc.

Painting: Repaint any electrical items scratched or marred in shipment or installation.

Interconnections: Provide all interconnection wiring between work provided in other divisions and the work provided in this division. All equipment is to be completely wired and fully operational upon completion of the project before final acceptance by the District.

Raceways, devices and boxes: Secure to structure without play, install raceway in the least noticeable location parallel to a building surface (i.e., wall, ceiling, floor) acceptable to District Inspector. Furnish and install all fittings, boxes, extension rings, etc. as required. Provide Class I, Division 1 wiring and conduit seals as required. Install underground conduit 36-inches below grade.

Secure lighting fixtures to structure without play.

30.2 Electrical Site Work

Provide all excavation, trenching, backfill, and surface restoration required for the electrical work.

Trenching shall be to depths as required by code, particular installation, or as shown on the Drawings. Trench width and length as required by the installation or as shown, trench bottom shall be free of debris and graded smooth. Where trench bottom is rock or rocky, or contains debris larger than 1-inch or material with sharp edges, over excavate 3-inches and fill with 3-inches of sand. Separation between new electrical utilities and other utilities shall be 1 foot 0 inches minimum, except gas lines shall be 1 foot 0-inches both vertical and horizontal. Perform crossing of concrete or asphalt only after surface material has been saw cut to required width and removed.

Backfill around raceways shall be 3-inch pea gravel or sand for systems of 600 volt or less. Provide yellow marker tape over raceways below grade. Place backfill material to obtain a minimum degree of compaction of 95 percent of maximum density at optimum moisture content. Moisten backfill material as required to obtain proper compaction. Do not use broken pavement, concrete, sod roots, and debris for backfill.

30.3 Seismic Requirements

All equipment installed on the project shall be anchored, tiled, restrained, or attached to the structure in such a manner that such equipment will remain in place and functioning when subjected to seismic forces for the seismic zone in which the facilities are located. Direct all subcontractors and suppliers to furnish and install equipment and to provide anchorage in a manner that will conform to these requirements.

31 Testing

Test all circuits for continuity, freedom from ground, and proper operation during progress of work.

Test all systems as they are completed per requirements.

Conduct special test as required for service and/or system ground. Test pump motors to verify that an overload condition does not exist.

32 **Final Test**

Conduct final test in the presence of District and/or authorized representatives.

Prior to the test, Developer shall have satisfied himself that the project area is properly cleaned up, all patching and painting deemed necessary properly done, and all systems, equipment, and controls are functioning as intended.

Run all tests and furnish all testing instruments required to demonstrate satisfactory operation of systems, equipment, and controls.

Upon completion of work, test complete system for proper operation, and certify system is complete and operational.

STANDARD SPECIFICATIONS FOR STANDBY GENERATOR

33 Equipment

33.1 General

This division is supplemental to Division 11 of the District's standard specifications.

This division covers work necessary to provide the submersible non-clog pumps and motors with rail system.

33.2 Submittals

Submittal information shall be provided to the District for the following items:

1. Shop Drawings: Submit shop drawings for favorable review of the Pumps. Include sufficient data to show that equipment conforms to Specification requirements, including a pump performance curve. Submit complete motor data. Submit in a single complete package.
2. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.
3. Affidavits: Furnish affidavits from the manufacturer stating that the pumps have been properly installed and tested, and each is ready for full time operation.

33.3 Warranty

Pumps

The pumps shall carry a 100%, non-prorated labor and material, *5-yr warranty against any defects in materials and workmanship following the date of initial start-up and operation as well as District written acceptance.*

34 Submersible Sewage Pump and Motor

34.1 General/Design Criteria

Provide two pumps. Each pump shall be capable of pumping the design flow. Minimum size of one pump shall provide a minimum scouring velocity of 4 feet per second (fps) in the force main.

Size force main for a minimum velocity of 4 fps and a maximum velocity of 8 fps. The force main shall not be less than 4-inches in diameter.

Each pump unit provided this project shall be manufactured by ITT-Flygt Pump Company, as distributed by Whitney Equipment Company, Bothell, WA, 425-486-9499.

Provide District Engineer with design service conditions, including the following information:

Service Conditions

Pump No. 1 Pump No. 2

Design Head (TDH) x x

Design Flow (gpm) x x

NPSHA (feet) x x

Minimum Shutoff Head (feet) x x

Motor Speed (Maximum 1,800 rpm) x x

Minimum Total Efficiency at design point (%) x x

Flygt Model Number/Impeller No. x x

34.2 Testing and Startup

Developer shall be responsible for calibration, startup, and initial performance to meet specifications herein. Supplier shall provide a trained, qualified manufacturer's representative to check installation and connection, perform field tests as indicated, and certify to District that its performance does meet all specifications.

Prior to acceptance of installed pumps, manufacturer's representative shall demonstrate proper operation of pumps at capacities stated, at which time data shall be taken on total dynamic head, efficiencies and flow of the pumps; and certification shall be provided that pumps meet all requirements set forth in these specifications and submittal literature.

Repair and retest units failing field tests. If unit fails second test, unit will be rejected and supplier shall furnish a unit that will perform as specified.

34.3 Pump Design

The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. *There shall be no need for personnel to enter the wet well.* A machined metal to metal watertight contact shall accomplish sealing of the pumping unit to the discharge connection. Each pump shall be fitted with sufficient length of stainless steel cable to reach from bottom to top of wet well plus five feet of slack. The working load of the lifting system shall be 50% greater than the pump unit weight.

34.3.1 Pump Construction

Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow-holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

34.3.2 Pump Impeller

The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, semi-open, multi-vane, backswept, non-clog design. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on the volute suction, which shall keep them clear of debris, maintaining an unobstructed leading edge. The impeller(s) shall have screw-shaped leading edges that are hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other materials found in raw wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of sludge and rag-laden wastewater. Impeller(s) shall be locked to the shaft and coated with alkyd resin primer.

34.3.3 Mechanical Seal

Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary tungsten carbide and one positively driven rotating ceramic ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary carbon seal ring and one positively driven rotating ceramic seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable.

Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plugs, with positive anti-leak seals, shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.

Seal lubricant shall be FDA Approved, non-toxic.

34.3.4 Wear Rings

A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impellers. The wear ring shall be stationary and made of brass, which is drive fitted to the volute inlet.

34.3.5 Volute

Pump volute(s) shall be single-piece gray cast iron, Class 35, non-concentric design and smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

34.3.6 Pump Shaft

Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be AISI type 420 stainless steel.

34.3.7 Bearings

The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Bearings shall be designed for a minimum life of 100,000 hours.

34.3.8 Electrical Pump Cord

Each pump shall be provided with submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be of sufficient length to reach from the bottom of the wet well to the splice box shown on the Drawings plus five feet of slack. The power cable shall be sized according to NEC and OCEA standards and also meet with PMSHA approval.

34.3.9 Electric Motors

The pump motor shall be UL approved as explosion-proof for continuous operation in a Class I, Division I, Group D hazardous location when not submerged.

The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, NEMA B type. The stator windings and stator leads shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F) and capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (257°F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The motor and pump shall be designed and assembled by the same manufacturer.

The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C (176°F). A performance chart shall be provided showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

34.3.10 Motor Sensors

The motor stator temperature shall be continuously monitored by three (3) low resistant, bi-metallic, (N.C.) normally closed thermal switches embedded in the stator windings. These thermal sensor switches shall be used as additional supplemental motor protection and shall be

wired in series with external third leg overload protection provided by the motor stator in the control panel.

The motor shall also be provided with a tandem probe sensing system. The two moisture sensing probes shall be mounted in the oil filled seal chamber and will detect the presence of conductive liquid, which passes the primary lower seal.

Upon detection, the sensors shall actuate a panel mounted relay, which will provide the operator with a visual indication of impending seal failure.

Seal lubricant shall be FDA Approved, non-toxic.

34.4 Installation

Installation of the pump units shall be in accordance with the manufacturer's specifications and direction. The installation shall be supervised and approved by the manufacturer's representative prior to operating or field testing the units.

Upon completion of the pump installation, the manufacturer shall provide written certification that the equipment is fully warranted as installed.

34.4.1 Pump Removal Rail System

The pump removal rail system shall provide smooth, easy, removal and installation of the specified pumps from the lift station. The system shall include for each pump unit a hydraulic sealing flange, discharge base elbow, guide rails, carrier guide bracket, ITT Flygt Grip-Eye System, nylon line, and lifting chain. The guide rails, carrier guide bracket, and lifting cable shall be constructed of stainless steel materials.

34.4.2 Fiberglass Reinforced Plastic (FRP) Sump

The pump station sump shall be a pre-manufactured, fiberglass reinforced plastic (FRP) assembly with integral pump discharge elbow connections. The sump shall be hydraulically optimized to improve flow in the sump during pumping by minimizing residual water storage and maximizing sump velocity. Sump shall be manufactured for the wet well dimensions shown on the Drawings and provided by ITT-Flygt.

34.4.3 Mix-Flush Valve

Provide one of the specified pumps with a Flygt 4901 Flush Valve for flushing the wet well during initial operation of the pump. The flush valve shall depend only on the pump flow and pressure to operate and no electrical components shall be allowed. Install per manufacturer's recommendation.

34.5 Wetwell Access Hatch

Provide one (1) aluminum "Safe Hatch" with the dimensions required for removal of design pumps. Hatch shall comply with applicable OSHA regulations for fall protection. The safety grate shall be made of 6061-T6 aluminum with a design strength of 17,300 psi. The grating shall be designed to withstand a minimum live load of 300 psf. Deflection shall not exceed

1/150th of the span. Grate openings shall be 5"x5" to allow for visual inspection and limited maintenance with the grate in place (not opened).

Each grate shall be provided with a permanent hinging system to lock the grate in the 90-degree open position. The grate shall have an opening arm that is designed such that the opening of the grate will provide a barrier between the operator and the opening. Each grate shall be factory coated with a thermosetting epoxy powder coating, OSHA safety orange, 2-4 mils.

Hatch shall be rated for H-20 wheel loading. Manufactured by Syracuse Castings for ITT-Flygt. No substitutions.

34.6 Valve Vault Access Hatch

Valve vault hatch shall be a single leaf, aluminum diamond plate with stainless steel hardware and fasteners. Door shall lock in vertical position without movement, spring or piston-assisted opening. Provide odor resistant gasket and route 1-1/2" pvc drain from frame to drain sump, equal to LW Products Model #S-3.

34.7 Sump Pump

Provide a sump pump with bronze body, removable inlet screen between motor and pump bodies with a six-vane impeller to pass solids which pass the inlet screen, and an oil-filled motor in sealed waterproof housing with overload protection. Mechanical seal: ceramic seat and carbon rotating element operating in oil. Motor shaft: stainless steel. Sump pump shall be controlled by mercury float switch. Sump pump: equal to PIP 701a Paco pump.

35 Furnishings (Not Used)

36 Special Construction

36.1 General

Provide a building to house the diesel engine generator, automatic transfer switch, and pump controls with the following features:

1. Wood frame or concrete unit masonry construction
2. Heating and lighting
3. Preformed metal roofing with Kynar finish
4. Gutters and rainwater leaders
5. Acoustical insulation treatment on ceiling and interior walls
6. Concrete pad in front of access door
7. Provide space inside the building for future installation of an Reduced Pressure Backflow Assembly
8. Obtain all required building permits and inspections
9. Provide a minimum of 4 feet clearance on three sides of the diesel engine generator
10. Comply with NEC requirements and provide a minimum of 4 feet clearance in front of all electrical switches
11. Design and construct the facility to comply with all applicable codes

36.2 Submittals

Submit engineer stamped plans, showing elevations, sections and detail drawings of the building showing the location of all equipment and panels. Hardware

36.2.1 Locksets

1. Cylindrical, heavy duty, with interior parts of stainless steel and other noncorrosive metals. Provide key-in-knob, 6-pin cylinders to match District's keyway. Schlage Series "C" with stainless steel mechanism with lever handle, "Olympiad;" Corbin "Sacramento;" or equal.
2. Backset: 2-3/4 inches.
3. Strikes: Furnish standard strikes with extended lips where required to protect trim from being marred by latch bolt. Provide dust boxes. Verify whether standard or ANSI cutouts are provided in metal frames.
4. Deadbolts: Provide heavy duty dead bolt match District's standard. Provide keyway to match District standard.

36.2.2 Hinges

Butts, full mortised. Exterior out swinging doors shall have non removable pins.

Labeled doors shall have ball bearing steel butts. Unless otherwise specified, the size of the butts will be determined by the following:

1. Doors 1-3/4 inch thick and up to 41-inch wide to have 4-1/2 inch.
2. Doors 1-3/4 inch thick, 42-inch to 48-inch wide to have 4-1/2 inch heavy.

Provide widths sufficient to clear trim projection when door swings 180 degrees.

Provide:

1. 3 hinges to 90-inch high for each door leaf.
2. 4 hinges to 120-inch high for each door leaf.

Provide ball bearing butts unless specified otherwise.

36.2.3 Closers

Furnish products of one manufacturer; smoothie style full rack and pinion type with steel spring and non-gumming, non-freezing hydraulic fluid. Provide controls for regulating closing, latching speeds and back check. Closer shall be designed with spring power adjustment required for easy opening useable by the physically handicapped; 8.5 pounds for exterior doors. Supply parallel-arm closers at reverse bevel doors and where doors swing full 180 degrees. Provide maximum degree of opening attainable consistent with closer function specified. Covers shall be factory painted or plated finish.

36.2.4 Door Stop, Floor Mounted

Shall be stainless steel. *Height to suit conditions.*

36.2.5 Door Stop, Wall Mounted

Shall be stainless steel. Furnish with durable high grade shock resistant rubber bumper.

36.2.6 Door Stop/Holder, Floor or Wall Mounted

Shall feature a strike with a hinged hook that fits flush with the strike when unit is acting as a stop only. The hook is manually lifted to engage the hold open lug. When released, the hook drops back flush with the strike. Material shall be stainless steel.

36.3 Hollow Metal Work

Acceptable manufacturers include Forderer Hollow Metal Products, Fire Protection Products, Republic, Steelcraft, or equal.

36.4 Frames, Galvanized Steel

Fabricate from hot dipped galvanized sheet steel meeting ASTM G90 or A525, commercial class 1.25.

Minimum zinc coating: 1.25 ounces per square foot of metal surface.

Metal thickness: 14 gauge or heavier where noted.

36.5 Doors, Galvanized

Fabricate face sheets and edge channels from hot dipped galvanized steel sheet meeting ASTM G90 or A525 commercial class 1.25.

Minimum Zinc Coating: 1.25 ounces per square foot of metal surface.

Metal Thickness: 16 gauge or heavier.

36.6 Jamb Anchors

Frames in Masonry Walls: Provide adjustable tee strap, jamb anchors. Metal thickness: 16 gauge minimum. Frames up to 7'-6" high shall have three anchors per jamb; frames 7'-6" to 8 feet high shall have four anchors per jamb and frames over 8 feet high shall have four anchors plus one anchor in each jamb for each 2 feet or fraction thereof of height over 8 feet.

Frames in Stud Walls: Furnish strap jamb anchors, not less than 16 gauge thickness and fully welded inside frames. Frames shall have the number of anchors required by their "UL" fire rating listing but not fewer than the following: Frames up to 7'-6" high shall have four anchors per jamb; frames 7'-6" to 8 feet high shall have five anchors per jamb; and frames over 8 feet high shall have five anchors per jamb plus one anchor for each 2 feet of height or fraction thereof.

Floor Anchors: 14 gauge minimum thickness, welded to frame at each jamb or mullion, punch for two 3/8-inch diameter anchor bolts. Additional jamb anchors do not waive the requirement for floor anchors.

36.7 Hollow Metal Frames for Louvers

16 gauge galvanized steel.

Anchors: Same as for door frames.

36.8 Fabrication/Hollow Metal Doors & Frames

36.8.1 General

Fabricate in the shop. Accurately fit all work and fabricate in a manner to produce smooth even surfaces free from warp, wave, buckle and other defects. Make square corners and angles unless shown otherwise on the Drawings. Set members in proper alignment, with edges straight and clean. Make provisions for hardware at locations according to prevailing accepted standards and as shown on the Drawings.

36.8.2 Frames

Fully welded, seamless construction with no visible seams or joints, strong, rigid and constructed so as not to bind, sag, twist or otherwise fail in use. Provide frames with throat opening dimension required to meet field requirements regardless of throat size shown.

1. Frame members: Form each frame member from one piece of sheet steel.
2. Joints: Miter corner joints, including integral stops, reinforce and weld continuously full length of joint. Fit other joints neatly and weld continuously full length of joint.
3. Hardware cut-outs: Make to hardware templates and physical hardware. Locate center of door knob or lever handle 36-inches above the floor. Locations coordinated with door cutouts. Make cut-outs as required for intrusion alarm switches where scheduled. Punch stops of all frames for silencers, 3 in latching stop for single doors, 2 in head of double door frames.
4. Jamb anchors: Weld to inside jamb.
5. Floor anchors: Weld to bottom of door frame jambs.
6. Spreaders: Connect removable steel channel spreader ties across bottoms of welded door frames to hold rigid during shipping and until they are secured in place in the work.
7. Hardware reinforcing: Weld in place, comply with NAAMM CH-1 standards. Shop drill and tap for template hardware. Field-drill and tap for surface mounted hardware.
 - a. Templates: Obtain from finish hardware manufacturer.
 - b. Hinges: 7 gauge steel, 1 1/2 inches wide by not less than 10-inches long. Prepare for full mortise hinges.
 - c. Strikes: 12 gauge steel, 1 1/2 inches wide with minimum lap of 2-inches beyond cut-out. Closers: 12 gauge steel, length to accommodate closer. Provide reinforcing at two locations on each frame for installation of either regular or parallel arm closers whether or not closers are scheduled.
 - d. Plaster guards: 24 gauge steel, provide at strike and hinge reinforcing.
 - e. Flush bolts: 12 gauge steel.
8. At exterior locations, provide shop welded 16 gauge galvanized steel rain hood at head of door frame.

36.8.3 Doors

1. Type: SDI Type III, extra heavy duty, fully welded style 2 full flush hollow steel construction for interior doors and exterior doors. Doors shall have no visible joints or seams on exposed faces and vertical edges.
2. Top and bottom rails: 16 gauge channel; fully flush design, continuous welded to face sheets.

3. Face sheet (or face panel) reinforcing shall meet the requirements of ANSI A151.1 for twist strength. The following methods are acceptable:
 - a. Continuous vertical stiffeners of not lighter than 22-gauge steel, spaced not to exceed 6-inches on centers and spot welded to both face sheets at intervals not greater than 6-inches. Fill all voids with insulation.
 - b. An inner grid system consisting of vertical and horizontal members of not lighter than 18-gauge steel, welded or interlocked for maximum strength and spaced not to exceed an average of 12-inches in either direction and spot welded to both face sheets at intervals not greater than 6-inches. Fill all voids with insulation.
 - c. A continuous formed sheet steel truss core, full height and width, spot welded to face sheet at intervals not greater than 6-inches in both directions. Fill all void with insulation. Edge profile: Bevel vertical edges of stiles 1/8 inch in 2-inches.
4. Door thickness: 1-3/4 inches or thicker as noted.
5. Clearances: 3/32-inch clearance at jambs and head and 3/8 inch clearance at bottom; 1/4 inch clear between door and threshold where threshold occurs. Provide required clearance between door and stop to accommodate smoke gasket.
6. Provide a watertight flush closing channel at the top edge. Provide weep holes in the bottom closure to permit escape of entrapped moisture.
7. Door cut outs: Cut outs for door openings shall be spaced at least the distance away from door edges or recesses for hardware that is required to maintain door fire rating and guarantee. All cut outs shall be made in the shop fabricating the doors.
8. Hardware reinforcing: Comply with NAAMM CHM-1 Standards. Shop drill and tap for template hardware. For surface mounted hardware, drill and tap in the field.
 - a. Hinge: 7 gauge
 - b. Lockset: 12 gauge
 - c. Flush bolt: 12 gauge
 - d. Closer: 9 gauge

36.8.4 Door Louvers

Provide 18 gauge louvers in doors where noted. Louvers shall be stationary, weatherproof, 45° zee configuration blades, air louvers Model 900 with trim Style A-1 or equal. Install at the factory in tamper proof molding with screws on the interior side of the door. Louvers shall be the same material and finish as the door. Provide 1/4 inch mesh galvanized hardware cloth screens in removable galvanized channel frames on the inside surface of louvers.

36.9 Acoustic Treatment

Acoustic panels shall have a NRC rating of 0.80 per ASTM C 423 within the 250 Hz to 1 KHz range. Flame spread rating of 25 or less and smoke developed of 450 or less per ASTM E 84. *Apply acoustic insulation to ceilings and all walls.*

36.10 Concrete Masonry Units

ASTM C90, Grade N, Type 1, Split-face

All masonry units shall contain Dry-block liquid polymeric concrete admix in quantities recommended by the manufacturer.

36.11 Mortar for Masonry

Mortar shall be type S and comply with ASTM C 270. All mortar shall contain 1 quart of Dry-block admix per sack of cement.

36.12 Masonry Sealer

Clear water repellent sealer, formulated from siloxane resins and diffused quartz carbide with a 6.5% active solids content.

Provide Fabrishield 653 as manufactured by Fabrikem Chemicals or equal.

37 Division 37 Conveying Systems (Not Used)

38 Mechanical

38.1 General

This division specific to the District's standard specifications for lift stations and includes work necessary for furnishing and installing mechanical appurtenances and accessories for the pump station and force main.

38.2 Submittals

Submittal information shall be provided to the District for the following items:

1. Ductile Iron Pipe
2. Ductile Iron Fittings
3. Stainless Steel Pipe and Fittings
4. PVC Pipe and Fittings
5. High density polyethylene (HDPE) pipe
6. Flowmeter
7. Level Sensors
8. Pressure Gauges
9. Other Mechanical Components

38.3 Pipe and Fittings

38.3.1 Ductile Iron Pipe

The pipe thickness shall not be less than that of class 50 pipe. Ductile iron pipe shall be cement-lined and asphaltic coated unless otherwise specified, and shall conform to standards of ANSI Standard A21.51 (AWWA C151). Rubber gasket pipe joints are to be push-on-joint (Tyton) or mechanical joint (MJ) in accordance with ANSI Standard A21.11 (AWWA C-111), unless otherwise specified. Flanged joints shall conform to ANSI Standard B16.1. Standard thickness cement lining and seal coat shall be provided in accordance with ANSI Standard A21.4 (AWWA C104). *All mechanical joints will be Mega Lug.*

Restrained joint pipe shall be ductile iron manufactured in accordance with requirements of ANSI/AWWA C151/A21.51. Restrained joint pipe shall be restrained mechanically using Mega-Lug joints and Field Lok gaskets and thrust block restraint at any bends or angles or an

equivalent. Push-on joints for such pipe shall be in accordance with ANSI/AWWA C111/A21.11. Pipe thickness shall be designed in accordance with ANSI/AWWA C150/A21.50 and shall be based on laying conditions and internal pressures as specified in the pressure section of these specifications. Standard thickness cement lining shall be in accordance with ANSI/AWWA C104/A21.4.

When requested, furnish certification from manufacturer of pipe and gasket being supplied that inspection and all of the specified tests have been made and the results comply with requirements of this standard.

38.3.2 Ductile Iron Fittings

Ductile iron fittings shall be used for ductile iron pipe and HDPE pipe.

All fittings shall be ductile iron where possible. Steel fittings will not be accepted. Ductile iron fittings shall be short body, cement-lined, and for the pressure rating noted in the pressure rating section of these specifications. Metal thickness and manufacturing processes shall conform to applicable portions of ANSI Standards A21.20, A21.11, B16.2, and B16.4. Standard cement lining shall be in accordance with ANSI Standard A21.4 (AWWA C104). Mechanical joint (MJ), ductile iron, compact fittings 3-inches through 24-inches and 54-inches through 64-inches shall be in accordance with AWWA C153.

Flanged pipe spools shall conform to ANSI/AWWA C115/A21.15 with the exception that flanges shall be fabricated from ductile iron, unless otherwise specified in the contract documents. Flanged pipe shall be cement lined in accordance with ANSI Standard A21.4(AWWA C104).

Ductile iron flange (FL) fittings shall be in accordance with AWWA C110, fabricated from ductile iron unless otherwise specified in the contract documents, with bolt pattern to match adjacent pipe. Gasket material for flanges shall be neoprene or Buna-N. Gaskets shall be full face ring type full face or ring type.

Type of ends shall be specified as ***mechanical joint (MJ)***, ***restrained joint (RJ)***, ***plain end (PE)***, or ***flanged (FL)***.

38.3.3 Stainless Steel Pipe and Fittings

All stainless steel pipe and fittings shall be Schedule 40 and meet ASTM A312, Type 304L. Fittings shall be beveled plain-end for welding or mechanical joint connection or flange as shown on the Drawings.

38.3.4 PVC Pipe and Fittings (PVC less than 6-inch diameter)

Polyvinyl chloride (PVC) material for pipe fittings and couplings shall conform to ASTM D 1784, Type 1, Grade 1, with 2,000 psi design stress. Pipe shall be Schedule 40 or 80 in accordance with ASTM D-1785, as shown on the Drawings.

38.3.5 PVC Pipe and Fittings (PVC gravity pipe, 6-inch and larger)

Pipe and fittings shall meet the requirements of ASTM Specification D3034 for 6"-15" SDR 35. The pipe shall be colored green for in-ground identification as sewer pipe.

All fittings and accessories shall be as manufactured by the pipe supplier or approved equal and have bell and/or spigot configurations compatible with that of the pipe.

38.3.6 High Density Polyethylene (HDPE) Pressure Pipe

Provide high density polyethylene plastic pipe suitable for use as a pressure conduit shall conform to the following specifications and standards:

1. Base Resin: Conform to all requirements of ASTM D 1248, Type III, Class C, Category 5, Grade P34, with a PPI rating of PE 3408
2. Cell classification: 345434C per ASTM D 3350
3. Environmental Stress Crack Resistance: No cracks after 5000 hours as determined by ASTM D 1693, Condition C
4. Rating: Long-term hydrostatic strength of 1,600 psi and hydrostatic design stress of 800 psi as determined by ASTM D 2837
5. Working Pressure Rating: 160 psi, SDR 11

Pipe shall be butt-fused and internal weld seams removed.

38.4 Flange and Pipe Supports

Flange supports shall be equal to Standon Adjustable Model S89 Flange Support. Pipe supports shall be equal to Standon Adjustable Model S92 Pipe Support. Both flange and pipe supports shall be equal to those manufactured by Material Resources, Hillsboro, Oregon. Adjust support, secure to pipe and secure to floor as recommended by the manufacturer.

Provide at locations shown on the mechanical plan(s). Finish all pipe supports same as piping material.

38.5 Pipe and Fittings Installation

Install pipes in accordance with manufacturer's recommendations.

Carefully lay pipe and supported at proper lines and grades. Follow piping runs shown on the Drawings as closely as possible, except for minor adjustment to avoid structural features. Make major relocations, if required, in a manner acceptable to District Engineer.

Keep openings in pipes closed during progress of work.

Form thrust blocking so that bolts, joints, gaskets, and flanges of adjacent joints are clear of concrete and so that bolts and joints can be dismantled without removing concrete. All concrete blocking shall have a minimum compressive strength of as identified in Division 3 "Concrete".

Pipe passing through concrete walls or slabs shall be made watertight utilizing Link-Seal or equivalent. Core drill all penetrations. All rigid pipe penetrations through concrete vaults or manholes shall have flexible fittings within 18-inches of the wall.

38.6 Valves and Appurtenances

Valves shall be designed for the intended service. Install valves in strict accordance with manufacturer's instructions. Buried valves shall have all operators or valves boxes installed so that wrenches or operators perform freely and without binding or other interference. Bed and backfill buried valves according to the requirements of the pipe to which they are attached. ***If shear pins are installed with any valve, the manufacturer shall certify the shear pin(s) to fail between 95% to 99% of the operator shaft failure torque.***

38.6.1 Eccentric Valves

Plug valves shall be eccentric plug valves for buried service, unless otherwise specified. Valves shall be of the non-lubricated eccentric type with resilient faced plugs. Valve bodies shall be ASTM A126 Class B cast iron. The valve seat shall meet one of the following two requirements:

1. Seat shall have a 1/8 inch welded overlay of not less than 90% pure nickel, with a raised seat area, so that the plug face contacts only nickel;
2. Seat shall be factory-coated with heat-fused thermoset epoxy or thermoplastic nylon in accordance with AWWA C550.
3. The valve plug shall be ASTM A536 ductile iron, faced with Neoprene with a cylindrical seating surface eccentrically offset from center of the plug shaft. Interference between the plug face and the body seat shall be externally adjustable in the field with the valve under pressure, and the plug in the closed position. Valves shall have sleeve type metal bearings and shall be of sintered, oil impregnated, permanently lubricated type 316 ASTM A743 Grade CF-8M

Valve shaft seals shall be of the single or multiple V-ring type, externally adjustable and re-packable under pressure without removing bonnet or actuator. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.

Valve pressure ratings shall be the same as adjacent fittings. Each valve shall be given a hydrostatic and seat test.

Valves shall be equipped with gear actuators. Gearing shall be enclosed in a steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into actuator. Actuator shaft shall be supported on permanently lubricated bronze bearings, and shall indicate valve position. An adjustable stop shall be provided to set closing torque and to provide seat adjustment.

Valve surfaces shall be coated internally and externally with a heat-fused thermoset epoxy or thermoplastic nylon.

Exposed nuts, bolts, springs, and washers for buried service valves shall be stainless steel.

Valves shall be equal to: M&H Eccentric Plug valves.

Buried valves shall have an AWWA 2-inch wrench nut.

Exposed valves shall have hand wheel actuators unless shown otherwise.

38.6.2 Swing Check Valves

The swing check valve shall function to permit flow only in one direction. The valve shall close tightly, without slamming, when the pressure on the discharge side exceeds the pressure on the inlet side. All swing check valves shall conform with AWWA C508-82 and the following specifications.

The swing check valve body shall be constructed with heavy cast iron or cast steel and have a bronze or stainless steel seat ring, a non-corrosive shaft and counterweight attachment, and complete non-corrosive shockless cushion chamber. The valve shall be constructed to withstand a minimum water operating pressure of 200 psi. Flanges shall be drilled to ANSI B16.1, Class 125#, or as specified in the design Drawings.

The inside and outside of valve body, bonnet and seal plate shall be coated with fusion bonded epoxy meeting AWWA C-550 latest revision.

The counterweight location shall be adjustable.

The valve disc shall be constructed of cast iron or cast steel and shall be suspended from a non-corrosive shaft. The valve shall allow the equivalent flow area of the adjoining pipe. The shaft shall pass through a stiffing box and be connected to the cushion chamber in the outside of the valve.

The valve shall be equal to M&H Model 159 Swing Check Valve.

38.7 Electromagnetic Flowmeter

Provide an electromagnetic flow metering system suitable for measuring and transmitting flow rate in a full-flowing pipe. The flow meter system shall be microprocessor based, utilizing a DC bipolar pulsed coil that automatically re-zeroes after each pulse cycle. System accuracy shall be 1% of actual flowrate over a fluid velocity range of 1 to 33 feet per second, and within 0.01 fps for velocities less than 1 fps. Repeatability shall be better than 0.1% of full scale. System accuracy shall be traceable to NIST using prototype meters of the same configuration. The system shall operate within the accuracy required over a temperature range of -20 to 120 degrees F.

The ***meter tube and coil*** shall be mounted on the pipe between ANSI B16 pipe flanges and shall be rated for 150-psi working pressure and 200-psi test pressure. The meter tube shall be 304 stainless steel. The meter shall be NEMA 6 rated, capable of complete submergence without damage, and rated for unclassified service. The meter shall include a 316 stainless steel grounding ring for installation at the inlet flange. The meter shall have an EPDM liner and all wetted parts shall be 316 stainless steel. The meter shall be suitable for either horizontal or vertical mounting.

The ***meter electronics and transmitter*** shall be remotely mounted from the meter and shall operate from 120 VAC power. The transmitter shall be panel mounted as shown on the Drawings. The electronics shall be NEMA 6 rated, unclassified, with an unspliced cable run from the transmitter to the meter tube. Wiring between flow sensors and remote mounted

converters shall use cable type and procedures as per the manufacturers' recommendations. The transmitter shall display flowrate in gallons per minute, totalized gallons, and an empty pipe indicator. Output shall be 4-20mA into 800 Ohms with an isolated ground and non-interacting zero and span adjustments. The display and output shall be user scalable for GPM, CFS, or MGD, and shall be password protected. All software shall be battery powered with a battery that has a ten-year service life.

The meter, electronics, and transmitter shall be RFI shielded to prevent interference from adjacent high noise electrical equipment such as variable frequency drives, electromagnetic starters, transformers, or transfer switches.

The flow meter shall be Danfoss, Model MAG 5100W, Endress+Hauser Promag 53W or Toshiba LF220.

38.8 Miscellaneous Mechanical

38.8.1 Adapters and Dielectric Fittings

Provide adapters between dissimilar types of pipes (e.g. copper-steel). Provide dielectric fittings at joints between dissimilar metals.

38.8.2 Building Floor Drains

Building floor drains shall be round top drains with p-trap, p-trap primer connection, sediment bucket, vandal-proof screws and backwater valve. Provide drain fabricated from cast iron with a satin bronze strainer equal to Wade Model W-1100 floor drains with adjustable strainers.

38.8.3 Pressure Gauges

Provide a pressure gauge for pressure transmitter installations as shown on the drawings. Mount gauges adjacent to transmitter on gauge plate and connect to same manifold. Gauges shall be surface mount-type with 4-1/2 inch scale faces and be completely suitable for measuring wastewater. Utilize diaphragm seals in lieu of snubbers. Select pressure ranges so that "normal" operating pressure of system is approximately 50 percent scale on the gauge. Wetted parts: brass, bronze, or stainless steel. Calibrate in "psi". Overall accuracy shall be ± 0.5 percent of full scale. Gauge shall be glycerin filled equal to 3D Instruments industrial process gauge.

38.9 Force Main Inspection & Testing

38.9.1 Hydrostatic Pressure Testing

All new force mains and appurtenances shall be tested under a hydrostatic pressure equal to 200 psi. All pumps, gauges, plugs, saddles, corporation stops, miscellaneous hose and piping, and other equipment necessary for performing the test shall be furnished and operated by the Developer. The pipeline trench shall be backfilled sufficiently to prevent movement of the pipe under pressure. All thrust blocks shall be in place and sufficiently cured to reach design strength before testing. Where permanent blocking is not required, the Developer shall furnish and install temporary blocking and remove it after testing. The Developer is responsible for the proper disposal of any waste, including water. An acceptable test of pipe and fittings buried

under or adjacent to proposed concrete slabs or other structures must be performed prior to construction of structure.

The mains shall be filled with water and allowed to stand under pressure for a minimum of 24 hours to allow the escape of air and/or allow the lining of the pipe to absorb water. The Developer will furnish the water necessary to fill the pipelines for testing purposes. Gauges used in the test may be required to be certified for accuracy at a laboratory by the District. Whenever possible, have pipe joints, fittings, and valves exposed for inspection. Any visible leakage detected shall be corrected by the Developer to the satisfaction of the District regardless of the allowable leakage specified below. Should the test section fail to meet the pressure test successfully, as specified, the Developer shall, at his own expense, locate and repair the defects and then retest the pipeline.

After the test has been completed, each valve shall be tested by closing each in turn and relieving the pressure behind. This test of the valve will be acceptable if there is no immediate loss of pressure on the gauge when the pressure comes against the valve being checked. The Developer shall verify that the pressure differential across the valve does not exceed the rated working pressure of the valve.

Prior to calling out the District to witness the pressure test, the Developer shall have all equipment set up completely ready for operation and shall have successfully performed the test to assure that the pipe is in a satisfactory condition. District shall witness test. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants.

The test shall be accomplished by pumping the main up to the required pressure; stop the pump for a minimum of 15 minutes up to a maximum of 60 minutes as directed by the District Engineer, and then pump the main up to the test pressure again. During the test, the section being tested shall be observed to detect any visible leakage.

The quantity of water required to restore the initial hydrostatic pressure shall be accurately determined by either:

- Pumping from an open container of suitable size such that accurate volume measurement can be made by the District.
- Pumping through a positive displacement water meter with a sweep unit hand registering one gallon per revolution. The meter shall be approved by the District.

For the test to be considered acceptable, the quantity of water lost from the main shall not exceed the number of gallons per hour as determined by the formula:

In Which

L =allowable leakage, gallons/hour

N =number of joints in the length of pipeline tested

D =nominal diameter of the pipe in inches

P =average test pressure during the leakage test, psi

There shall not be an appreciable or abrupt loss in pressure during the 15-minute test period.

39 Standby Diesel Generator Set/Standards

39.1 General

Provide on self-contained, interior rated standby engine generator system to automatically operate the pump station during a loss of prime power from electrical provider. The standby generator shall be sized to run the entire pump station during power outage.

39.2 Submittals

Provide the following:Error! Bookmark not defined.

- Standby diesel engine-generator set complete with all appurtenances. Unit shall be complete with all standard accessories for the manufacturers and models listed in addition to those additional and special features described.
- Base mounted fuel system including fuel tank, fuel piping from tank to engine, engine mounted fuel pump, and fuel gage.
- Automatic starting and shutdown controls, starting batteries, battery rack, charger, and generator controls.
- Exhaust system complete with flexible connectors, silencer, exhaust piping, and insulation and supports for silencer and exhaust pipe.
- Radiator exhaust air duct.
- Load bank including related equipment.
- Connection to main service
- Interface and controls with automatic transfer switch. Submittals

39.3 Shop Drawings

Submit shop drawings that include the following information:

- Floor layout drawings for the engine-generator, with location dimensions for all connections including electrical, fuel, and exhaust, with base dimensions and weights.
- Composite assembly drawing of engine-generator showing location of all auxiliary equipment, dimensions and weight.
- Front, rear, and both side elevations of the complete engine-generator unit assembly, including radiator exhaust air duct.
- Evaluation of engine generator size based in starting requirements. Provide calculations verifying transient voltage dip will not exceed 15 percent with sudden application of rated load.
- Drawing of diesel generator set offered showing interconnecting wiring diagrams; all wiring in unit and on Drawings shall be number coded.
- Literature describing the diesel engine generator set.
- Literature describing auxiliary equipment to be furnished.
- Base assembly, housing, and vibration isolation mounts.
- Load
- Transfer switch

The following shall be furnished in tabular form:

- Engine make
- Number of cylinders
- Bore (in inches)
- Stroke (in inches)
- Generator make and type
- Generator electrical rating, kva
- Cubic inch displacement Fuel oil consumption
- Exciter and type
- Horsepower at rated load
- Enclosure size, exterior dimensions.
- Seismic anchorage system designed for Seismic Zone 3.

39.4 Factory Test Report

After fabrication and testing but before shipping from the factory, submit results of the factory test for review. Do not ship any generator units until the factory test results have received favorable review.

39.5 Field Test Report

Submit field test report for review within fifteen days of the time of completion of the field test.

39.6 Manual

Provide complete manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts list.

39.7 Affidavits

Furnish affidavits from the manufacturer stating that the diesel engine-generator set including seismic anchorage is properly installed, tested, and ready for full time operation.

39.8 Guarantee

Furnish a written guarantee/warranty covering all materials and workmanship provided under this section for a minimum of two years from the date of final acceptance of the work.

40 Engine Specifications/Engine Equipment

The engine shall be for operation on No.2 diesel fuel, shall be water-cooled, and shall include a mounted radiator with duct flange, pusher-type fan. Provide engine speed mechanical or isochronous electric governor to control engine speed within 3, percent nominal, 5 percent maximum from no load to full rated output. Mechanical governors shall be directly driven; throttle linkages or belt drives are not acceptable.

40.1 Engine Controls

1. Control Panel: Engine controls and generator controls shall be housed in one control panel, generator mounted.

2. Normal Controls: Provide a complete automatic engine start-stop control, which shall start engine on closing remote contact and initiate engine cool down and shutdown on opening contact. The engine controls shall also include a three-position selector switch with the following positions: RUN/STOP/AUTOMATIC; the STOP position shall shut the engine down immediately, bypassing the cool down cycle. Provide a water temperature gauge, oil pressure gauge, engine run-time meter, and tachometer.
3. Safety Shutdowns: The cranking shall be tried a total of three times prior to being locked out and initiating an alarm. Provide a cranking limiter to open the starting circuit in approximately 45 seconds if the engine fails to start in that time. Provide sensing elements to shut the engine down immediately when conditions reach a level deemed harmful to the unit. Provide an individual signal light and alarm terminals for each condition. Provide an alarm relay and horn. Safety shutdowns shall include:
 - Low lubricating oil pressure
 - High water temperature
 - Overspeed
 - Overcrank
 - Low cooling water level
 - Undervoltage
 - Any additional conditions standard with the manufacturer
4. Alarm Outputs: Provide one set of normally open and one set of normally closed dry (i.e., non-energized) output contacts for connections to the alarm system as a "Composite Generator Alarm." The contacts shall be actuated for anyone or more of the shutdown conditions or for overcurrent trip of the generator main breaker; provide alarm signal light for such overcurrent trip. The contacts shall remain activated during the entire period of the abnormal condition, and reset shall be automatic. The contacts shall be wired to a terminal strip inside a closed, gasketed box.
5. Louver Controls: Provide louver control circuits, which cause the intake and exhaust louvers to open prior to starting of the engine and to close after the engine has stopped. The louvers shall spring open upon loss of power (i.e. fail open) and motor closed. Provide louver operators that will open the louvers within 15 seconds. Engine starting shall be delayed for a field adjustable period of up to 15 seconds to allow louvers to fully open. Closing time shall be adjustable up to 5 minutes after the engine has stopped. Louver controls shall operate by this procedure with the selector switch in either automatic or test position and in the exercise mode.

40.2 Batteries

Provide starting batteries mounted in attached battery racks with non-conducting floor. Guarantee the batteries for two years or more and provide a new battery for any battery found defective within the guarantee period. Mount batteries above the concrete floor level. Batteries shall be the lead acid type, selected to provide engine break-away current for one second at a battery temperature of 20°F and to provide 1-minute total cranking without recharging. Engine shall be at the temperature maintained by the jacket heater for a 20°F ambient.

40.3 Battery Charger

Provide a charger of the two-rate type, with current and voltage ratings to suit the batteries: Include a dc ammeter, fused ac input and dc output, and charge rate selector switch. The charger shall operate on 120 Vac. Charger output shall be current limited to 140% of rated current.

40.4 Exhaust Silencer

Provide an exhaust silencer of the critical silencing type capable of not less than 30 dB-A attenuation, sized by the engine manufacturer to provide silencing without harmful back-pressure. Furnish with 24-inch long steel flexible exhaust connection sections. Install silencer in accordance with the manufacturer's requirements. Thermally insulate silencer and exhaust piping using 4Y2-inch thickness molded calcium silicate covered with a 0.016-inch thickness weatherproof aluminum or 0.010-inch thickness weatherproof stainless steel jacket having moisture barrier and held in place by 1/2-inch stainless steel bands.

40.5 Engine Exhaust Pipe

Provide Schedule 40, black steel pipe conforming to ASTM A120, with condensate drains at low points. Insulate pipe with material as specified above.

40.6 Jacket Water Heater

Provide single-phase jacket water heater(s) with one thermostat. Size heater to maintain 100°F in 20°F ambient. Heaters having a total wattage of 1,200 or less shall be 120 volts; larger shall be 208 or 240 volts.

40.7 Fuel Supply System

Provide a fuel supply system capable of delivering the required amount of fuel to the engine even when the fuel level is down within one-inch of the tank bottom. Provide a dual wall tank mounted integral to the engine-generator base and sized to provide for 24 hours of continuous operation with the generator at full load. Fuel oil piping shall be Schedule 40 black steel with 150 pound welded steel fittings.

Provide a fuel gauge.

Provide all required conduits, supply, return, fill and vent fuel lines, and other accessories as required by the engine manufacturer's design. Generator installation, generator fuel storage and venting must comply with any standards or codes as set forth by South Kitsap Fire, inspected and pass inspection by same and signed as acceptable by South Kitsap Fire.

40.8 Lubrication

Provide gear-type engine driven oil pump, with full flow oil filter with replaceable element. Provide all required lubricants for operation per manufacturer's recommendations.

40.9 Radiator

Radiator and fan shall be sized to maintain safe operation from no load to full load at 90°F maximum ambient temperature.

40.10 Initial Fills

Provide crankcase oil.

Provide initial fill of engine coolant as recommended by the manufacturer to protect engine cooling system to a minimum temperature of 20°F, and as required to inhibit corrosion in the cooling system.

Fuel Oil: Supply the fuel oil for testing of operation.

40.11 Generator

The generator shall be four-pole and of revolving field design with temperature-compensated solid state voltage regulator and high speed brushless rotating rectifier exciter system. The stator shall be directly connected to the engine flywheel housing and rotor shall be driven through semi-flexible driving flanges to ensure permanent alignments. The insulation system shall be Class F with Class B temperature rise. The three-phase, broad range generator shall be 12-lead, reconnectable, and shall meet the requirements of NEMA Standard MG-1.

40.12 Generator Performance

Frequency regulation shall be mechanical or isochronous +/- 3% nominal, +/- 5% maximum from no-load to rated load.

Steady-state voltage regulation shall be within +/- 2% of rated voltage, from no-load to full rated load. Rheostats shall provide a minimum of +/- 5% voltage adjustment from rated value.

Voltage regulator shall be of the silicon controlled rectifier type. Stable voltage shall be reestablished within 2 seconds following sudden application or removal of 25% increments of rated load.

The maximum allowable short term voltage dip, looking at waveform peaks on an oscillograph, shall not exceed 18% of rated voltage (for a total of 20% voltage dip including the steady state allowance). Preload and step load conditions are specified herein.

40.13 Alarm & Control Panel

The Engine control panel shall be integrally mounted to engine generator assembly on the generator at the opposite end of the radiator. It shall be enclosed in a NENIA 4 enclosure.

The control shall have automatic remote start capability from a panel-mounted three position (Stop, Run and Remote) switch.

The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing alarm and shutdown conditions.

The lamps shall be high-intensity LED type.

The generator set control shall indicate the existence of the following alarm and shutdown conditions on a digital display panel:

- Low oil pressure warning
- Oil pressure sender failure
- Low coolant temperature
- High coolant temperature warning
- Low coolant level
- Engine temperature sender failure
- Low DC voltage
- High DC voltage
- Weak battery
- Low fuel warning
- Over load
- Battery Charger Malfunction
- Shutdown Alarms
- Low oil pressure
- Low-Low Fuel
- High coolant temperature
- Fail to crank
- Overcrank
- Overspeed
- High AC voltage
- Low AC voltage
- Under frequency
- Over current
- Short circuit
- Emergency stop
- Engine control panel shall be integrally mounted to engine generator assembly and shall, include the following:
 - Oil pressure gauge (psi)
 - Coolant temperature gauge (F)
 - Operating hour meter (hrs)
 - Hand-off Auto Selector switch (H-O-A)
 - AC Frequency meter (hertz)
 - AC Volt meter (0-600v)
 - AC Current Meter (Amps)
 - Load Meter (kW)

Alarm panel shall have a reset push button for acknowledging alarm conditions and latching indicating lights for each alarm point to display to operation personnel the reason for engine shutdown. Label lights as shown above.

40.14 Alarm Contacts to Telemetry

Provide auxiliary dry contacts for activating remote activation of any of the following conditions:

- Low Fuel

- Low-Low Fuel
- Generator Run
- Generator failure (shutdown)
- Generator trouble
- Fuel leak
- Pre-warning for low oil pressure
- Pre-warning for high coolant temperature

Generator failure alarm shall be activated when any shutdown condition exists. Generator trouble shall be activated when any alarm conditions exists.

40.15 Generator Main Power Circuit Breaker

Size the breaker to match the generator in accordance with all applicable codes. The breaker shall be housed in a NEMA 1 gasketed enclosure mounted on the generator set. Breaker shall be quick-make, quick-break type, with wiping contacts and arc chutes for each pole. Breaker shall be trip free and have trip indication independent of on-off positions. Breaker lugs shall be front accessible and shall be UL Listed for either copper or aluminum cables. Provide battery and charger for shunt trip circuit. Provide exerciser and all appurtenances for periodic automatic running of the engine generator set.

40.16 Vibration Isolation System for Engine-Generator Unit

Isolation system shall be a combination reinforced concrete inertia pad supported on earthquake-restrained spring vibration isolators.

Vibration isolation shall be greater than 95%.

Vibration isolation system shall be Korfund Dynamics Corporation Series L Isolators supporting a Type RCPT base frame, Mason Industries Type KSL Base supported on SSLFH mounts with adjustable vertical limit stops, or equal.

40.17 Engine-Generator and Accessories Manufacturers, Model Numbers and Sizing Data

The engine-generator set shall be manufactured by one of the following manufacturers only:

- Cummins/Onan
- Pacific Detroit/Kohler

40.18 Voltage Dip Characteristics

Initial load: 2 kVA minimum, 0.8 power factor.

Additional electric motor load to be started:

- Motor size: G or H; match the largest pump
- Phase: 3
- Motor Code: Match the largest pump
- Special features: Reduced voltage starting or across the line - as required by the District and the power company.

40.19 Generator Output

- Voltage: 480Y/277 unless 208Y/120 or 240 is approved for the facility.
- Phase: 3
- Wires: 4 or 3
- Maximum engine speed: 1,800 rpm

40.20 Spare Parts

The following spare parts shall be furnished:

- (3) Sets of fuel filter elements and gaskets
- (3) lubricating oil filter elements and gaskets
- (3) air cleaner elements
- (2) complete sets of belts

40.21 Equipment Operating Manuals

Provide five (5) copies of manufacturer's operating and maintenance instructions for each piece of equipment. Information shall be complete and in suitable form for ready use by District operations staff.

Catalog cuts and information regarding spare parts shall be included. Operating manuals and instructions shall be assembled in hardback binders.

40.22 Load Bank

Provide a duct-mounted load bank with flanged connections (manual generator load controller). The load bank shall provide an incremental mimic load, which will be manually added/subtracted from the generator. Provide a load bank control panel suitable for mounting remote from the load bank.

The load bank shall be automatically connected to the generator output 30 seconds after the generator reaches rated voltage and frequency during the exercise period. Upon switching from normal to emergency power, the transfer switch position contact shall automatically disconnect (dump) the load bank load.

Power connection to the load bank shall be 3-phase, 3-wire. External cables and connections to the load bank shall be as specified elsewhere in this specification. A load bank enclosed main circuit breaker shall be unit mounted on the engine-generator.

Load Indication: Load indication shall consist of three remote current transformers, which are to sense total current output of the generator, an ammeter switch and ammeter in the load bank control panel, and interconnecting wiring.

Manual Load Bank Ratings at 200 Feet Elevation and 100°F:

- Capacity: Not less than 60 percent of the engine's rated capacity
- Voltage: 480 Vac, 3-phase unless 208 or 240 Vac is approved for the facility
- Load Step: 3, 5, or 10 equal steps from 0 to the engine-generator rating in KW; each step shall have fuse or circuit breaker protection for resistor elements

- Frequency: 60 Hertz
- Time Rating: Continuous
- Maximum Air Temperature Rise: 25°F

The system shall have a load bank control panel, which as a minimum includes the following:

- Fuse or circuit breaker protected
- Voltmeter (one-phase)
- Ammeter and ammeter switch (3-phase and off)
- Kilowatt Meter: 2% accuracy, total generator output sensing
- Manual load step switching for 10 step control.
- NEMA 12 enclosure

The load bank shall be Avtron Model K711, Loadtec, or equal. 16.26 Engine Generator Installation

41 Engine Generator Installation

41.1 General

Mount and anchor the engine-generator set and tank assembly to a concrete base pad. Mount the engine-generator set on concrete inertia base using seismically-restrained spring isolators. Design the engine-generator set and fuel tank assembly anchorage and support systems to resist seismic Zone 3 earthquake forces, using a "C" value of 0.50 (essential equipment) in the formula " $F = C \times W$ ", where "F" is the horizontal seismic force to be resisted and "W" is the equipment dead weight. In the shop drawing submittals, include calculations to demonstrate the adequacy of the anchorage and support systems.

41.2 Foundations, Installation and Grouting

Furnish the necessary materials and construct suitable concrete foundations. In setting equipment, make an allowance of at least 1-inch for grout under the equipment bases. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work.

41.3 Tools

For each type of equipment to be furnished by the Developer, provide a complete set of all special tools (including grease guns or other lubricating devices) which may be necessary for the routine adjustment, operation and maintenance of such equipment.

42 Load Bank Installation

42.1 General

Structure shall be securely anchored with concrete anchor bolts per manufacturer's drawing details and in accordance with manufacturer's instructions. Equipment shall be plumb and

washer shimmed so that doors open and close smoothly. Bolts and holes shall mate without the use of tools. Bolt sizing shall comply with seismic anchorage requirements.

42.2 Interconnecting Wiring

All conduit, conductors, and electrical interconnections shall be installed complete for all power and control circuitry as shown on the manufacturer's drawings and as recommended by the manufacturer.

43 Testing

43.1 General

Tests are to determine proper operation and capacity of the equipment and to demonstrate compliance with the Drawings and Specifications. All equipment that fails any test will be rejected, and complete re-testing will be required after the Developer makes corrections or modifications to equipment, which has previously failed any test. All field tests shall be witnessed by the District.

43.2 Factory Tests

Engine generator unit shall be tested at manufacturer's plant at full load before shipment. Test shall consist of a steady load run of at least 4 hours duration at 100 percent full rated load. Complete test reports shall be made which show the engine fuel consumption, kilowatt output, voltage, frequency, amperage, engine temperature, lube oil pressure, and load transfer results. Five (5) copies of the certified test reports shall be supplied to District prior to shipment. District and/or their representative shall be given opportunity to witness the tests by the manufacturer.

43.3 Field Tests

Upon completion of unit installation, carry out running tests. Operate engine for a period of not less than 2 hours, in which 5 starts of the engine generator set shall be made and power supplied to motor(s) and purrip(s). Engine generator shall be tested to verify that the transient voltage dip will not exceed 15 percent of rated voltage when sudden application of rated load is applied. Test shall demonstrate the ability of the engine generator to carry the specified loads. Upon completion of the tests, final adjustments shall be made to equipment by a qualified representative of the engine manufacturer. Fuel and oil filters shall be replaced, belt drive tensions checked, and the proper operation of all equipment demonstrated to District's representative. District's representative shall be instructed in the maintenance and operation of equipment. Five (5) copies of these test results shall be provided to District and included with the operation and instruction manual.

43.4 Alarm, Control, and Equipment Tests

Demonstrate each alarm and safety shutdown provision as being caused by the abnormal condition unless an alternative test condition has been favorably reviewed by the District Engineer prior to the scheduling of the tests.

Operate each control circuit and device to demonstrate its proper operation. Demonstrate the battery charger and jacket water heater operation successfully.

43.5 Operational Tests

Simulate a power failure in order to demonstrate the proper operation of the transfer switch and engine-generator.

Demonstrate motor starting capability by applying the specified initial load and then the equivalent of starting and running the specified motor loads. Voltage dip shall be measured and recorded to demonstrate conformity to the Specifications.

Show that phase rotation of the engine-generator and the utility power are compatible at the site.

43.6 Endurance Tests

Operate the engine-generator for 1/2 hour at one-half its kW rating.

Operate the engine-generator for four (4) hours continuously at 100% of its kW and kVA ratings.

Measure the temperature rise of the windings of the generator using the resistance method.

Provide load banks, fuel, test equipment, labor, materials, and all other equipment and services required for all tests.

43.7 Training

Provide 4 hours of on-site instruction of District's personnel at a time agreeable to the District.

44 Automatic Transfer Switch

44.1 General

The automatic transfer switch shall transfer from the normal service to a standby engine generator in the event of power failure. The switch shall transfer the system back to normal power after normal power has been restored. The switch shall include all controls and accessories. The switch shall be UL labeled and shall be suitable for total system transfer including motor and lighting loads.

44.2 Construction

The automatic transfer switch shall be of the mechanically held double throw type, actuated by two electrical operators momentarily energized and connected to the transfer mechanism by a simple over-center linkage. All main power contacts and auxiliary contacts shall be mechanically attached to a common shaft, shall be double-break silver alloy with wiping action, and shall be protected by arcing contacts. Arcing contacts shall close before and open after the main contacts and shall be readily replaceable. Contact design and arrangement shall permit repeated making and breaking of full-load current, in a combination of motor and other loads, without damage to the main contacts. Provide a main transfer mechanism utilizing rugged metal parts throughout.

Molded circuit breaker type designs are not acceptable.

The switch transfer shall be produced in such a way that a time delay of at least 0.4 seconds exists between the opening of the closed contacts and the closing of the open contacts. The transfer switch shall be capable of transferring in either direction with 70% of rated voltage applied at the switch terminals.

All switch and relay contacts, coils, springs, and control elements shall be serviceable or removable from the front of the mounted switch and accessory assembly without the removal of either assembly from its compartment and without disconnection of drive linkages, power conductors, or control conductors.

The enclosure shall be NEMA 1 construction with hinged doors on the front for access to the interior controls. Secure doors by a locking type latch. Provide two keys for the lock.

Cable connections shall be accessible from the front without removing internal components.

Safety Requirements: Arrange the electrical supply to each control panel to be disconnected by a single switch or circuit breaker, except for necessary foreign circuits. Cover any live parts within the control panel fed from foreign control or signal circuits or arrange for them to be disconnected by one of the following methods:

- Enclosed relays which are automatically de-energized when the main disconnecting switch is opened; or
- Door-operated enclosed disconnect switches; or
- Clearly identified enclosed manually operated disconnect switches, which may be located inside the control panel door, provided the operating handles are isolated or barriered from all open live parts.

Arrange the controls so that manipulation of control switches, adjustments to dining relays, or replacement of fuses can be done without exposure to live parts.

The transfer switch shall have the following features:

- Continuous rating of 480 volts, 3-phase, with 3-poles and full neutral bus. Current rating shall be as shown on the Drawings.
- Adequate line and load lugs for terminating the power conductors shown on the Drawings.
- A terminal strip with terminals for terminating all external control circuits. Number all terminals using the wire number for the wire terminated.
- Cable wiring with cable ties, secured in place and guarded where subject to mechanical injury.
- Permanent identification of each wire at each point of connection using numbered wiring sleeves. Provide electrically common wires with the same number. Uniquely number electrically different wires.

44.3 Controls

Include the following controls and accessories:

- **Three-Phase Relay Protection:** Three adjustable close differential relays, connected phase to-phase, all set to drop out at 80% and to pick up at 90% of nominal voltage.
- **Test Switch:** A test control switch which shall cause the automatic transfer switch to start the engine, transfer, retransfer, and the like, simulating a power outage. Mount this switch on the door of the transfer switch compartment.
- **Override Switch:** An override control switch (1) to prevent the automatic transfer switch from transferring from the "normal" to the "standby" position and (2) to prevent the engine generator from being signaled to start. This control switch shall be mounted on the door of the transfer switch compartment.
- **Indicating Lights:** One each to indicate the switch is supplying "normal" or "standby" power. Provide neon type lamps with series resistors as required, in oil-tight units with clear lenses. Label each light with plastic nameplates engraved "NORMAL" and "STANDBY", respectively. Mount lights on the door of the transfer switch compartment.
- **Engine Starting Delay:** A timer which, following loss or deterioration of "normal" power, will delay closure of engine starting contact for an adjustable period up to 2 minutes, to eliminate starts during brief or momentary outages of "normal" power. Set delay at 5 seconds.
- **Transfer Relay:** A relay to prevent the transfer to standby until the standby power voltage and frequency are 90% of rated values.
- **Retransfer Delay:** A timer to provide an adjustable delay from 2 up to 25 minutes (minimum range) before retransfer to "normal" power. If "standby" power fails before preset delay period elapses, and if "normal" power is within set limits of voltage, override the delay and retransfer immediately.
- **Nameplates:** An engraved plastic nameplate for every lamp, switch, and other control device or indicator. Identify all switch and control positions. Nameplate wording shall be subject to review by the District Engineer.
- **Unloaded Generator Operation:** A timer which, following retransfer to "normal" power, will maintain engine in unloaded operation for a fixed period of 5 minutes before signaling it to shut down.
- **Auxiliary Contacts:** Two sets of Form C contacts, which change state after the engine starting, delay. One of these sets is for starting the engine, the other is spare.
- **Transfer Delay:** A timer to provide an adjustable delay of 1 to 5 seconds in the closing of the open contacts after the closed contacts have opened. Provide this delay for both transfer and retransfer switch operations.

44.4 UL Label

The transfer switch shall have a UL label on the unit when it arrives at the site. Absence of the UL label shall be sufficient cause for the unit to be rejected. Provide all of the specified features, options, and accessories. If the manufacturer's standard UL unit does not have the specified features, options, or accessories, then provide alternative features, options, or accessories to accomplish the same purpose in a manner similar to that specified, while still providing a unit with a UL label.

44.5 Current Ratings

The transfer switch shall have continuous ampere rating as shown on the Drawings and a short circuit withstand rating for 3 cycles at 480 volts as follows

CONTINUOUS AMPERE RATING	WITHSTAND RMS AMPERES, SYMMETRICAL
100-150	16,000
225-800	40,000
1,000-1,600	50,000

44.6 Finish

Shall be manufacturer's standard not less than 3 mils thick. Color shall be light gray ANSI 61 per 255.1.

44.7 Factory Tests

Assemble, wire and test the automatic transfer switch at the factory. Conduct tests to assure that every component functions properly. Submit prototype test reports on bus bracing for the District Engineer's review.

44.8 Installation

Securely anchor the transfer switch both to the wall and floor; for switches not suitable for floor mounting, provide a structural metal base, which is hot dip, galvanized after fabrication. The door shall open freely and close tightly. Repair any defect or damage to the switch, enclosure or paint, to the satisfaction of the District.

44.9 Appendix E/Sewer Service Connection Guide

Gravity Service Line Connections:

- If a 6" stub is provided to the lot, a cleanout per District specifications must be installed in the right-of-way or easement. This must be completed to grade prior to final acceptance.
- If a 4" stub is provided to the lot, the contractor shall install a cleanout per District specifications.
- If cleanouts are installed in an area where vehicle traffic can be expected they must be provided with an H-20 rated sewer frame and cover. If the frame is to be installed in an unpaved area, the cleanout must also have a concrete collar.
- Glue fittings are not acceptable, except when used as a glue-on/screw-on cleanout lid.
- Side sewer connections may use native bedding if it is not composed of large rock, sticks, or other debris. The District shall determine the suitability of any native backfill material when it is in question.
- The maximum bend on 4" and 6" lines is 45 degrees.
- All pipes must be visible to the inspector.
- Install 4" diameter cleanout within 5' of the building foundation wall.
- Pipe shall be 4" PVC sewer pipe, gasket fitting, SDR 35, ASTM D3034, and must be green in color.
- All wyes used must be brought up to finish grade.
- No inspections will commence without a green side sewer inspection permit on-site and visible to the inspector.
- Pipe shall not be bent to make bends; it must be furnished with appropriate fittings.
- Do not backfill any portion of the installation prior to District inspection.

Eone Grinder Pump Service Connections that will be conveyed to the District:

- The grinder pump station shall not be set into the excavation until the excavation has been inspected by the District.
- Pumps must be installed to the manufacturer and District specifications.
- Do not drop, roll or lay the pump on its side for any reason.
- A minimum of 6" of aggregate must be used as bedding (please see specifications).
- Prior to pouring of concrete the unit must be leveled and filled with water. The concrete must be manually vibrated.
- Standard compression couplings will not be allowed.
- The pipe between the home and the tank must be SDR 35, 3034, green gasket sewer pipe.
- Padlocks and keys provided with the system shall be provided to the District during startup and testing.
- A 48-hour notice must be given to the District by the Contractor/Homeowner prior to start up and testing of the pump station that will be performed by Correct Equipment.

STANDARDS FOR EONE GRINDER PUMPS CONVEYED TO DISTRICT

45 Grinder Pump Equipment

45.1 General

This division covers that work necessary for furnishing and installing grinder pumps, discharge piping and appurtenances to comply with these specifications and the District's standard details.

The Developer shall furnish and install a complete factory-built and tested grinder pump station manufactured by Environment One Corporation, consisting of a grinder pump suitably mounted in a basin constructed of high density polyethylene or fiberglass, electric quick disconnect (NEMA 4X), pump removal system, shut-off valve, anti-siphon valve, and check valve assembled within the basin, remote electrical alarm/disconnect panel, and all necessary internal wiring and controls.

45.2. Submittals

Submittal information shall be provided to the District for the following items:

1. Submit shop drawings containing catalog cuts, design of modifications required in this section, complete electrical schematics, and motor data.
2. Submit details of field jointing of access ways.
3. Provide a recorded easement for the grinder pump facilities on each property prior to acceptance.

45.3. Warranty

Provide the Developer's standard two (2) year installation warranty.

45.4. Design Criteria

Provide a minimum of one grinder pump for each lot served.

Each simplex grinder pump station shall serve no more than one (1) house and a mother-in-law apartment located on the same lot.

No more than one duplex shall be served by a simplex grinder pump station. A triplex shall be served by a duplex grinder pump station or two simplex grinder pump stations.

Comply with Washington State Labor & Industries requirements regarding intrinsically safe electrical equipment.

45.5. Grinder Pump & Appurtenances

Developer shall furnish an "Environment One" grinder pump station. Supply each grinder pump with two "Environment One" identically-keyed padlocks prior to acceptance and testing.

Polyethylene pressure pipe shall be used for the discharge piping from the grinder pump.

Pipe shall have a base resin rating of PE 3408 with a pressure rating of 160 psi, SDR 11.

45.6. Valves Associated with Grinder Pumps

Plug valves shall be cast iron body, welded nickel or adjustable stainless steel seat, Buna-N coated plug and Buna-N packing. Valves shall be full port opening with drip tight shutoff and mechanical joint or flanged ends.

Valve operator shall be a 2-inch square nut with AASHTO H-20 traffic rated cast iron valve box (worm gear operated for valves 6-inches and larger).

Valves shall have factory coated. Coat interior metal surfaces and exterior surfaces with 12 mils minimum fusion epoxy per AWWA 550 or 20 mils coal tar epoxy.

Ball valves shall be bronze body, Teflon seat, stainless steel ball and stem with flanged or threaded ends. Provide ball valves with stainless operating handle and drip-tight shutoff. Ball check valves shall be Schedule 80 PVC with Teflon seats and EPDM O-ring gaskets.

Valve shall be rated at 150-psi @75sf. Provide double union type valve with threaded or socket ends.

Valve box shall be a concrete meter box, equivalent to Fogtite No. 2, or fiberglass meter box rated for H-20 loading and equal to Fogtite No. 2. Valve box lid shall have "SEWER" label.

45.7. Grinder Pump Installation

The Developer shall be responsible for removing groundwater to provide a firm, dry subgrade for the structure, and shall guard against flotation or other damage resulting from general water or flooding. The grinder pump station shall not be set into the excavation until the installation procedures and excavation have been reviewed and approved by the District.

The pump station is supplied with a standard 4-inch inlet grommet for inlet piping. Developer shall not insert inlet piping beyond the factory-provided "stop". The basin may not be dropped, rolled or laid on its side for any reason.

Installation shall be accomplished so that 1-inch to 3-inch of access way, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the excavation must be large enough to allow for the concrete anchor surrounding the tank.

A 6-inch minimum layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8 inch or more than 3/4 inch, shall be used as bedding material under each unit. A concrete anti-flotation collar, as detailed on the drawings, and sized according to the manufacturer's instructions, shall be required and shall be pre-cast to the grinder pump or poured in place. The grinder pump station with its precast anti-flotation collar shall have a minimum of four lifting eyes for loading and unloading purposes. The unit shall be leveled, and filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids.

If it is necessary to pour the concrete to a level higher than the inlet piping, an 8-inch sleeve is required over the inlet prior to the concrete being poured.

Backfill of clean native earth, free of rocks, roots, and foreign objects shall be thoroughly compacted in lifts not exceeding 12-inches to a final Proctor Density of not less than 85%. Improper backfilling may result in damaged access ways.

The electrical control panel shall be installed and wired to the grinder pump station by the Developer using the factory supplied 6 conductor, 12 gauge TC type cable as shown on the standard drawings. Type TC cable shall be installed in PVC Schedule 40 continuous conduit and burial depth shall comply with local code requirements.

Polyethylene pressure pipe joints shall be flanged, thermal fusion butt welds or made using weld-on compression couplings. Joints in 1¼" and 2" pipe shall be made only at pump basins, valves, fittings and changes in pipe diameter. For pipes larger than 2" in diameter, joints between pipe sections shall be thermal fusion butt welded. All flanges and fittings shall be thermal fusion butt welded to the pipe. Operators of fusion welding equipment shall be trained by the pipe manufacturer, who shall certify that operators are qualified. Install warning tape in the trench approximately one foot below finished grade, directly above the pipe.

Install trace wire with all polyethylene pressure or force main and grinder pump discharge piping. Trace wire shall be a minimum of 10 gauge.

45.8. Startup and Field Testing

A 24-hour notice shall be provided to the District for witness of startup and testing of the pump station. Prior to the testing, the pump station shall be complete (including landscape), the main line isolation valve shall be opened by District personnel, and the installer shall have successfully performed all testing to assure the station operates properly.

Standard Water and Sewer Details

Standard Water Details

Separation Standards

Water Main Trench

Wet Tap

Thrust Blocking

Blow Off Assembly

Fire Hydrant Assembly

1 ½" or 2" Water Service

Single Water Service

3", 4" and 6" Compound Meter Service

Residential Fire Sprinkler Metering

Valve Marker/Valve Extension

Double Check Backflow Assembly

2" AND Smaller Reduced Pressure Backflow Assembly

Air/Vac Assembly

Pressure Reducing Station

Fire Service Connection

Service Pressure Reducing Valve

Standard Sewer Details

Sewer Trench Detail

HDPE Flange Connection

Typical House Sewer Lateral

Single Service Connection

Double Service Connection

Sewer Cleanout Details

Service Connection Marker

Manhole Details 1

Manhole Details 2

Manhole Details 3

Typical Saddle Manhole

Typical E-1 Grinder Pump Installation

Typical Grinder Pump Stub and Valve Box

Grinder Pump Installation Concrete Ballast

Force Main Drop Structure

Force Main Cleanout Detail

Force Main Drop Support Clip

Low Pressure Force Main Connection to Gravity Sewer

Inside Gravity Drop Structure