

KITSAP COUNTY

STANDARDS

FOR

SANITARY SEWER CONSTRUCTION



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Last Revised: February 8, 2021

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KITSAP COUNTY STANDARDS FOR SANITARY SEWER

Adopted _____

Introduction

Kitsap County was founded in 1857 and was originally named Slaughter County. It is now home to over 265,000 people. Residents are represented by three County Commissioners and are served by a variety of agencies and government departments, including Public Works. Kitsap County occupies a unique portion of the State of Washington, directly between the urban areas of Seattle and Tacoma and the wilderness of the Olympic Mountains. It is bounded by Hood Canal on the west, Puget Sound on the east, and Mason and Pierce Counties to the south.

The purpose of the *Standards for Sanitary Sewer Extensions* is to provide minimum design and construction requirements for the extension of and connection to the Kitsap County sewer facilities. It also specifies documentation and administration requirements necessary for obtaining approval and acceptance of sewers. These *Standards* shall govern all construction and upgrading of sewer systems and facilities conveyed to Kitsap County, except where otherwise provided for in other ordinances.

These *Standards* implement, and are intended to be consistent with the latest edition of the Washington State Department of Ecology's "Criteria for Sewage Works Design." Except where provided otherwise in these *Standards*, construction details, workmanship, and materials shall be in accordance with the most recent edition of the "Standards Specification for Road, Bridge, and Municipal Construction," prepared by the Washington State Department of Transportation and the American Public Works Association.

Kitsap County will only grant variances from these *Standards* upon evidence that such variances are in the public interest and based on sound engineering judgment. The requirements for safety, function, appearance, and maintainability shall be fully met. Variances must be approved in writing prior to construction.

Failure to comply with these *Standards* shall be cause for withholding all approvals associated with the sewer facilities proposed.

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KITSAP COUNTY
STANDARDS FOR SANITARY SEWER CONSTRUCTION
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Chapter 1 Sewers

This chapter covers the design, construction, operation, and maintenance of gravity and forcemain sewers and manholes. The requirements apply equally to sewer systems that are privately owned as well as publicly owned sewer systems. Also included in this chapter is a section on various types of alternative systems for conveyance of wastewater to a centralized location or wastewater facility.

1-1 General Requirements

1-1.1 Definitions

ANSI: American National Standards Institute

ASTM: American Society for Testing and Materials

ATS: Automatic Transfer Switch

AWWA: American Water Works Association

BHP: Brake Horsepower

Building Sewer (Upper Lateral): that portion of a sanitary sewer line that will be constructed from the end of the side sewer to the residence or building in which the sewage originates.

CB: Circuit Breaker

CD: Compact Disk

CDF: Control Density Fill

CSA: Canadian Standards Association

DFT: Dry Film Thickness

DI: Ductile Iron

DWV: Drain, Waste, Vent (Pipe)

EPDM: Ethylene Propylene Diene Monomer (Rubber)

ETL: Electrical Testing Laboratories

FL: Flared (fitting)

Flexible pipe: All other PVC and HDPE will be considered flexible pipe.

FM: Factory Manual

FPS: Feet Per Second

FRP: Fiberglass Reinforced Plastic

GE: Groove End

GFI: Ground Fault Interrupter

GP: Grinder Pump

GPM: Gallons Per Minute

HDPE: High Density Polyethylene

HOA: Hands-off-Automatic

ICRI: International Concrete Repair Institute

ID: Inner Diameter

IEEE: Institute of Electrical & Electronic Engineers

IPCEA: Insulated Power Conductor Engineering Association

IPS: Individual Pump Station; a small, single pump station designed to provide service to a single residence or business.
kW: Kilowatt
LED: Light Emitting Diode
LID: Local Improvement District
NACE: National Association of Corrosion Engineers
NEC: National Electrical Code
NEMA: National Electrical Manufacturers Association
NESC: National Electrical Safety Code
NFPA: National Fire Protection Association
NPT: National Pipe Thread
O&M: Operations and Maintenance
OD: Outer Diameter
OSHA: Occupational Safety & Health Act
PE: Plain End
PLC: Programmable Logic Controller
PSF: Pounds per Square Foot
PSI: Pounds per Square Inch
PVC: Polyvinyl Chloride
Rigid Pipe: Ductile Iron or C900/C905 PVC will be considered rigid pipe.
RTU: Radio Telemetry Unit
SBR: Styrene-butadiene Rubber
SDR: Standard Diameter Ratio
Sewer Main: A sewer that may have direct side sewer connections and receives flow from one or more other mains.
Side Sewer (Lower Lateral): that portion of a sewer line that will be constructed between a main sewer line and the property line or easement line (whichever is further) of a residence or other building in which the sanitary sewage originates.
SSPC: Steel Structures Painting Council
TDH: Total Dynamic Head
UL: Underwriters Laboratories
UPC: Uniform Plumbing Code
VFD: Variable Frequency Drive
VSD: Variable Speed Drive
WADOE: Washington Department of Ecology

1-1.2 Approvals

1-1.2.1 Submittal Procedure

Whenever a property owner, individual, business, corporation, or other entity desires to connect to the County's sanitary sewer system an Application to Construct Sanitary Sewer Extension shall be provided with the first Construction Plan submittal. In order to coordinate the review of Construction Plans for all projects in Kitsap County, the Department of Public Works has implemented a standard procedure for plan submittals in conjunction with the Department of Community Development (DCD).

A Submittal Checklist is included in Section C4 of these *Standards* which is intended to assist the proponent of the project through the sanitary sewer extension approval and acceptance process. The Submittal Checklist is general and does not cover all possible situations. The County reserves the right to deviate from the checklist if the project warrants.

1-1.3 Design

1-1.3.1 General

The General Plan Format shall be used in conjunction with the Department of Ecology's most current version of "Criteria for Sewage Works Design." Since the following requirements are general and do not cover all possible situations, the County reserves the right to deviate from the following if the County feels the project warrants such.

1-1.3.2 Record Drawing Requirements

Record drawings are required for all construction projects conducted in Kitsap County prior to Acceptance by the County.

1. All Record drawings must be stamped and dated by a State of Washington Registered Engineer or Surveyor.
2. Each sheet of the Record drawing plans shall include the following statement along with the engineer's professional stamp, signed and dated, located at the bottom right-hand corner of the sheet when possible: "These plans are Record Drawings and the information shown accurately reflects existing field conditions as of this date: _____"
3. The Record Drawing Plans should consist of the design plans submitted, approved, and permitted for the construction project. The information shown shall reflect the actual construction completed under the permit with any and all deviations from the design plans. All changes shall be annotated with a cross-out and/or a cloud. This information shall be provided by the engineer of record.
4. Record drawings are to be drawn on clean sheets and submitted to the Public Works Department with one paper copy and an electronic set.
5. Electronic drawings are to be submitted in two formats: Adobe PDF and CADD. Adobe PDF files shall be scalable and properly labeled with project and drawing names.

6. The sewer utility shall be shown on separate sheets with detailed information. In addition, a composite with all utilities shown together, without detailed information, and focusing on utility crossings, is required.

1-1.4 Siting Considerations

Siting of sewer mains and manholes shall be restricted to the public right-of-way and/or easements dedicated for this utility. Due to the depth of this type of utility the pipe shall be located as close as possible to the center of the right-of-way, with manholes located in the center of the traveled lane.

1-2 Industrial and Commercial Pretreatment (Fats, Oils, and Grease Removal)

1-2.1 Descriptions/Design

Grease removal devices (interceptors and traps) shall be sized based on one of the methods outlined in the most current Uniform Plumbing Code (UPC) or other criteria as determined on a case by case basis based on review of relevant information, including, but not limited to grease interceptor performance, waste stream characteristics, facility location, maintenance needs, and or inspection needs. The aforementioned determinations may or may not conform to the UPC construction standards or sizing criteria for grease interceptors or similar devices. Supporting sizing calculations shall be submitted to the County.

1-2.1.1 Grease Interceptor

Each facility is solely responsible for the cost of the grease interceptor installation, inspection, cleaning and maintenance. The minimum capacity of any exterior grease interceptor will be 1500 gallons unless approved by the Director.

Grease interceptors must be vented.

1-2.1.2 Grease Trap

Each facility is solely responsible for the cost of the grease trap installation, inspection, cleaning and maintenance. When the use of Grease Interceptors is deemed unfeasible by the County, grease traps may be permitted at the discretion of the Director.

Grease traps shall be designed using standard engineering principles for sedimentation and flotation in gravity separators.

1-2.2 Materials

1-2.2.1 Grease Interceptor

Grease interceptors shall be designed using standard engineering principles for sedimentation and flotation in gravity separators. The grease interceptor will have a minimum of two (2) compartments with fittings designed for grease retention.

Grease interceptors shall be equipped with a sampling port at the outlet of the interceptor. Inspection tees and manholes must enable the utility to monitor and test the discharge for compliance with utility requirements or to allow monitoring and testing in accordance with the rules and regulations of other federal, state or local agency having governmental or contractual jurisdiction within the utility service area.

1-2.2.1 Grease Trap

Grease traps shall be equipped with a device to control the rate of flow through the unit. The rate of flow shall not exceed the manufacturers rated capacity recommended in gallons per minute for the unit.

1-2.3 Installation

1-2.3.1 Grease Interceptor

Grease interceptors shall be installed at a location where it is easily accessible for sample collection, inspection, and cleaning and removal of retained grease. The grease interceptor may not be installed in any part of the building, unless pre-approved, and the location must meet the approval of the County.

Grease interceptors shall be located in the food service establishment's lateral line between all fixtures which may introduce grease into the sanitary sewer and the connection to the sanitary sewer collection system. Such fixtures shall include but not be limited to sinks, dishwashers, floor drains for food preparation and storage areas, mop sinks, floor mat wash down areas, and any other fixture which is determined to be a potential source of grease.

Access manholes, with a minimum diameter of 24 inches, shall be provided over each chamber and inlet/outlet tee. The access manholes shall extend at least to finished grade and be designed to prevent water inflow or infiltration. The manholes shall also have readily removable covers to facilitate inspection, cleaning and removal of retained grease and sample collection. Riser maximum will not exceed 24 inches.

1-2.3.2 Grease Trap

Fixtures such as waste disposal units and dishwashers shall not be permitted in facilities with grease traps.

1.2.4 Operation, and Maintenance

Flushing the grease interceptor or grease trap with water having a temperature in excess of 140 degrees Fahrenheit is prohibited.

Grease interceptors and grease traps shall be considered out of compliance if the total volume of grease and solids displaces more than 25% of the effective volume of the final chamber of the interceptor; or if a greasy buildup develops on the building sewer between service visits as determined by video inspection of the sewer mains. Grease interceptors and grease traps must be serviced and emptied of accumulated waste content as required maintaining a minimum design capability or effective volume, but

not less than once every ninety (90) calendar days. If a facility determines that cleaning every 90 calendar days is unnecessary in order to remain in compliance with requirements, the facility may make a written application for a variance from the cleaning schedule.

Sanitary wastes (restroom wastes) cannot be introduced into the grease interceptor.

Any facility that has a grease interceptor or grease trap shall maintain a pumping contract with a licensed grease pumping company. The pumping company will pump the interceptor or traps on a regular schedule without notification from the facility. The pumping company will notify the County if the contract is canceled by either party.

All facilities shall maintain a written record of inspection and maintenance activities and the rendering/disposal company manifest for a minimum of three (3) years. All such records shall be submitted to the County and made available for on-site inspection during all operating hours.

Wastes removed from a grease interceptor or grease trap shall be disposed of at a facility permitted to receive such waste. Neither grease, solids, nor liquids removed from grease interceptors or traps shall be returned to any grease interceptor, private sanitary sewer line, any portion of the sanitary sewer collection system, or any portion of the storm water system.

1-3 Sewer Systems Design Considerations

1-3.1 General

Any extension of the Kitsap County sanitary sewer system shall be completed in accordance with the applicable forms and agreements.

In order to facilitate future sewer main extensions to adjacent properties, sewer main extensions will comply with the following principles. Sanitary sewer main extensions located in the county right-of-way shall be extended across the entire length of the abutting right-of-way. Sanitary sewer main extensions within a sub-development or plat, shall be extended to the adjacent property line.

1-4 Sewer Pipe Design and Construction

1-4.1 Minimum Size

The minimum sewer main size shall be 8-inch diameter.

The minimum side sewer pipe size shall be 6-inch for a single residence, a commercial service, or multi-family service. Residential side sewers serving two residences may be a single 6-inch side sewer to the property line; branching into two 4-inch building sewers to the two residences, as shown on the County Standard Details PD-8 and PD-9.

The minimum building sewer pipe size shall be 4-inch for a single residence and 6-inch for a commercial or multi-family service.

The minimum size forcemain shall not be less than 4-inch diameter, except for grinder pump installations which shall be a not less than 1-1/4 inch diameter.

1-4.2 Depth

The minimum gravity sewer main depth shall be 4 feet, as measured from finish grade to top of pipe. Forcemains shall be laid with a minimum cover of 4 feet. If the minimum depth cannot be maintained ductile iron pipe or a casing will be required. Below 16 feet of depth rigid pipe is required.

The minimum side sewer depth shall be 4 feet, as measured from finish grade to the top of pipe. The design and installation shall anticipate the crossing of other utilities in the right-of-way, with the side sewer typically crossing under these utilities.

The minimum building sewer depth shall be 18 inches as measured from finished grade to the top of the pipe and not closer than 30 inches horizontally from a building when running parallel to the building.

The minimum forcemain depth for grinder pump installations shall be 18 inches as measured from finished grade to the top of the pipe.

1-4.3 Roughness Co-Efficient

For pipe sizes not shown, use a Manning's "n" value of 0.013 (regardless of pipe material) and full flow velocity of 2.0 fps to determine allowable minimum slope.

1-4.4 Slope (Minimum Velocity)

The minimum full flow velocity for sanitary sewers shall be 2.0 fps. Calculations supporting that a minimum 2.0 fps velocity can be achieved as designed, shall be submitted to the County by the Developer's Engineer, when requested. In no case will slopes less than the following minimum slopes be allowed for sewer mains:

Pipe Diameter (inches)	Minimum Slope (feet per 100 feet)
8	0.50
10	0.30
12	0.25
14	0.20
15 and greater	0.15

The minimum grade for a side sewer or building sewer shall be 2%. Special circumstances may require consideration of grades less than 2% but will require approval of the County.

The maximum grade for a sewer main, side sewer, or building sewer shall be 100%. Grades in excess of 100% will be considered only to resolve exceptionally steep site conditions, and only with the installation of pipe anchors at no more than 16-foot centers in accordance with the County Standard Detail PD-2.

Sanitary sewer mains shall be laid with uniform slope between manholes. Sewers on 20% slope or greater shall be anchored securely with pipe anchors. Pipe anchors shall conform to County Standard Detail PD-2 and spacing shall be as follows:

1. Not over 36 feet center to center on grades 20% and up to 35%.
2. Not over 24 feet center to center on grades 35% and up to 50%.
3. Not over 16 feet center to center on grades 50% and over.

At pumping capacity, the self-scouring flow velocity shall be between 2 to 8 fps. Optimum velocities for reducing maintenance costs and preventing accumulation of solids range between 3.5 and 5 fps.

Check dams as per the County Standard Detail PD-3 shall be placed along the pipe at intervals of 100 feet on sewer mains laid on slopes of 6.0% or greater. Check dam spacing shall be shown on the Plans.

Thrust blocks shall be poured in place, per County Standard Details PD-5 and PD-6. Concrete thrust blocks for forcemains shall be placed at bends, tees, dead ends, and crosses.

1-4.5 Alignment

Gravity sewer mains shall be designed with straight alignment between manholes.

1-4.6 Increasing Size

Where a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. A method for approximating these results is to place the 0.8 depth point of both sewers at the same elevation. Pipeline sizes will only be increased at manholes.

1-4.7 High-Velocity Protection

Where velocities greater than 15 fps are expected, special provision shall be made to protect against internal erosion or displacement by shock.

1-4.8 Air Relief Valve

Air and vacuum release valves shall be placed at all high points in the forcemain and shall conform to the County Standard Detail MD-5 for "air and vacuum release assembly."

Air releases valves by A.R.I. or approved equal shall be for sewage and designed to prevent clogging due to solids in the fluid. Valve bodies shall be reinforced nylon or

stainless steel with a minimum 3-150 psi working pressure rating. Combination air valves shall be intended for wastewater application and have the following features:

1. Conical body shape
2. Funnel-shaped lower body
3. Spring-loaded joint between the stem and upper float
4. Rolling seal mechanism
5. All inner metal parts shall be 316 stainless steel.
6. Floats to be made of composite materials.
7. Minimum 1 ½" threaded discharge outlet
8. Stainless steel ball valve to release trapped pressure and drain the body prior to maintenance.

1-4.9 Blow-Offs

Blow offs shall be constructed per Detail MD-6

1-4.10 Thrust Restraint

Thrust blocks, restrained joints, and/or tie rods and shackles shall be provided at all bends or at points where restraint is needed along the forcemain per details PD-2, PD-5, and PD-6.

1-4.11 Pig Launching/Retrieval Facilities

Each pump station shall have a pig launch station as shown in the County Standard Details MD-2 and MD-3.

Forcemains that do not discharge directly into a manhole shall be equipped with both a launch station and a recovery station for a pipeline cleaning device commonly referred to as a pig. Construction shall be in conformance with County Standard Details MD-2, MD-3, and MD-4.

1-4.12 Materials

1-4.12.1 General

The Developer shall submit information from the material manufacturer or fabricator showing that the materials meet the requirements of the design and pertinent specifications. The developer shall provide submittals to the County on all materials to be used.

1-4.12.2 Pipes and Fittings

Pipe used for sanitary sewers shall be either cement mortar-lined or epoxy lined ductile iron, PVC, or HDPE. It is not intended that materials listed herein are to be necessarily considered equal or generally interchangeable for all applications. Calculations supporting pipe or bedding classifications specified shall be submitted to the County by the developer's engineer, when requested. All fittings, unless otherwise noted herein, shall be the same material as the mainline pipe.

1-4.12.2.1 Gravity Pipe

Ductile iron pipe for gravity sanitary sewer pipe and forcemain pipe shall conform to Class 50 (or greater) AWWA C 151 and shall be cement mortar lined, push-on joint, or mechanical joint. Joints for ductile iron pipe shall be rubber gasketed conforming to the requirements of AWWA C 111.

Side sewer and building sewer tee or wye fittings for ductile iron gravity pipes shall be rubber gasket push-on joint or mechanical joint ductile iron fittings. Saddles fastened to pipe with external bands shall not be acceptable on any new system. Fittings shall have sufficient strength to withstand handling and load stresses normally encountered. Fittings for ductile iron gravity and forcemain pipe shall be ductile iron and shall meet the requirements of AWWA C110 or AWWA C153. Fittings shall be cement mortar lined or epoxy lined, meeting the requirements of AWWA C 104.

Polyvinyl chloride (PVC) gravity sanitary sewer pipes shall conform to the requirements of ASTM D 3034, SDR 35 for pipe up to 15 inches diameter and ASTM F 679, Type 1 only, for pipe sizes 18 inches to 27 inches. Joints for PVC gravity sewer pipe shall be push-on type with a restrained elastomeric ring gaskets conforming to ASTM D 3212. Gaskets shall conform to ASTM F 477.

Side sewer and building sewer fittings for PVC pipes shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13343-C, as defined in ASTM D 1784. Fittings shall have sufficient strength to withstand handling and load stresses normally encountered.

1-4.12.2.2 Forcemain Pipe

Forcemain pipe, transition couplings, reducing couplings, transition-reducing couplings, and flexible couplings shall be compression type, constructed with ductile iron or steel sleeves and ductile iron followers. Bolts and nuts shall be stainless steel. Factory finish shall be the standard of the manufacturer. Couplings shall be Romac, Smith-Blair, or equal.

Polyvinyl chloride (PVC) pressure sanitary sewer pipes shall meet the requirements of AWWA C900 or AWWA C905, Class 200, DR14. PVC pipe shall have the same outside dimensions as ductile iron pipe.

Joints for PVC forcemain pipe shall be push-on type meeting the requirements of ASTM D 3139 using a restrained rubber gasket conforming to ASTM F 477. Solvent welded pipe joints are not permitted except for pipe sizes below 3" diameter.

Forcemain pipe transition couplings, elbows, tees, reducing couplings, transition-reducing couplings, and flexible couplings shall be compression type, constructed with ductile iron or steel sleeves and ductile iron followers. Bolts and nuts shall be supplied with the fitting by the manufacturer. Factory finish shall be the standard of the manufacturer. Couplings shall be Romac, Smith-Blair or equal.

High Density Polyethylene (HDPE) forcemain pipes shall meet the requirements of AWWA C901 or C906, Class 200. HDPE pipe shall have the same inside dimensions as ductile iron pipe.

Joints for HDPE forcemain pipe shall be butt fusion weld type meeting the requirements of ASTM F 2620 and ASTM D 3261. Solvent welded pipe joints are not permitted.

Sanitary sewer forcemains for building sewers utilizing an IPS shall be a minimum of 1-1/4 inch diameter, Schedule 80 PVC or HDPE.

1-4.12.3 Bedding and Backfill

Pipe bedding and trench requirements shall be as indicated in the County Standard Detail PD-1 Typical Trench Section.

Pipe foundation stabilization material for both flexible and rigid pipe shall be imported material conforming to WSDOT 9-03.17, Class B.

Pipe zone bedding and pipe zone backfill for flexible pipe and HDPE pipe shall be imported material conforming to WSDOT 9-03.13.

Pipe zone bedding and pipe zone backfill for rigid pipe shall be imported material conforming to WSDOT 9-03.12(3).

Trench zone backfill in improved and paved areas for both flexible and rigid pipe shall be imported material conforming to WSDOT 9-03.19. In unimproved areas all trench zone backfill can be select native material obtained from the trench excavation that meets the requirements of Bank Run Gravel for Trench Backfill or imported Bank Run Gravel for Trench Backfill.

Controlled Density Fill (CDF) or Controlled Low-Strength Material (CLSM) shall be conforming to WSDOT 2-09.3(1)E. No CDF shall be placed until the County has reviewed and approved the mix design. The County's approval of the mix design will be understood to indicate conditional acceptance only. Final acceptance will be based on tests conducted on field installations for conformance with WSDOT 2-09.3(1)E.

The use of pea gravel for pipe zone bedding and pipe zone backfill for both flexible and rigid pipe is not approved for use. The County will consider the use of pea gravel for special cases on a case-by-case basis, and reserves the right to charge the Developer an hourly rate to review all requests. Should the use of pea gravel be allowed, approval may require the installation of trench check dams as indicated in the County Standard Detail PD-3 Check Dam. Should the use of pea gravel be approved, the pea gravel utilized shall conform to the following specification:

Pea gravel shall consist of processed or naturally occurring rounded to subangular granular material and particles. Material shall be hard and durable. It shall not include crushed materials and shall be free of organic, wood waste or other deleterious or

objectionable materials. It shall have such characteristics of size and shape that it will readily compact and meet the following gradation requirements:

Screen/Sieve	Percent Passing
1-inch	100
3/4-inch	80-100
3/8-inch	0-40
No. 4	0-20
No. 40	0-10
No. 100	0-2

1-4.12.4 Miscellaneous

Concrete thrust blocks for pressure force mains shall be commercial concrete (minimum 3,000 psi) per Section 6-02.3(2)B of the Standard Specifications for Road, Bridge, and Municipal Construction. Thrust blocks shall be poured in place with bond breaker at fittings and fasteners per County Standard Details PD-5 and PD-6. Concrete thrust blocks shall bear against solid undisturbed earth at the sides and bottom of the trench.

Pipe anchors shall be constructed of commercial concrete (minimum 3,000 psi) per Section 6-02.3(2)B of the Standard Specifications for Road, Bridge, and Municipal Construction with 1-inch diameter galvanized steel rod tie downs. The anchors shall be constructed per County Standard Detail PD-2.

1-4.13 Joints

1-4.13.1 Sewer Mains

Either tees or wyes shall be used for side sewer connections to new sewer mains. Saddles fastened to pipe with external bands shall not be acceptable on any new system.

1-4.13.2 Side Sewers

A maximum of two residential units or, depending on design flow, one commercial or multi-family building shall be allowed to connect to each side sewer.

No domestic side sewer connections shall be made directly to any manhole.

Each side sewer will terminate with a test tee and 6-inch cleanout located at the property/easement line for each lot/building/dwelling to be served, as shown on the County Standard Details PD-8 and PD-9.

A side sewer serving a commercial/industrial building or facility which has the potential of discharging grease, oil and/or chemicals to the sanitary sewer shall indicate so during permit application. These properties will require the applicant to submit plans indicating the type and location of grease interceptor or pretreatment devices installed as part of the building plumbing and a scheduled maintenance plan.

1-4.13.3 Building Sewers

A maximum of one residential unit or one commercial/multi-family building shall be allowed for each building sewer.

The building sewer shall be connected to the test tee located at the end of the side sewer and extend to the building to be served.

No connections from downspouts, gutters, and basement sump pumps or outside drains or any other feature receiving or exposed to rain or groundwater shall be connected to the building sewers.

1-4.14 Installation

1-4.14.1 General

The developer shall complete the proposed sanitary sewer construction in accordance with the approved construction drawings, details, specifications, state requirements, and local regulatory requirements.

Survey line and grade control hubs shall be provided by the developer's engineer in a manner consistent with accepted practices. Developers shall provide all required staking and grades for the proper installation. No deviation shall be allowed without prior approval of the County. Staking shall be provided at the minimum of 50 feet intervals. All staking shall be under the supervision of a licensed land surveyor or a professional engineer.

All existing sewer lines shall be kept in service at all times. Provision shall be made for disposal of sewage flow if any existing sewers are damaged. Damage to existing sewers shall be repaired by the Developer to a condition equal to or better than their condition prior to the damage. Water accumulating during construction shall be removed from the new sewers but shall not be permitted to enter the existing system. The developer shall be responsible for flushing out and cleaning any existing sewers, into which gravel, rocks, or other debris has entered as a result of the work, and shall repair lift stations or other facilities damaged by the work at the developer's expense.

The physical connection to an existing manhole or sewer shall not be made until authorized by the County. Such authorization will not be given until all upstream lines have been completely cleaned and tested.

Connection of a side sewer to an existing sewer main, where an in-line tee or wye is not available, will be made by the use of a saddle furnished and installed by the County once the Developer has exposed the sewer main and provided any shoring necessary to provide for safe working conditions. Developer shall schedule the saddle with the County in advance. Developer shall obtain the necessary permits prior to exposing the existing sewer main.

1-4.14.2 Trenching

The maximum permissible trench widths in the pipe zone shall be according to the County Standard Detail PD-1. Above the pipe zone the trench may be any width.

The developer shall provide all materials, labor, and equipment necessary to shore trenches to protect the work, existing property, utilities, pavement, etc., and to provide safe work conditions in the trench. The developer may elect to use any combination of shoring and overbreak, tunneling, boring, sliding trench shield, or other method of accomplishing the work consistent with applicable local, state and federal safety codes.

Upon completion of work, the developer shall remove all shoring unless indicated otherwise on the approved plans or as directed by the County. Damages resulting from improper shoring or failure to shore shall be the sole responsibility of the developer.

The developer shall furnish, install, and operate all necessary equipment to keep excavation above the foundation level free from water during construction, and shall dispose of the water so as not to cause injury to public or private property or nuisance to the public. Sufficient pumping equipment in good working condition shall be available at all times for emergencies, including power outage, and shall have available at all times competent workers for the operation of the pumping equipment.

Excavation for manholes and other structures connected to the pipelines shall be sufficient to provide a minimum of 12 inches between their surface and the sides of the excavation.

1-4.14.3 Bedding

Bedding shall be installed in accordance with the County Standard Details PD-1 and PD-12. Bedding shall provide a uniform support along the entire pipe barrel, without load concentration at joint collars or bells. Bedding disturbed by pipe movement or by removal of shoring or movement of the trench shield or box shall be reconsolidated prior to backfill.

Bedding shall be placed in more than one lift, the first lift is to provide at least 4 inches of bedding under any portion of the pipe and shall be placed before the pipe is installed, and shall be spread smoothly so that the pipe is uniformly supported along the barrel. Subsequent lifts of the not more than 6 inches thickness shall be installed to a depth of 6 inches over the crown of the pipe. Each lift shall be compacted to 90% of maximum density as determined by ASTM D 1557. Densities shall be determined by the sand-cone method, ASTM D 1556 or by nuclear methods, ASTM D 2922.

1-4.14.4 Pipe Installation

The sewer pipe shall be laid up grade from point of connection on the existing sewer or from a designated starting point. The sewer pipe shall be installed with the bell end pointed upgrade. Pipe will be considered "sent home" when the pipe segment is fully seated within the bell section of the previously installed pipe segment. When pipe laying is not in progress the forward end of the pipe shall be kept tightly closed with an

approved temporary plug. A temporary plug shall be provided at the point of connection to the existing sewer and shall not be removed until the new lines have been flushed, cleaned, tested and approved for use.

After an accurate grade line has been established, the pipe shall be laid in conformity with the established line and grade in the properly dewatered trench. Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surfaces. The invert line may vary from the true line and grade within the limits stated to develop uniformity, concentricity, and uniform compression of jointing material provided such variance does not result in a reverse sloping invert. The limit of the variance at the invert shall not exceed plus or minus 0.03 foot at the time of backfill. Line and grade shall be maintained with a laser beam operated by a qualified person. Checking of the invert elevation of the pipe may be made by calculations from measurements on the top of the pipe. Pipes with an invert variance greater than allowed shall be relaid.

All pipe material between manholes shall be the same material, except for drop connections. All connections to manholes shall be made with manhole adapters. Manhole adapters shall be watertight with voids around manhole adapters thoroughly grouted and sealed inside and outside of the manhole walls and installed in accordance with manufacturer's recommendations.

When required, the design shall specify a check dam material of either native clay material, a mixture of pipe bedding material and imported bentonite clay material, or control density fill (CDF) material. The check dams shall be a minimum of one foot in length and keyed into the bottom and sides of the trench a minimum of one foot and extended a minimum of one foot over top of pipe leaving a minimum of one foot between the top of the check dam and finished surface as per County Standard Detail PD-3.

1-4.14.5 Backfill

The location of the end of side sewers shall be marked by the developer at the property line by a 2"x4" wood stake buried in the ground, located at the end of the side sewer stub. The exposed end shall be painted white and the depth to the side sewer or tee indicated in black paint. Minimum height above the surface shall be 3 feet.

Sewer trenches shall be backfilled as soon after the pipe laying as possible after inspection. The Developer shall have no more than 200 feet of trench open in which the sewer has been completed, except by permission of the County.

Backfilling of trenches in the vicinity of manholes will not be permitted until the concrete or mortar has become thoroughly hardened.

Backfill above the pipe shall be accomplished in such a manner that the pipe will not be shifted out of position nor damaged by impact or overloading.

Trenches shall be backfilled in lifts no greater than 8 inches.

Backfill shall be compacted, as determined by ASTM D 1557, to at least 85 percent maximum density in unimproved areas, and to at least 95 percent maximum density in improved and paved areas. Densities shall be determined by the sand-cone method, ASTM D 1556 or by nuclear methods, ASTM D 2922.

Warning tape shall be placed approximately 2 feet above the top of all sanitary sewer pipes and shall extend its full length. The warning tape shall be green in color and shall have the words "Caution Sewer Line Buried Below" printed continuously along the full length. Warning tape shall be Terra Tape or equal. A (12 gauge) copper coated metal tracer wire shall be attached to all forcemain pipe and shall extend its full length. Tracer wire shall be continuous, with no underground splices. Tracer wire shall terminate in a test station in a valve can no more than 300 feet apart. The tracer wire shall be tested for continuity prior to acceptance.

1-5 Manholes and Cleanout Design and Construction

1-5.1 Location

1-5.1.1 Cleanouts

Cleanouts shall be installed when a side sewer branches to serve two residences, at the property/easement line for each building sewer, at a 100-foot spacing of straight building sewer alignment, and at building connections, or as directed by the County.

Cleanouts shall be installed at all fitting combinations within an aggregate change in directions in excess of 45 degrees. If combinations of bends have straight pipe turns of 4 feet or greater between bends, that shall not be considered an aggregate change of direction.

Cleanouts installed in roads, driveways or walkways, paved or unpaved, shall have a frame and cover per PD-12 and PD-13.

1-5.1.2 Manholes

Manholes will be required at any change in slope, change in alignment or change in pipe size.

No horseshoe or saddle manholes will be allowed. Where a new manhole needs to be cut into the existing mainline, flow shall be temporarily rerouted and a new manhole constructed.

Whenever possible, manholes will be located within the roadways centered in a travelled lane.

Manhole manufacturers shall be: Shope Concrete Products, Hanson Pipe and Precast Inc., or approved equal.

1-5.2 Connections

Maximum spacing of manholes shall be 400 feet. Manholes shall be at end of pipe runs over 150 feet. All manholes shall be accessible by maintenance vehicles. Sewer facilities will be located within 5 feet of an existing accessible surface such as a road, parking lot, or driveway.

In cases where there is not existing access, an access road shall be constructed which shall have a maximum slope of 12%, a minimum width of 12 feet. The access road shall be constructed by utilizing one of the following techniques:

1. Construct an asphalt surface meeting Kitsap County Standards; or
2. Construct a gravel surface road by removing all unsuitable material, placing a geotextile fabric over native soils, and providing a minimum 6" of suitable subgrade material compacted to 95%, and providing a minimum of 2" thick crushed rock surface; or
3. Construct a landscape block surface by removing all unsuitable material, laying a geotextile fabric over the native soil, placing landscape blocks, filling the honeycombs with soil particles, and planting grass.

When the length of the access road exceeds 40-feet, a vehicle turn-around must be provided, designed to accommodate vehicles having a maximum length of 31-feet and having an outside wheel path radius of 40-feet. The director may allow an exception from the turn-around requirement if the access road slope is less than 8%, and the road has a straight alignment.

Cleanouts installed, from wye fitting with plug and cap at the end of a main, will only be acceptable in lieu of a manhole when installed on a dead end main and the line is not more than 150 feet (including the riser) with a minimum slope of 1.0% from the next adjacent manhole.

All connections to manholes shall be at the manhole base using approved connectors. Rechanneling may be required.

The County will consider the use of drop manholes for special cases on a case-by-case basis. Should the use of drop manholes be allowed the connections shall be made with ductile iron materials including a minimum of one full length of pipe from undisturbed soil. The precast manhole base shall have an external ledge integrally cast around the outside of the manhole to transfer the vertical loads from the drop manhole connection. Fittings shall be outside the manhole and fully supported by concrete encasement as per the County Standard Detail MV-4.

1-5.3 Diameter

Manholes shall be 48-inch minimum inside diameter precast concrete units with eccentric cones for pipe diameters up to 18-inches. Larger diameter manholes may be required depending on pipe size, number of penetrations, and pipe configuration.

1-5.4 Flow Channels

Allowances shall be made for a one-tenth foot drop in elevation across the manhole in the direction of flow.

1-5.5 Watertightness

Infiltration through any part of the structure will be repaired as required, to the satisfaction of the County.

1-5.6 Frames, Covers, and Steps

Manholes over 20 feet deep shall have intermediate safety platforms as per County Standard Detail MV-2.

1-5.7 Manhole Base Liners

When required by Kitsap County new and existing manholes shall be provided with prefabricated fiberglass reinforced plastic (FRP) Manhole Base Liners. New Manhole Base Liners shall be integrally cast and adequately anchored inside new precast manhole base sections during the concrete casting process at the manhole suppliers manufacturing facility. Existing Manhole Base Liners shall be sized by the manufacturer to fit within the existing manhole and grouted in place in the field. Contractor shall field verify invert elevations of existing sewer piping prior to manufacture of base liner. The base liner shall be a one-piece construction of unlayered, homogenous composite with minimum thickness of 0.12" (3 mm) and shall be in lengths and nominal inside diameters corresponding to the new or existing concrete base section.

The Manhole Base Liner shall include full flow channels with side-walls to the crown of the largest diameter pipe. Channels shall be constructed with orientation and inverts as required. The inner surface of the bench shall be provided with an anti-skid pattern. For new manholes, watertight gasketed pipe bell connections to suit specific pipe types, grade and alignment, shall be monolithically attached to the base liners and shall extend to the outside profile of the concrete structure. For existing manholes, Link Pipe Sewer Sealer or approved equivalent shall be used to repair the exterior piping once the Manhole Base Liner has been installed.

The outer surface of the liner shall be aggregate coated and have steel spirals/lattice bonded to the FRP in order to insure adequate anchoring to concrete base sections to pass vacuum testing with 10" of negative pressure.

The inside liner surfaces shall be free of bulges, dents and other defects that result in a variation of inside diameter of more than 1/4" (7 mm) for base liner flow channel and pipe connections. The precast concrete pipe penetration joint surfaces shall be free of excess concrete at external and internal surfaces to insure a proper seal between the pipe connection and the liner.

The FRP liner shall be a non load-bearing component, which is resistant to the chemical environment normally found in wastewater collection systems. Base liner properties shall be in accordance with the following:

1. 0.12" (3mm) minimum thickness.
2. Fiberglass (Type E Glass).
3. Minimum length of fibers – 0.625 inches.
4. Content by weight 10% - 12%.
5. Inert Filler.
6. Content by weight 10% - 13%.
7. Bonding aggregate - prewashed, cleaned; dried, fractured 3/8" gravel.
8. Graded particle size minimum 0.08" and maximum 0.12".
9. Rate of application – 3.5 lb/ sq ft.
10. Density of F.R.P. Polyurethane Hybrid Composite (ASTM D1622) – 1.17g/cm³.
11. Shore "A" Hardness Durometer (ASTM D2240) – Exceeds 90 on scale.
12. Percolation Test - Water absorption of top surface – 0.032%.
13. Thermal shock (CSA-B45-M93) 100 thermal cycles – no sign of defects.
14. Chemical Resistance (Selected Reagents) (ASTM D1308):

Nitric Acid 69%	No surface Degradation - Surface
Hydrochloric Acid 60%	No surface Degradation
Ammonia 28%	No surface Degradation
Sodium Hydroxide 5.25%	No surface Degradation
Sulfuric Acid 50%	No surface Degradation
Sulfuric Acid 70%	No surface Degradation
Sulfuric Acid 80%	No surface Degradation
Acetone	No surface Degradation
Unleaded Gasoline	No surface Degradation
Turpentine	No surface Degradation
Acetone Immersion (ASTM).	No attack

1-5.8 Materials

1-5.8.1 Mainline Cleanouts

Cleanouts shall be constructed of the same material as the sewer main and shall conform to the County Standard Details PD-12 and PD-13.

1-5.8.2 Manholes

Manhole sections shall be of the offset type and shall meet the requirement of AASHTO M 199. The diameter of the bottom precast unit may be in excess of 48 inches, but provide a fixed opening of 24 inches at the top. The joints shall be of tongue and groove type with rubber gaskets conforming to the applicable requirements of AASHTO M 198.

The mortar used between the joints in the precast sections and for laying manhole adjusting rings shall be composed of one part cement to two parts of plaster sand (5000 psi mortar mix).

Manholes manufactured with cast-in place rubber boots such as “A-lock’,” are acceptable.

Manhole frames shall be gray-iron conforming to the requirements of AASHTO M 105, Grade 30B. Covers shall be ductile iron conforming to ASTM A 536, Grade 80-55-06. Repair of defects shall not be permitted.

Manhole covers shall be interchangeable within the dimensions shown in the County Standard Plans (Detail MD-3). Manhole frames and covers shall meet the strength requirements of Federal Specification RR-F-621E. All mating surfaces shall be machined finished to ensure a non-rocking fit.

Covers shall be locked to the frames by three 5/16-inch countersunk stainless steel bolts. In steep (in excess of 10% grade)) or high traffic conditions (greater than 2,500 vehicles per day), the recess nut application shall be used.

Drop manholes shall be constructed as a standard manhole, but as shown on the County Standard Detail MV-4.

Manhole steps shall be designed to withstand pullout forces of 1,500 pounds and meet the requirements of Detail MV-7. All steps shall be factory installed. In no case shall the steps be allowed to penetrate through the wall of the manhole section.

Manhole ladders shall meet the requirements of Detail MV-8.

1-5.9 Manhole and Cleanout Installation

Cleanouts shall be installed per County Standard Details PD-12 and PD-13. Cleanouts installed in areas to be paved shall be brought to grade level as per County Standard Detail PD-12.

The side sewer 6-inch cleanout shall be brought to within 6-inches of finished grade plugged with a threaded plug and enclosed in a cast iron valve box with cover. See County Standard Detail PD-8 and PD-13.

The building sewer cleanout shall be full building sewer diameter and shall be extended to a point not less than 6-inches or more than 12 inches below the finished ground surface and shall be plugged with a removable threaded watertight plug.

Precast base sections shall be set on compacted foundation material ([per 1-4.12.3](#)). Before the precast base is set in place, the foundation material shall be carefully leveled to provide full bearing for the entire base section.

Manhole sections shall be placed and aligned so as to provide vertical sides and vertical alignment of the steps and ladders. The completed manhole shall be rigid, true to dimension, and be watertight. Rough, uneven surfaces will not be permitted.

The outside and inside of the manhole adjusting rings, lift holes, and precast concrete section joints shall be mortared and troweled smooth with 1/2-inch (minimum) of mortar in order to attain a water tight surface.

Newly installed manholes will be prechanneled. The channels in manholes shall conform accurately to the sewer grade and shall be brought together smoothly with well-rounded junctions satisfactory to the County. Channel sides shall be carried up vertically from the invert to the crown elevation of the various pipes. The concrete shelf shall be warped evenly and sloped 3/8-inch per foot to drain. Rough, uneven surfaces will not be permitted. Channels shall be constructed to allow the installation and use of a mechanical plug of the appropriate size.

Manhole adapters shall be provided where connecting pipe to concrete manholes. Manhole adapters shall be rubber gasketed boot, (Kor-n-seal) or approved equal per detail MV-5.

All stubbed out sewer pipes placed through manhole walls for future connections shall extend at a minimum 2% slope to the edge of the right of way, or the edge of utility easement (whichever is greater), but not less than 10 feet. Stubs shall be capped.

All lift holes shall be completely filled from the outside with expanding mortar and smoothed both inside and out to insure water tightness. All steel loops must be removed flush with the manhole wall. The steel stubs shall be covered with mortar and smoothed. Rough, uneven surfaces will not be permitted.

For grade adjustments of manhole frame and cones, a minimum of 4 inches and a maximum of 16 inches shall be provided between the top of the manhole cone or slab and the top of the manhole frame.

Manhole rims and cleanouts in undeveloped areas shall be constructed to an elevation from finish grade to no more than 6 inches above finish grade.

Existing manholes and cleanouts shall be adjusted to finish grade when the surface is altered by construction activity.

The cover assembly of a manhole shall not be grouted to final grade until the final elevation of the pavement, gutter, ditch, or sidewalk in which it is to be placed has been established, and until permission thereafter is given by the County to grout the assembly in place. Cover shall be seated properly to prevent rocking.

1-6 Testing

The required test methods are derived from Section 7-17.3(2) of the *Standard Specifications for Road, Bridge, and Municipal Construction*. As the Standard Specifications are updated there may be discrepancies between the County test methods and the most current Standard Specifications. If such cases arise, the most stringent test methods shall be adhered to.

For gravity sewer systems, the Developer may use either the exfiltration or low pressure air method, except where the ground water table is such that the County may require the infiltration test. The Hydrostatic Pressure Test method is required for forcemains. T.V. inspection of forcemains will not be required.

All constructed sanitary sewer installations shall be cleaned and backfilled prior to tests. Developer shall conduct preliminary tests and be assured that the section to be tested is in an acceptable condition before requesting the County to witness the test. Persons authorized to complete the work shall be present during all inspection and testing.

For gravity sanitary sewer systems, the system may be pretested any time during the construction process after at least two feet of backfill has been placed over the pipe. The County shall require final testing for County acceptance after backfilling has been completed and all other utilities have been installed.

For gravity sanitary sewer systems, if the Developer elects to test one pipe joint at a time, leakage allowances shall be converted from per 100 feet to per joint by dividing by the number of joints occurring in 100 feet.

Visual inspections shall be conducted on all alignment, grade, backfill, etc., and other items the County deems relevant. When an inspection is required on the weekend, holidays, or after normal business hours the developer will be charged for the inspector's overtime.

If any sanitary sewer installation fails to meet the requirements of the test method used, the Developer shall repair or replace all defective materials or workmanship at no expense to the County.

Notices of corrections or deficiencies shall be given at the time of inspection or written and delivered to the developer. All corrections and/or deficiencies noted by the County shall be corrected prior to scheduling a re-inspection. Fees for re-inspection may be applied at the discretion of the County.

Upon the satisfactory testing and upon satisfactory evidence that all interior plumbing has been approved, the side sewer shall be approved for use and operation by the County and allowed to discharge into the County sanitary sewer system.

1-6.1 Leakage Testing

1-6.1.1 Exfiltration Test

This test will be performed according to the procedures outlines in Section 7-17.3(2)B of the *Standard Specifications for Road, Bridge, and Municipal Construction*.

1-6.2 Infiltration Test

This test will be performed according to the procedures outlines in Section 7-17.3(2)C of the *Standard Specifications for Road, Bridge, and Municipal Construction*.

1-6.2 Television Inspection

All sanitary sewer lines shall be inspected by the use of a television camera before final acceptance. The costs incurred in making the initial inspection shall be included in the initial inspection fee charged by the County for the project.

The Developer shall bear all costs incurred in correcting any deficiencies found during television inspection including the cost of any additional television inspection that may be required by the County to verify the correction of said deficiency.

The Developer shall be responsible for all costs incurred in any television inspection performed solely for the benefit of the Developer.

1-6.3 Mandrel Testing

This test will be performed according to the procedures outlines in Section 7-17.3(2)G of the *Standard Specifications for Road, Bridge, and Municipal Construction*.

1-6.4 Pressure Testing

1-6.4.1 Low Pressure Air Test For Sanitary Sewers constructed of Air Permeable Materials

This test will be performed according to the procedures outlines in Section 7-17.3(2)E of the *Standard Specifications for Road, Bridge, and Municipal Construction*.

1-6.4.2 Low Pressure Air Test For Sanitary Sewers constructed of Non Air Permeable Materials

This test will be performed according to the procedures outlines in Section 7-17.3(2)F of the *Standard Specifications for Road, Bridge, and Municipal Construction*.

1-6.4.3 Hydrostatic Pressure Test

Facilities must hydrostatically test all sewer forcemain pipe. Prior to the hydrostatic test, flush all mains. Flushing must entail launching and flushing polyurethane pigs through the mains, or an equivalent method, until the line is deemed clean by the County inspector. An inspector must witness all flushing prior to the installation of air release valves, pressure sustaining valves, and other appurtenances.

This test will be performed after all appurtenances have been installed according to the procedures outlines in Section 7-09.3(23) of the *Standard Specifications for Road, Bridge, and Municipal Construction*.

1-6.5 Side Sewer and Building Sewer Testing

The County shall inspect all side sewers prior to backfilling. Any work that has been covered and which the County did not inspect shall be uncovered to allow inspections and testing.

When side sewers and building sewers are not tested simultaneously with the test of the sewer mains, a test tee shall be installed at the first pipe out of the sewer main tee or wye branch so that a plug can be inserted for sealing off the side sewer for testing.

The test tees provided at all junctions of all building sewers with a side sewer shall be used to insert a plug to test the building sewer.

Water tests shall be completed by plugging the side/building sewer and filling with water to the point of overflow at the cleanout.

Water shall be kept in the side sewer for a minimum of 15 minutes. The system shall be watertight with no visible or measurable leakage.

An alternate to water testing is a standard air pressure test of 4 psi of pressure for a 5-minute period with no measurable loss of pressure.

1-7 Special Requirements

1-7.1 Required Separation between Potable Water Lines, Reclaimed Water Lines, and /or Sanitary Sewers

Sanitary sewers will be constructed to maintain the minimum horizontal and vertical separations as required by Section C1-9.1 of the *Criteria for Sewage Works Design*.

1-7.2 Pumpout Facilities at Marinas

Sanitary sewers will be constructed meet the requirements of Section C1-9.2 of the *Criteria for Sewage Works Design*.

1-7.3 Stream Crossing

Sanitary sewers will be constructed meet the requirements of Section C1-9.3 of the *Criteria for Sewage Works Design*.

1-7.4 Inverted Siphons

Sanitary sewers will be constructed meet the requirements of Section C1-9.4 of the *Criteria for Sewage Works Design*.

1-7.5 Required Separation from Water Supply Wells

Sanitary sewers will be constructed meet the requirements of Section C1-9.5 of the *Criteria for Sewage Works Design*.

1-7.6 Odor Control

Sanitary sewers will be constructed meet the requirements of Section C1-9.6 of the *Criteria for Sewage Works Design*.

1-7.7 Corrosion Control

Sanitary sewers will be constructed meet the requirements of Section C1-9.7 of the *Criteria for Sewage Works Design*.

1-7.8 Trenchless Technologies

Sanitary sewers will be constructed meet the requirements of Section C1-9.8 of the *Criteria for Sewage Works Design*.

1-7.9 Pipe Casing

Sanitary sewers will be constructed meet the requirements of Section C1-9.9 of the *Criteria for Sewage Works Design*.

1-7.10 Underground Utility Locations

It shall be the responsibility of the sewer contractor making the sanitary sewer extension to verify the exact locations of all existing utilities prior to commencing any work. The Developer shall contact the utilities underground location center, 1-800-424-5555, a minimum of two working days prior to commencing work.

1-7.11 County Inspections

All sewer installation inspections and test observations shall be made by Kitsap County Department of Public Works. The county inspector shall be notified a minimum of two working days in advance of commencing work on a sanitary sewer extension. Prior to final acceptance of all installations the County shall conduct an inspection of all main lines by the use of television equipment. Final acceptance of sewer installations will not be made until tests and inspections are complete and prove satisfactory. All side sewer and building sewer installation inspections and test Observations shall be made at Kitsap County Department of Public Works. The County Inspector shall be notified a minimum of two working days in advance of commencing work on a sanitary sewer extension. Prior to final acceptance of all side sewer and building sewer installations in new sewer mains, the County shall conduct an inspection of the sewer mains by the use of television equipment. Final acceptance of side sewer and building sewer installations will not be made until tests and inspections are complete and prove satisfactory.

1-8 Alternative Systems

1-8.1 Individual Grinder Pump Stations (IPS)

1-8.1.1 Application

Together with submittal of the individual sewage pump installation plans for approval, the property owner shall also submit a signed copy of the "Sewage Pump Installation, Operation, and Maintenance Agreement" together with a filing fee.

It will be the property owner's responsibility to obtain preliminary approval of the concept for their particular situation. Upon preliminary approval, the property owner will be required to submit an engineered plan of the proposed installation showing all pertinent information together with specifications of all materials to be used.

1-8.1.2 Design Considerations

The station's operational components shall be located at an elevation that is not subjected to the 100-year frequency storm flood and associated wave action, or shall be otherwise adequately protected as certified by a professional engineer registered in the State of Washington.

Only one grinder pump station is allowed per residence. It will be the responsibility of the homeowner to maintain the grinder station and the force main on their property.

Areas with up to and including 10 homes (without further possibility of expanding) may be served by individual grinder pump stations and shall be reviewed and approved by Kitsap County on a case-by-case basis. Developments with more than 10 homes shall use a commercial pump station, as specified elsewhere in these standards, to be operated and maintained by the County.

The developer shall submit information from the material manufacturer or fabricator showing that the materials meet the requirements of the design and pertinent specifications. The developer shall provide submittals to the County on all materials to be used.

A 6" layer (minimum) of pipe foundation stabilization material per [1-4.12.3](#).

Backfill of select native fill for trench zone backfill per [1-4.12.3](#).

Grinder pump station shall be installed as recommended and required by the Manufacturer.

1-8.1.3 Grinder Pump (GP) Selection

Pumps installed on a GP system must meet the criteria for the maximum hydraulic gradeline and be able to meet the pumping requirements of the structure where it is installed.

The designer must review the system as a whole and select a type or characteristic of a pump for the entire system that has sufficient head to operate at the maximum hydraulic gradeline. The designer may opt to include design zones within the system with different maximum hydraulic gradelines. Compute the hydraulic gradeline using common engineering fluid mechanics calculations using the Hazen Williams or Manning equation with an appropriate roughness coefficient. The engineer must select a pump able to discharge influent peak flow (volume) without exceeding the working volume within the pump holding vessel. The engineer will determine the influent peak flow (volume) by reviewing the number of fixtures within a structure or by applying a peaking factor to

average daily volumes. The designer must use a minimum of 400 percent of average daily flow for estimating peak influent volumes.

Grinder Pumps shall be E-One or approved equal

1-8.1.4 Tank/Vessel Type and Sizing

Tanks shall be constructed of fiberglass or HDPE. Tanks shall be watertight. Tank shall be a minimum of 24" in diameter and have a minimum depth of 5 feet. For homes with basements, minimum depth of tank shall be such that tank is received on site with adequate depth for bury without the need for field fit risers. Tanks must have a minimum of 24 hours of storage within the tank.

Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. The corrugations of the outside wall are to be a minimum amplitude of 1-1/2" to provide necessary transverse stiffness. Any incidental sections of single wall construction are to be 1/4" thick (minimum). All seams created during tank construction are to be thermally welded and factory tested for leak tightness.

The tank shall be furnished with one EPDM grommet fitting to accept a 4.50" OD DWV or Schedule 40 pipe.

The station shall have all necessary penetrations molded in and factory sealed. To ensure a leak free installation no field penetrations will be acceptable.

All discharge piping shall be per section [1-4.12](#). The discharge piping shall include a ball valve rated for 235 PSI. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.

All electrical devices and connections shall be in accordance with NEC and approved by the authority having jurisdiction.

A concrete anti-flotation collar shall be provided if groundwater is present or there is reasonable potential for groundwater. The anti-flotation collars shall be attached to the grinder pump tank.

No individual sewage pump shall be installed on the discharge side of an existing septic tank. Pumping units shall be connected directly to the building sewer line.

1-8.1.5 System Components

1-8.1.5.1 Pipeline

1-8.1.5.1.1 Service Line/Check Valves

Each service line between the IPS and the collection line must have a gate or ball valve installed at the main. In addition, install a minimum of two check valves on the GP service lines. The check valve attached to the IPS counts as one of the check valves.

1-8.1.5.1.2 Valves

Install sufficient mainline valves at locations to isolate portions of the system and to ensure continuous operation for maintenance and repair. On straight runs of pipeline, valves are required every one-quarter mile.

The pump discharge shall be equipped with a factory installed, gravity operated, flapper type integral check valve built into the discharge piping.

Holes or ports in the discharge piping are not acceptable anti-siphon devices.

1-8.1.5.1.3 Pipeline Material

The service piping from the pump unit to the side sewer or County forcemain county forcemain shall be a minimum of 1-1/4 inch diameter schedule 80 PVC or HDPE SR11. A minimum burial depth of 24 inches shall be maintained on private property or 48 inches in the Right-of-Way.

1-8.1.5.1.4 IPS Testing

Each grinder pump shall be submerged and operated for 5 minutes (minimum). Included in this procedure will be testing of all ancillary components such as the check valve, the anti-siphon valve, discharge assembly, and dedicated level controls and motor controls for each unit. All completed stations shall be leak tested to assure the integrity of all joints, seams, and penetrations. All necessary penetrations such as inlets, discharge fittings and cable connectors shall be included in this test along with their respective sealing means (grommets, gaskets, etc.).

Only after final testing and acceptance by the County is the grinder pump station allowed to pump sanitary sewage into the County system.

1-8.1.5.1.5 Discharge to a Gravity Collection System

Where a gravity sewer main exists in the public right-of-way, building sewer pressure lines shall discharge into gravity side sewers at the property/easement line as per County Standard Detail PD-10.

1-8.1.5.1.6 Discharge to a Conventional Force Main

Where a gravity sewer main does not exist in the public right-of-way, building sewer pressure lines shall pass through a valve box containing an isolation valve and a check valve located at the property line prior to connecting to the force main as per County Standard Detail PD-11.

Where the service line connects to the county forcemain a saddle with a corporation stop valve shall be furnished and installed by the County once the Developer has

exposed the sewer main and provided any shoring necessary to provide for safe working conditions. Developer shall schedule the saddle with the County in advance. Developer shall obtain the necessary permits prior to exposing the existing sewer main. Developer shall provide and install check valve and valve can over the corporation stop as shown on the County Standard Details.

1-8.2.2 Pump

1-8.2.2.1 Pumps

The individual sewage pump installation shall consist of a single grinder pump, tank, and system controls, valves, piping, excavation, and backfill as outlined in these standards.

The pumps shall be capable of delivering between 10-20 gpm at the design TDH, with a rate of 12-15gpm being preferred. The pumps shall be capable of operating at a negative TDH without overloading the motor. A pump curve indicating the pump capacity at design head and operating point shall be included with the submittal.

The grinder pump Manufacturer shall provide a part(s) and labor warranty on the complete station and accessories, including, but not limited to, the panel, for a period of 24 months after notice of Owner's acceptance or receipt of equipment and materials.

The assembly shall be dynamically balanced and operate without unordinary noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or solids banks which could impair the operation of the pump.

The grinder shall be capable of reducing all components that can be typically found in domestic raw sewage, including but not limited to a reasonable amount of "foreign objects" such as paper, wood, plastic, glass, wipes, and rubber into finely divided particles which will pass freely through the passages of the pump and the discharge piping.

The grinder shall be positioned in such a way that solids are fed in an upward flow direction.

1-8.2.2.2 Control Panel/Level Control

System controls shall consist of a higher water alarm light, one circuit breaker per pump, 120V AC control voltage transformer, starters, NEMA 3R enclosure for electrical control circuits which shall be mounted on the building adjacent to the pump unit, three liquid level control floats (pump off, pump on, high water alarm) and necessary wiring and appurtenances for a complete installation.

The alarm panel shall include external audible and visual alarm, push-to-run switch, push-to-silence switch, redundant pump start, and high-level alarm capability.

1-8.3 Long-term System Management

1-8.3.1 Ownership, Operation, and Maintenance

Ownership, Operation, and Maintenance of the Individual Pump Stations shall be the responsibility of the property owner. Property owners shall complete an O&M Agreement form documenting their understanding of this at the time of installation.

1-8.4 Other Alternative Systems

No other alternative systems are expressly permitted but will be considered by the County on a case-by-case basis, and will be evaluated based on the merits of the project to the County.

END OF SECTION

Chapter 2 Sewer Pump Stations

This chapter covers the design and construction of sewage pump stations. General requirements such as location, flows, reliability, and other special design details for pump stations are included.

2-1 General Requirements

2-1.1 Introduction

Except where otherwise indicated, the following sections are intended to be consistent with Ecology's "Criteria of Sewage Works Design."

Except where provided otherwise, construction details, workmanship, and materials shall be in accordance with the latest edition of "Standard Specifications for Road, Bridge, and Municipal Construction" prepared by the Washington State chapter of the American Public Works Association.

The developer shall submit information from the material manufacturer or fabricator showing that the materials meet the requirements of the design and pertinent specifications. The developer shall provide submittals to the County on all materials to be used.

Equipment manufacturers or their authorized representatives shall submit a manufacturers installation affidavit (certificate) with respect to their equipment certifying that:

1. the equipment has been properly installed and lubricated;
2. the equipment is in accurate alignment;
3. the manufacturer was present when the equipment was placed in operation;
4. the manufacturer has checked, inspected and adjusted the equipment as necessary;
5. the equipment is free from any undue stress imposed by connecting piping or anchor bolts;
6. the equipment is not imposing any undue stress on any connecting members;
7. vibration of the complete pump assemblies shall be within the limits recommended by the applicable standards of the Hydraulic Institute.
8. the equipment has been operated satisfactorily under full load conditions;
9. the manufacturer has inspected their equipment during the operational demonstrations and system validation tests to the extent specified; and
10. the equipment is fully covered under the terms of the guarantee.

Any extension of the Kitsap County sanitary sewer extension shall be completed in accordance with the applicable requirements of the *Standards for Sanitary Sewer Extensions*.

Prior to construction, the County shall have an approved set of plans from Washington State Department of Ecology (Ecology) on file in the County offices.

2-1.1.1 Operation and Maintenance (O&M Manuals):

Provide complete O&M Manuals to Kitsap County Sewer Utility for review and approval as follows:

1. Draft O&M Manual – One electronic copy in Adobe PDF version 9 or greater format, bookmarked and searchable a minimum of 30-days prior to station start up.
2. Final O&M Manual – Two complete hardcopy sets of the approved Draft O&M Manual, along with one electronic copy on CD in Adobe PDF version 9 or greater format, bookmarked and searchable for approval. Final manuals will be bound in identical hardcover three-ring binders with the pump station name, volume number, and set number clearly shown. Approved Final O&M Manuals shall be submitted to Kitsap County Sewer Utility prior to final acceptance of the Sewer Pump Station.
3. Final Program Files – Two electronic copies of all final programming for all installed Program Logic Controllers (PLC), Human Machine Interfaces (HMI), Flow Meters, Variable Frequency Drives (VFD) or other programmed devices. Electronic copies shall be provided on two labeled CDs or USB flash drives.

The manuals will 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 will be provided.

All information shall be specifically for the installed components. Data sheets which cover multiple equipment or list options shall be marked to indicate the installed equipment, including provided options. All other equipment or options shall be crossed out. Each item in the submittal shall include, but not be limited to the following information:

1. Fly sheet indicating: Contracting Agency's name; description of equipment; manufacturer's name, address, and telephone number; and local supplier/representative's name, address, and telephone number.
2. Detailed index indicating submittal contents, with major headings related to table dividers.
3. Disassembly and assembly drawings
4. Parts list and/or bill of materials
5. Wiring diagrams
6. Lubrication instructions, including type and frequency
7. Preventative and periodic maintenance summary
8. Operating instructions
9. Overhaul and parts replacement instructions

10. Source for parts
11. Testing and troubleshooting procedures
12. Performance curves
13. Factory test data
14. Manufacturer/Vendor Startup & Testing Reports
15. Manufacturer's Installation Affidavit (Certificate)
16. List of recommended spare parts
17. List of expendable parts (i.e., air or oil filters)
18. Warranty

2-1.1.2 Record Drawings

Provide pump station record drawings in accordance with [1-1.3.2. Record Drawing Requirements](#). In addition to these requirements, provide as constructed panel and interconnection drawings for all control, telemetry, and electrical cabinets and panels.

2-1.1.3 Location, Site Selection, and Site Layout

Site Requirements: The size of a proposed pump station site will vary depending on the facility configuration and access requirements. Design criteria includes the following:

1. A minimum of 50 ft separation from the pump station structure (i.e., wet well/dry well) should be provided to the property line and/or adjacent facilities.
2. The maximum slope for access roads should be 15%.
3. Vaults should be designed to avoid designation as a confined space. Vaults that are six feet or deeper should have stairways or installed ladders with extensions per OSHA standards. A concrete pad should be placed around vaults which is suitable for confined space personnel retrieval equipment.
4. Facilities should be oriented according to prevailing wind direction and to minimize potential for hydrogen sulfide gases entering control building intake grills or electrical panels whenever possible.

2-1.1.4 Flood Protection

The station's operational components shall be located at an elevation that is not subjected to the 100-year frequency storm flood and associated wave action, or shall be otherwise adequately protected as certified by a professional engineer registered in the State of Washington. All electrical controls, connection boxes, disconnects, and motor drives shall be located above grade and not subject to flooding or sewage related malfunction.

2-1.1.5 Access for Maintenance Vehicles

Access to pump stations is critical for County maintenance and operations (M&O) personnel. Pump station site design must include space to facilitate service equipment. This is in addition to the permanent on-site equipment including an emergency generator.

1. Space for a standby generator should be reserved whether the unit is fixed or portable.

2. Access should be provided around the entire perimeter of the pump station for required maintenance equipment.
3. The driving area into the pump station shall be paved with asphalt and shall support vehicles with a gross vehicle weight of 50,000 pounds.
4. All maintenance vehicles anticipated to service the station should park on-site. No street parking (off-site) for maintenance vehicles should be assumed.
5. Adequate clearance from overhead power lines to allow for the safe operation of a crane should be provided.
6. Non-driving areas shall receive a 6-inch thickness of crushed surfacing top course material.
7. Above-grade equipment and piping should be protected by bollards.
8. All hatches in access area shall have no less than H-30 rating.

2-1.1.6 Fire Protection

Number and location of fire extinguishers shall meet all appropriate fire and safety codes and the requirements of the Kitsap County Fire Marshal.

Fire extinguishers shall meet the following requirements:

1. Steel bodied, all metal top (head) and valves.
2. Multi-purpose dry chemical, UL Rated, 2A-10BC.
3. Provide hose and horn on each.
4. Red with epoxy finish coat.

Provide "FIRE EXTINGUISHER" sign for each extinguisher meeting requirements of NFPA 10.

Fire extinguishers and cabinets shall be obtained from a single manufacturer.

2-1.1.7 Site Piping Layout

Pump station may discharge to a manhole or directly to a mainline pipe depending on the application at the discretion of the Director.

2-1.1.8 Fencing

A 6-foot chain link fence, with 16-foot wide double swing access gate shall be provided around the pump station site, two feet inside the property line. Gate shall be aligned with wetwell unless otherwise approved in writing by Kitsap County.

2-1.1.9 Lighting

All pump station sites shall have a minimum of a minimum of two LED equivalent 75-watt bulbs in adjustable floodlights for night visibility at outdoor control panels with one manual switch. No lighting shall be installed inside the pump station wetwell.

All pump station site buildings shall have a minimum of one manually controlled externally mounted floodlight for night visibility over each entrance door and interior lighting. All lighting shall be LED. No lighting shall be installed inside the pump station

wetwell.

No automatic controlled lights shall be installed, only manual switch lights shall be installed.

2-1.1.10 Water Supply

When 50 or more equivalent residential units are to be connected to a pump station, a 3/4-inch non-freeze post hydrant shall be provided on site.

Non-freeze post hydrants shall be Zurn, Model Z-1385 (3/4-inch), or approved equal.

Water services shall meet all water purveyor requirements including backflow prevention.

2-1.1.11 Landscaping

Landscaping shall be on the outside of the fence to screen the site. All plantings shall be low maintenance.

2-1.1.12 Free-Standing Shelters

All exterior electrical control cabinets, transfer switches, RTU cabinets and other similar electrical equipment shall be provided a free-standing shelter to provide weather protection unless otherwise waived in writing by the Kitsap County Sewer Utility Senior Program Manager. Shelters shall be of a galvanized structural steel construction with metal roof designed by an Engineer or Architect licensed in the State of Washington. Refer to section [2-1.2.3 Metal Roofing](#) for roofing requirements. All shelter shall meet requirements of current Kitsap County Building Codes.

2-1.2 Building Requirements

Permanent pump station support buildings shall be of a concrete and masonry construction with metal roofing designed by an Engineer or Architect licensed in the State of Washington.

All buildings shall meet requirements of current Kitsap County Building Codes.

All pump station buildings shall be heated and ventilated.

2-1.2.1 Masonry Walls

All masonry units shall be grouted solid and reinforced. Block shall be laid in running bond, unless otherwise approved.

Masonry units shall be nominal 8" high and 8" high by 16" long as manufactured by Mutual Materials Co, or approved equal.

Exterior masonry units shall be colored. Color shall be approved by Kitsap County.

Masonry units shall be manufactured with an integral water repellent additive during production such as “Dry-Block” by W.R. Grace & Co.

Exterior masonry unit faces and exposed unpainted faces shall receive a clear water repellent sealer installed over cleaned surfaces in accordance with manufacturer’s recommendations. Coating shall extend from masonry sill cap down to top of concrete footing.

Exterior masonry units shall be treated with PROSOCO Blok-Guard® & Graffiti Control II. Provide one gallon of PROSOCO Eraser® Graffiti Wipe to Kitsap County.

Mortar shall contain an integral water repellent admixture such as “Dry-Block” mortar admixture by W.R. Grace & Co. Follow manufacturer’s published recommendations for preparation and use.

2-1.2.2 Doors and Frames

Exterior doors and frames shall be FRP. Doors shall be 1-3/4-inch thick and of flush construction, having no seams or cracks. All doors up to 35-3/4 inches x 83-1/2 inches shall have equal diagonal measurements. For consistency in the resin chemistry tailored for this application and to maintain the same physical properties throughout the structure, all fiberglass components including face plates, stiles, rails and frames must be fabricated by the same manufacturer. Components obtained through various outside sources for plant assembly will not be accepted.

Color shall be approved by Kitsap County.

Hardware shall be suitable and adapted for its required use and shall fit its designated location. Subject to requirements, provide products by one of the following manufacturers for each type of hardware:

1. Locks and Latches: Yale. No Substitutions.
2. Mechanical Pushbutton Lock: dormakaba Simplex® L1000 Series. No Substitutions.
3. Cylinders and Keying: Same manufacturer for locksets.
4. Hinges: Bommer Industries, Hager.
5. Surface Mounted Closers: Von Duprin. No Substitutions.
6. Wall Stops: Trimco, Ives, Glynn Johnson.
7. Door Plates: Ives, Hager, Rockwood.
8. Security Bars: Pemko.
9. Door Gaskets: Pemko.
10. Exit Devices: Von Duprin. No Substitutions

External doors shall be provided with a Mechanical Pushbutton Lock assembly with cylindrical lock lever, combination entry, and key override. External double doors must be security doors with guard strip in the middle or have removable mullion.

Hardware supplier shall meet with Kitsap County to determine the keying requirements for the project.

2-1.2.3 Metal Roofing

Metal roofing shall be a structural standing seam metal roof system by AEP Span, Design Span® hp or approved equal. The County will be the sole judge of what qualifies as an “equal” system.

Color shall be approved by Kitsap County.

Provide components approved by roof panel manufacturer and required for a complete weather tight panel system including trim, copings, fascia, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels.

2-1.2.3.1 Metal Roofing Warranty

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: Two years from date of Substantial Completion.

Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 10 years from date of Substantial Completion.

Special Weather tightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weather tight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

2-1.2.4 Color Scheme

Typical exterior color scheme for pump stations is Tan colored masonry with Evergreen or Hunter Green metal roofing, flashing, gutters and downspouts.

Typical interior color is white.

2-1.3 Developer Requirements

2-1.3.1 General

The developer shall complete the proposed sanitary sewer construction in accordance with the approved construction drawings, details, specifications, state requirements, and local regulatory requirements. The developer shall implement the runoff and erosion control plan that was approved by the County.

The developer shall provide all materials, labor, and equipment necessary to shore trenches to protect the work, existing property, utilities, pavement, etc., and to provide safe work conditions in the trench. The developer may elect to any combination of shoring and overbreak, tunneling, boring, sliding trench shield, or other method of accomplishing the work consistent with applicable local, state and federal safety codes.

2-1.3.2 Site Work

The developer shall furnish, install, and operate all necessary equipment to keep excavation above the foundation level free from water during construction, and shall dewater and dispose of the water so as not to cause injury to public or private property or nuisance to the public. Sufficient pumping equipment in good working condition shall be available at all times for emergencies, including power outage, and shall have available at all times competent workers for the operation of the pumping equipment. Equipment is to be refueled by the Developer prior to weekends, holidays, or any work stoppage longer than 1 day. Kitsap County reserves the right to take any/all corrective action during equipment failure or emergency.

All existing sewer lines shall be kept in service at all times. Provision shall be made for disposal of sewage flow if any existing sewers are damaged. The developer shall repair damage to existing sewers to a condition equal to or better than their condition prior to the damage. Water accumulating during construction shall be removed from the new sewers but shall not be permitted to enter the existing system. The developer shall be responsible for flushing out and cleaning any existing sewers, into which gravel, rocks, or other debris has entered as a result of the work, and shall repair lift stations or other facilities damaged by the work at the developer's expense.

The physical connection to an existing manhole or sewer shall not be made until authorized by the County. Such authorization will not be given until all upstream lines have been completely cleaned and tested.

Excavation for a precast concrete wetwell shall be sufficient to leave 1-foot clearance between the wetwell outer surface and the earth bank. Excavation for a cast in place concrete wetwell shall allow enough space for formwork.

The developer shall provide all materials, labor, and equipment necessary to shore excavations to protect the work, existing property, utilities, pavement, etc., and to provide safe working conditions in the excavation.

2-1.3.3 Materials and Equipment

The material manufacturer or fabricator shall furnish appropriate certification, based on manufacturer's routine quality control tests, that the materials meet the requirements of the pertinent specifications. The developer shall provide submittals to the County on all materials to be used including pump performance curves indicating pump efficiency, horsepower, and head capacity relationships; structural details including wetwell wall thickness and reinforcing; and all mechanical and electrical details for this lift station.

2-1.4 Design Flow Rates, Hydraulics, and Number of Pump Units

2-1.4.1 General

The design of the submersible pump station shall provide for a "lead pump" cycle time of no more than six cycles per hour during peak wet weather flow design conditions, and no less than one cycle per hour during minimum dry weather flow design conditions.

2-1.4.2 System Hydraulics

The design capacity of a pump station shall be computed on the basis of the total area and projected population that can be served by the pump station (based on the most current zoning projections). Method of calculation shall be consistent with Criteria for Sewage Works Design Section C2-1.2.

2-1.4.3 Number of Pumps

At least two pump units shall be provided. The pumps shall be designed to fit actual flow conditions and each must be capable of handling the expected maximum peak sewage flow.

2-1.4.4 Pump Removal and Replacement

Submersible pumps shall be readily removable (including power and control cables from a termination box) and replaceable without dewatering the wetwell or requiring personnel to enter the wetwell. The termination box shall be located external to the well. Other pump units at the same station shall continue to be operable while one pump is (removed) maintained. Pump unit lifting devices shall be included in the design.

2-1.4.5 Pump Selection

2-1.4.5.1 Submittals

Submit the following:

1. Technical literature, bulletins, and/or catalog cuts of the equipment.
2. Performance curves.
3. Quality control test results.
4. Materials of construction.
5. Complete installation instructions, including electrical and mechanical requirements.
6. Operations and Maintenance Manuals.

2-1.4.5.2 Warranty

The pump manufacturer shall warrant the pumps, including components and motor, against defects in workmanship and materials for a period of five (5) years under normal use and service.

The pump manufacturer shall warrant the guide system (including guide, cables or rails, and brackets) against defects in workmanship and materials for a period of ten (10) years under normal use and service.

The pump manufacturer shall fully warrant the impeller against clogging for a period of one year under normal use and service.

Pump manufacturer warranties shall be in published form and shall apply to all similar units.

2-1.4.5.3 Quality Control

Perform equipment tests in accordance with the Hydraulic Institute's - Submersible Pumps for Hydraulic Performance, Hydrostatic Pressure, Mechanical and Electrical Acceptance Tests.

Tests shall be performed on the actual assembled pumps to be supplied; prototype model tests are not acceptable.

Tests shall cover a range from shut-off to a minimum 20 percent beyond specified design capacity.

Conduct test per above on all supplied pumps, generating a curve showing actual flow, head, BHP, and hydraulic efficiency.

Obtain the submersible sewage pumps from one source and a single manufacturer.

2-1.4.5.4 Products

The pumps specified herein are the product of Xylem Flygt Corporation, NP-3000 series, and explosion proof, there is no known equal.

Local Supplier: Whitney Equipment Company, 21222 30th Drive SE, Suite 110, Bothell, WA 98021, (425) 486-9499.

Performance and Conditions of Service: Pumps shall operate over the range of flows and heads specified and approved. Motor horsepower shall not exceed the values specified, and the hydraulic efficiency shall be equal to or higher than 50%.

Pumps shall operate without cavitation or vibration within the specified flow range, with a submergence of one (1) foot above the impeller centerline.

2-1.4.5.4.1 Pump Design

The pumps shall be submersible non-clog type that is suitable for the application, each connected to a discharge connection of a minimum diameter of 4 inches.

Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact.

2-1.4.5.4.2 Pump Construction

Provide pumps fabricated of the following materials:

Pump Components	Material
Pump Case	Cast Iron, ASTM A48, Class 35B
Motor Housing	Cast Iron, ASTM A48, Class 35B
Impeller	Hard Iron, ASTM A532 (Alloy III A, 25% chrome cast iron)
Intermediate Housing (Backplate)	Cast Iron, ASTM A48, Class 35B
Discharge Base Elbow	Cast Iron, ASTM A48, Class 35B
Pump/Motor Shaft	Stainless Steel, AISI 431
Shaft Sleeve	Stainless Steel, ASTM A276, Type 420
Wear Ring, Case	Cast Iron, ASTM A48, minimum 200 Brinell
Impeller	Hard Iron, ASTM A532 (Alloy III A, 25% chrome cast iron)
O-Rings	Nitrile Rubber (NBR)
Fasteners	Stainless Steel, Type 316TI
Mechanical Seal – Lower	Tungsten Carbide
Mechanical Seal – Upper	Tungsten Carbide
Guide Rails	Stainless Steel, ASTM A276 Type 316L
Lifting Chains	Stainless Steel, ASTM A276 Type 316L
Oil – All Uses (Seal Lubrication, Motor Cooling, etc.)	FDA Approved, Ecologically Safe

Furnish pump case, impeller, intermediate housing, and motor housing with smooth surfaces devoid of blow holes and other irregularities.

All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory-applied polyamidoamine epoxy protective spray coating on the exterior of the pump.

Sealing design shall incorporate metal-to-metal contact between machine surfaces.

All major castings shall be produced in the manufacturer's own foundry, under the manufacturer's direct supervision.

2-1.4.5.4.3 Components

General:

Provide pumps capable of handling raw, unscreened sewage.

Where watertight sealing is required, machine and fit mating surfaces with O-rings.

Provide with heavy duty lift lugs or hoisting bail designed for lifting the entire pump and motor assembly.

1. Impeller and Wear Rings:
 - a. Provide enclosed, non-clog type impeller of Hard Iron.
 - b. Statically and dynamically balance impeller.
 - c. For enclosed impeller pumps, provide wear rings on case and impeller of material and Brinell hardness specified to ensure maximum pump/impeller life and continuing high efficiencies. Soft metals (e.g., bronze) or elastomers as wear ring material are not acceptable.
2. Shaft
 - a. Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings are not acceptable.
 - b. Machine the shaft of Type 420 stainless steel; or, Gr 1045 carbon steel with a replaceable Type 420 stainless steel shaft sleeve under the lower mechanical seal to isolate the shaft from the pumped media.
 - c. Carbon steel as shaft material without a stainless steel sleeve is not acceptable.
3. Mechanical Seal
 - a. Provide two totally independent mechanical shaft seals, installed in tandem, each with its own independent spring system acting in a common direction.
 - b. Install the upper seal in an oil-filled chamber with drain and inspection plug

- (with positive anti-leak seal) for easy access from external to the pump.
- c. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced.
 - d. Do not provide seals with the following characteristics:
 - i. Conventional double mechanical seals with single or multiple springs acting in opposed direction.
 - ii. Cartridge-type mechanical seals.
 - iii. Seals with materials other than those specified.
 - iv. Seals using the impeller hub as a mounting surface.
4. Bearings
- a. Furnish upper and lower bearings, single row (preferred) or double row as needed to provide a B10 life of, at minimum, 50,000 hours at anticipated axial and radial loadings.
 - b. Provide sealed, shielded (permanently lubricated) bearings.
5. Motor
- a. Provide a motor that is squirrel cage, induction in design, housed in completely water-tight and air-filled chamber, with a minimum 1.15 service factor.
 - b. Insulate the motor stator and stator leads with, at minimum, Class H insulation rated for 180 degrees C total temperature.
 - c. Provide motor cooling by providing an adequately rated motor with sufficient surface area for ambient only cooling.
 - d. Provide motors that are capable of operating for at least 2 hours in a dry mode without damage to motor or seals.
 - e. Provide motors that are designed, rated, and warranted for continuous operation at 40 degrees C, temperature rise not to exceed 80 degrees C, capable of 30 evenly spaced starts per hour.
 - f. Do not provide motors that contain in excess of 2 gallons of oil (combined total for cooling and seals), or that contain other than an FDA approved, ecologically safe oil.
 - g. Pump and motor package to be FM approved, Class 1, Division 1, Group C & D service for hazardous locations as defined by the National Electric Code (NEC).
 - h. All motors shall be 3 phase, 480 volts and power supply to station should be the same.
6. Thermal/Leakage Relay
- a. Provide an ITT Flygt MiniCAS thermal/leakage relay with mounting socket for each pump installed.
7. Protection
- a. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. Set temperature monitors at levels recommended by pump manufacturer. When activated, switches shall

activate an alarm and the pump shall shut down. The pump control panel shall send the activated alarm signal to the Radio Telemetry Unit (RTU) and the front panel. Power disconnect breaker to be installed on the outside of control Panel.

- b. Leak detection sensors shall be provided to detect water in the stator chamber, cable entry chamber, and mechanical seal oil chamber. The leak sensors shall utilize a float switch to detect the presence of water. When activated, the sensors shall activate an alarm illuminating an amber warning light on the pump control panel only. The pump shall not be shut down.

2-1.4.5.4.4 Appurtenances

2-1.4.5.4.4.1 Guide System

Pumps to allow for removal and reinstallation without the need to enter the wetwell and without removal of bolts, nuts, or other fasteners.

Pumps shall connect to permanently mounted discharge connections by simple downward motion, without rotation; guided by at least two (per pump) non-load-bearing, Type 316L stainless steel, non-sparking, guide rails permanently installed in the wetwell extending from the top of the station to the discharge connection. Final connection shall ensure zero leakage between the pump and discharge connection flange.

Pumps shall automatically connect to the discharge elbow when lowered and sealed by a profile gasket or machined metal-to-metal watertight contact.

Discharge connection/guide system shall be such that no part of the pump bears directly on the floor of the wetwell.

Each pump shall be fitted with a Flygt Pump Lift™ pump lifting system consisting of the following minimum components:

1. Minimum 3-foot length of Type 316L stainless steel chain of adequate strength for raising and lowering pumps.
2. Type 316 stainless steel shackles of adequate strength for raising and lowering pumps.
3. Spectra cord guide rope of adequate length to reach from top of pump to minimum 6-feet above wetwell opening.
4. Flygt Grip-Eye pump lifting assembly.

Chain holder with safety hook for each pump to be Type 316L stainless steel. Anchors, fasteners and other connecting hardware shall be Type 316 stainless steel.

2-1.4.5.4.4.2 Power and Control Cable

Combined power cable and control cable of adequate length to allow a unit to be wired without splicing. Cables should be suitable for the application, sized in accordance with

NEC requirements.

Cable entry sealing system:

1. Cable terminal box on side of motor housing, with cable entry sealed to ensure that no entry of moisture is possible into the motor terminal area even if the cable is damaged or severed below water level.
2. Control cable shall contain the required conductors for the temperature and seal leak detection systems.

2-1.4.5.4.4.3 Spare Parts

Supply the following spare parts:

1. One Pump Basic Repair Kit (Seals, Bearings, and O-Rings) for each pump type and/or size
2. One Impeller and Insert Ring for each pump provided.
3. One Sleeve Assembly (Sleeves, Washers, and Impeller Bolts) for each pump provided.

2-1.4.5.5 Execution

2-1.4.5.5.1 Installation

Equipment shall be installed in accordance with the equipment manufacturer's written installation instructions and the requirements of the design. The Contractor/Developer shall provide and pay for the services of a manufacturer's service engineer to review the installation and make final adjustments to the equipment.

Manufacturer installation affidavits (certificates) shall be provided in accordance with [Section 2-1.1](#).

Pumps shall be set plumb with no stresses on the pump discharge.

Equipment shall not be subject to electrical or mechanical shock. Damaged, dented or marred equipment shall be replaced or repaired in a manner satisfactory to Kitsap County, at the option of Kitsap County, at no cost to Kitsap County.

2-1.4.5.5.2 Start-up and Training Service

The Developer shall provide for the services by the equipment manufacturer for a qualified factory-trained field service engineer site visit to inspect, check, service, adjust and make corrections to the installation. Additionally, after the pumps have been completely installed and wired, the equipment manufacturer's qualified factory-trained field service engineer shall do the following:

1. Megger stator and power cables.
2. Check seal lubrication.
3. Check for proper rotation.
4. Check power supply voltage.
5. Measure motor operating load and no-load current.

6. Check level control operation and sequence.

A written report by the manufacturer's service engineer shall be submitted to Kitsap County certifying that the equipment has been properly installed and checked.

Field test all pumps, generators, and supporting equipment after installation to demonstrate satisfactory operation. See Section [2-1.12 Final Testing and Acceptance](#).

1. Furnish all labor, materials, tools, equipment, incidentals and services for developing a sufficient supply of potable water for functional testing. Sufficient quantities of water shall be available to test the full range of the equipment.
2. Testing shall be done in the presence of Kitsap County.
3. Any equipment that fails to meet the requirements, will be modified, repaired or replaced.

Instruct Kitsap County's personnel on the operation and maintenance of the equipment.

2-1.4.5.5.3 Cleaning

All materials and equipment shall be new and, therefore, shall require only a minimum amount of routine cleaning during or after installation.

All debris, grit, petroleum products, rust scale, construction by-products, and foreign matter shall be removed, and damaged coatings shall be repaired prior to final acceptance. All cleaning regimen suggested by the manufacturer shall be done.

2-1.5 Wetwells and Vaults

2-1.5.1 System Fabrication

Wetwells and vaults shall be precast reinforced concrete, cast-in-place reinforced concrete, or stainless steel construction. Wetwell floors shall be sloped to the pump suction to minimize grit accumulation. Vault floors shall be sloped to integral floor drain. Wetwells and vaults shall be watertight.

Precast assemblies shall be manufactured to meet the requirements of ASTM C-478, and the following minimum design requirements:

1. Normal weight concrete.
2. Minimum concrete cover over reinforcement shall not be less than that required by ACI 318, if greater than ASTM C858.

2-1.5.1.1 Minimum Loading Requirements:

Loading assumptions shall conform to ASTM C857 except as follows:

1. Top slabs shall be designed for A-16 (HS20-44) Loading OR 250 PSF Live Loading, whichever is greater.
2. Wall and bottom slab design and uplift calculations shall include hydrostatic pressure from groundwater.

3. For structures designed using groundwater pressures, buoyancy calculations shall have a minimum factor of safety equal to 1.5.
4. Live loads and weights for post-installed items such as internal piping, pumps, valves, sewage, concrete grout fill, etc. shall not be included in the buoyancy calculations.

All precast assembly sections shall utilize a round rubber gasket meeting ASTM C-443 specifications. All joints shall be watertight and will be mudded with non-shrink grout. All wetwell and vault components, including, but not limited to, access hatches, pump bases, ladders, and supports will be securely fastened to the precast sections in a watertight manner.

Cast-in-place wetwell and vaults designs shall be stamped by a registered engineer, licensed in State of Washington.

All penetrations in wetwells and vaults shall be sealed utilizing one or both of the following methods:

1. Modular Mechanical Seal - Expanding rubber seal with 316 stainless steel hardware installed in accordance with the manufacturer's recommendations to provide a watertight seal. Modular seals shall be PSI/Thunderline Link-Seal® or approved equal.
2. Rubber Flexible Connector – Kor-N-Seal Boot with 316 stainless steel pipe pipe clamp assembly, 316 stainless steel Korband assembly, cavity O-Ring, and non-shrink grout, or approved equal.

All miscellaneous metal parts in wetwell shall be 316L stainless steel. Metal outside the wetwell shall be aluminum, stainless steel or hot dipped galvanized following fabrication.

No lights or intrusion alarms shall be installed in the wetwell.

2-1.5.2 Coating System

Surface coatings shall be semi-gloss, except that ceilings shall be coated with flat coatings to match wall areas.

Surfaces to be coated and coating systems to be used are described below. The final coat shall be applied only after all other work, including punch list items, has been completed.

Surface	Coating System
1. <u>Metal Work</u> : Equipment, including metal base and guards; conduits, piping; appurtenances, including grilles and louvers; doors; electrical, pneumatic, and instrumentation control panels and stations, including supports. Refer to equipment specifications for exceptions.	
a. Iron and steel (includes galvanized) (except non-ferrous and stainless), exposed above ground or in vault structures (not buried)	B (except as indicated under b. & c.)
b. Iron and steel piping and appurtenances located in the wetwell	D (except as indicated under c.)
c. Submersible pumps	E
2. <u>Concrete, Grout, and Masonry</u> :	
a. Exterior concrete exposed slabs and surfaces	Unpainted
b. Exterior concrete buried surfaces of wetwells, manholes, valve vaults	A
c. Interior concrete/grouted surfaces of wetwell	C
d. Interior concrete/grouted surfaces of manholes	C
e. Interior concrete surfaces of valve vault	A or C
3. <u>Materials Not Requiring Paint</u>	
a. Rubber, stainless steel, copper pipe, PVC pipe, and fiberglass fabrications.	—
b. Labels and Nameplates: Do not paint over Underwriters Laboratories Factory Mutual, or other code-required labels or equipment name, identification, performance rating, nomenclature plates.	—
c. Pre-Finished Items, except as damaged, including: (1) acoustic materials (2) finished mechanical and electrical equipment (3) light fixtures (4) switchgear (5) distribution cabinets (6) operating louvers	—
d. Metal Surfaces, including: (1) aluminum railing, ladders, hatlines, light poles (2) stainless steel (3) chromium plate (4) copper (5) bronze (6) brass (7) aluminized and galvanized (and vinylized) chainlink fabric fences, gates, and closures (8) Duct silencers and motor-operated dampers	—

Surface		Coating System
e.	Moving Parts of Operating Equipment such as the following: (1) valve and damper operators (2) linkages (3) sensing devices (4) motor and fan shafts (5) gears	—

Coating System A

Coating Material: Modified Polyamine Epoxy

Surfaces: Concrete

Surface Preparation: Allow new cast-in-place concrete to cure a minimum of 28 days at 75°F (24°C). Verify concrete dryness and prepare concrete surfaces in accordance with NACE 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Moisture vapor transmission should not exceed three lbs per 1,000 sq ft in a 24-hour period (Reference ASTM F 1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride"). Relative humidity should not exceed 80% (Reference ASTM F 2170 "Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes"). Abrasive blast, shot-blast, water jet or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide a minimum ICRI-CSP 3 surface profile. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.

Application: Factory – Exterior Surfaces
 Field – Interior Surfaces

Coating System:

Primer/Finish: Tnemec Series 141 Epoxoline
 One coat, 16 mils DFT

Coating System B

Coating Material: Modified Polyamidoamine Epoxy and Aliphatic Acrylic

Polyurethane

Surfaces: Metal

- Surface Preparation:
1. Bare ferrous metal surfaces shall be prepared in accordance with SSPC SP-6 (Commercial Blast Cleaning).
 2. Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning all surfaces in accordance with SSPC SP-2 (Hand Tool Cleaning).
 3. Galvanized or nonferrous surfaces shall be treated with a passivator and vinyl wash primer as recommended by the coating system manufacturer.
 4. If smoothing of rough metalwork is necessary, a smoothing cement acceptable to the paint system material manufacturer shall be used.

Application: Field

Coating System:

Primer: Tnemec Series 135 Chembuild
One coat, 4.0 to 6.0 mils DTF
Color: Off-White

Finish: Tnemec Series 73 Endura-Shield
Two coats, 2.0 to 3.0 mils DFT per coat
Color: See Paragraph 3.05

Coating System C

Coating Material: 100% Solids High Build Epoxy

Surfaces: Concrete

Surface Preparation: Surfaces must be sound and contaminant-free with a surface profile equivalent to a minimum CSP3 to CSP5 in accordance with ICRI Technical Guideline No. 310.2R-2013. Dry abrasive sand with water blast to surface profile as recommended by the manufacturer.

Application: Field

Coating System:

Primer: As recommended by coating system manufacturer

Finish: Raven 405
 Spray apply two coats, 125 mils DFT total
 Allowed tolerances of plus 40 mils DFT to minus 0 mils DFT
 Color: Light Blue

Coating System D

Coating Material: 100% Solids Modified Polyamine Epoxy

Surfaces: Metal

Surface Preparation: As recommended by coating system manufacturer.

Application: Field

Coating System:

Primer: As recommended by coating system manufacturer

Finish: Tnemec Series 435 Perma-Glaze
 Two coats, 12 to 15 mils DFT per coat
 Color: See Paragraph 3.05

Coating System E

Coating Material: Epoxy (per Flygt/Xylem)

Surfaces: Metal

Surface Preparation: In accordance with SSPC SP-10 (Near white metal blast)

Application: Factory
 Curing as required by coating manufacturer

Coating System: Xylem Standard Code 08 Coating System

Primer: Temanyl PVB, one coat 1.6 Mil DFT

Finish: Duasolid 50, 3 coats 4-5 Mil DFT per coat

2-1.5.3 Hatches

The hatch opening shall be sized and located to allow unobstructed removal of the pumps

Hatches shall be rectangular aluminum, Bilco style or equal. Hatches shall work with the pump rails in the wetwell to provide unobstructed removal of pumps.

Hatches shall be a dual leaf type with a hold open arm that automatically locks the cover in the open position and have hasp type locking mechanism for Kitsap County provided padlock.

All hatches shall contain a safety cage for secondary fall prevention system that is powder coated safety orange or safety yellow with an automatic lock to keep gratings in the open position.

Hatches for vaults shall contain a ladder with safety extension posts with spring balanced mechanisms to provide smooth, easy, controlled operation when raising and lowering the post. Vault 6-foot deep or greater shall be equipped County approved davit receiver.

Hatches shall be H-30 rated with 316 stainless steel compression spring tubes that are constructed of anti-corrosive material. All hatch and safety grate hardware and fasteners shall be 316 stainless steel.

2-1.5.4 Station Valve Vault

The valve vault will be placed adjacent to the wetwell.

All pipes, valves and check valves shall be connected via bolted FL x FL except between wetwell and valve vault.

2-1.5.5 Wetwell Flushing Line and Valve

Provide 4" wetwell back flushing line and gate valve between valve vault and wetwell. Back flushing line and associated gate valve shall be configured to allow the redirection of one pump's discharge back into the wetwell while a second pump discharges into the forcemain. Back flushing line shall be routed into the wetwell to an elevation equal to 1-foot above the lead pump on setpoint. Provide a Groove End (GE) x Plain End (PE) 45-degree bend connected to end of back flushing line with a grooved coupling inside wetwell.

2-1.5.6 Pump Station Isolation Gate Valves

Provide a pump station isolation gate valve outside the wetwell on all influent lines into wetwell.

Provide a pump station isolation gate valve on the forcemain side of the valve vault outside of the valve vault.

Isolation valves will be provided with operating wrench of sufficient length to extend from the surface to the operator nut. A cast iron valve box with cover marked sewer is required.

2-1.5.7 Gate Valves

Resilient Wedge Gate Valves, 2 to 18 IN (Water, Wastewater Application):

1. Comply with AWWA C509 or AWWA C515.
2. Materials:
 - a. Stem and stem nut: Bronze:
 - i. Wetted bronze parts in low zinc bronze.
 - ii. Aluminum bronze components: Heat treated.
 - b. Body, gate: Ductile iron.
 - c. Resilient wedge: Fully encapsulated rubber wedge per ASTM D429.
 - d. Seating rubber: EPDM elastomer.
 - e. Nuts and bolts for connecting bonnet and body shall Type 304 stainless steel. Bolts may be regular square or hexagonal heads confirming to ANSI B18.2.1. Metric size socket head cap screws are not allowed.
 - f. Interior lining and exterior coating shall be fusion bonded epoxy meeting the requirements of AWWA C550.
3. Design requirements:
 - a. Minimum 150 psig cold water working pressure.
 - b. Buried: NRS, O-ring stem seal, 2 IN square operating nut.
 - c. Exposed: NRS, O-ring, stem seal, handwheel.
 - d. Counter-clockwise open rotation.
 - e. Fusion bonded epoxy coating interior and exterior except stainless steel and bearing surfaces:
 - i. Comply with AWWA C550.
 - ii. Wetted bronze parts in low zinc bronze.
 - iii. Aluminum bronze components: Heat treated.
 - f. Ends to match connecting piping.
4. Acceptable manufacturers:
 - a. Kennedy.
 - b. M&H.

2-1.5.8 Check Valves

Swing Check Valves (Wastewater):

1. Comply with AWWA C508.
2. Acceptable manufacturers:
 - a. M&H.
 - b. Kennedy.
 - c. Clow.

3. Materials:
 - a. Body and cover: Cast iron, ASTM A126, Class B.
 - b. Seat ring, hinge: Bronze, AWWA C508.
 - c. Disc: Cast iron, ASTM A126, Class B with rubber face.
 - d. Hinge shaft: Stainless Steel, ASTM 276, type 304.
 - e. Stuffing box, follower and gland: Bronze, AWWA C508.
 - f. Interior lining and exterior coating shall be fusion bonded epoxy meeting the requirements of AWWA C550.
4. Design requirements:
 - a. Integral flanged ends, flat faced and drilled per ANSI B16.1 Class 125.
 - b. 175 psig working pressure and 350 psig hydrostatic pressure.
 - c. Valves shall be provided with one outside lever and spring. Spring tension shall be adjustable. The valve design shall permit mounting levers and springs on either side of the valve body.
 - d. Valve shall be provided with a clear opening equal to or greater than the connection piping, with no raised seating surface. Seats shall be threaded onto the body and shall be replaceable.
 - e. Constructed to permit top entry for complete removal of internal components without removing the valve from the line.
 - f. Inspection lid shall have minimum 1/4-inch NPT tap for pressure gauge.

2-1.5.9 Pipe, Fittings, and Gaskets

Ductile Iron Pipe:

1. AWWA/ANSI C111.
2. AWWA/ANSI C115.
3. AWWA/ANSI C150.
4. AWWA/ANSI C151.
5. Line pipe with 40 mils nominal dry film thickness: Protecto 401 Ceramic Epoxy or accepted equal.

Fittings and Flanges:

1. AWWA/ANSI C110.
2. AWWA/ANSI C115.
3. Flanges drilled and faced per ASME B16.1 for both 125 and 250 psi applications.
4. Line fittings with 40 mils nominal dry film thickness: Protecto 401 ceramic epoxy or accepted equal.

Flanges: Unless otherwise specified, comply with AWWA C115 with the following restrictions:

1. Flange material: Meeting the requirements of AWWA 207 with the following restrictions:

- a. Ductile iron or gray iron for Pipe Size up to 12 IN.
- b. Ductile iron for Pipe Size greater than 12 IN.
2. Flange finish: Flat faced.
3. Flange Type: Solid.

Gaskets:

1. Gasket Materials: Gasket Materials shall meet the requirements AWWA C115 and the following:
 - a. Rubber: Red Rubber (SBR) per ASTM D1330, Grade I & II:
 - i. Hardness (Shore A Value) per ASTM D2240: 80±5.
 - ii. Minimum Gasket Yield Pressure: 200 psi.
 - iii. Suitable for Maximum Seating Pressure: 1,200 psi.
 - b. Non-asbestos Synthetic: Shall be a blend of synthetic fibers, fillers, and elastomeric binders {suitable for potable water service}:
 - i. Minimum Gasket Yield Pressure (1/16 IN thick Gasket) 3000 psi.
 - ii. Minimum Gasket Yield Pressure (1/8 IN thick Gasket) 4000 psi.
 - iii. Suitable for Maximum Seating Pressure: 15,000 psi.
 - c. Neoprene:
 - i. Hardness (Shore A Value) per ASTM D2240: 80±5.
 - d. EPDM:
 - i. Hardness (Shore A Value) per ASTM D2240: 60±5.
2. Gaskets for Flanged Joints:
 - a. Gasket materials shall meet the requirements of AWWA C115 with the following restrictions:
 - i. Design Internal Pressure ≤ 150 psi:
 1. Pipe Size 3 IN through 12 IN: Rubber, Full faced, 1/8 IN thick.
 2. Pipe Size 14 IN through 64 IN: Rubber, Ring, 1/8 IN thick.
 - ii. Design Internal Pressure > 150 psi and ≤250 psi:
 1. Pipe Size 3 IN through 64 IN: Rubber, Ring, 1/8 IN thick
3. Gaskets for Mechanical Joints: Comply with AWWA/ANSI C111/A21.11:
 - a. Gasket material: Vulcanized Styrene Butadiene Rubber (SBR) meeting the physical property requirements per Table 4, AWWA/ANSI C111/A21.11 and the following:
 - i. Hardness (Shore A Value) per ASTM D2240: 75±5.
 - ii. Min Ultimate Tensile Strength per ASTM D412: 1,500 psi.

- iii. Min Ultimate Elongation (based on original length) per ASTM D412: 150%.
 - iv. Minimum Aging per ASTM D572: 60%.
 - v. Maximum Compression Set per ASTM D395, Method B: 20%.
 - vi. Resistance to Surface Ozone per ASTM D1149: No Cracking.
4. Gaskets for Push-on Joints: Comply with AWWA/ANSI C111/A21.11:
- a. Gasket material: Vulcanized Styrene Butadiene Rubber (SBR) meeting the physical property requirements per Table 8, AWWA/ANSI C111/A21.11.
5. Gaskets for Grooved Type Mechanical Coupling (AWWA C606) Joints: Rubber meeting ASTM D2000 meeting the physical property requirements per Table 1, AWWA C606.

2-1.5.10 Basin Wall Pipes

All pipes passing through concrete basin walls shall be proved with Link Seal™ Modular Seals, installed in accordance with the manufacturer's recommendations, to provide a watertight, non-shrinkable seal.

2-1.5.11 Wet Well Drop Bowl Assembly

Provide a drop bowl assembly inside wet well that facilitates the controlled drop of wastewater and prevents cascading.

The drop bowl shall be a plastic composite collection device with a hood designed for higher velocity flows. Hood shall be removable and attach to drop bowl with 316 stainless steel fasteners in accordance with manufacturer's instructions. Drop bowl and hood manufacturer shall be RELINER/Duran Inc. or accepted equal.

Drop pipe shall be SDR 35 PVC, Schedule 40. Bevel cut outlet of drop pipe at 45-degree angle. Drop pipe shall extend a minimum of 3-feet below bottom of sewer inlet. Connect drop pipe to drop bowl assembly with flexible coupler, Fernco type coupling with stainless steel hardware, or accepted equal.

Drop bowl and drop pipe size shall be based on inlet sewer size as recommended by the manufacturer.

Attach and support drop bowl assembly to concrete wall with 316 stainless steel hardware, fasteners and anchors in accordance with manufacturer's instructions. Drop pipe shall be provided a minimum of two supports. If required, additional supports for drop bowl assemblies in the wet wells shall be provided and installed as field directed by Kitsap County.

2-1.6 Noise Control

All constructed facilities and equipment must meet the requirements of Kitsap County Code Title 10 Peace, Safety and Morals Chapter 10.28 Noise. Maximum permissible noise levels shall not exceed those defined by the Kitsap County Code.

2-1.7 Odor Control

All pump stations shall be provided odor control. The use of sodium hypochlorite will not be considered.

Odor control requirements shall be evaluated by the design engineer and approved by the County. A minimum of an un-obstructed 12' by 12' area will be set aside for future odor control equipment.

Odor control equipment shall be enclosed in an above grade structure within the pump station site.

2-1.8 Reliability

2-1.8.1 Equipment Redundancy

Where two or more pump units are provided, they shall have the capacity that with any one unit out of service, the remaining units will have capacity to handle the maximum peak sewage flows.

2-1.8.2 Emergency Power

2-1.8.2.1 Portable Engine Generators

Where 20 or less equivalent units are to be connected to a pump station, a power transfer switch (double throw disconnect) and receptacle compatible with the County's portable generators shall be provided.

Power receptacle compatible with the County's portable generator shall be receptacle number AREA10415S22 for 1 ½" hub or AREA10416S22 for 2" hub Crouse-Hinds Receptacles. 100 amp, 4 wire and 4 pole.

2-1.8.2.2 Permanent Engine Generators

When 21 or more equivalent residential units are served by the pump station an emergency power source or auxiliary-pumping equipment shall be provided to ensure continuous operability for a minimum of 48 hours. Generators shall be equipped with an automatic load transfer switch. See [2-2.1.4 Electrical Design](#) for generator and transfer switch requirements.

Generator fuel shall be as directed by the Kitsap County Sewer Utility Senior Program Manager.

2-1.8.2.3 Fuel Storage

The Developer shall be responsible to coordinate the fuel system requirements with the local building and fire codes for installation. The Developer shall verify all necessary space, containment, alarming and monitoring requirements are met. The Developer shall provide all necessary equipment, raceway, wiring etc. to meet the requirements of the local codes, Fire Marshall, NEC, and as recommended by the generator manufacturer.

2-1.8.3 Bypass Capability

All pump stations shall be provided with provisions to bypass pump directly from the wetwell using County provided portable pumps directly into the forcemain. Connection point to forcemain for bypass pumping shall be an aluminum 6" male camlock fitting with cap.

2-1.8.4 Overflow Storage Capability

When less than 21 equivalent residential units are served by the pump station, on-site generators or a second power source are not required, but storage within an overflow tank shall be provided for an 8 hour peak flow as shown in County Standard Detail PS-4.

2-1.8.5 Alarms and Telemetry

2-1.8.5.1 Telemetry Equipment

The RTU shall monitor, log, and control the following I/O Terminations from the control panel:

1. Power Fail.
2. Dry Well Flood (if equipped).
3. High Wetwell.
4. Low Wetwell.
5. Pump Fail.
6. Generator Fail (if equipped).
7. Intruder.
8. VFD Fail.
9. CL2 Leak (if equipped).
10. Pump 1 Run.
11. Pump 2 Run.
12. Pump 3 Run (if equipped).
13. Analog Real Time Effluent Flow
14. Spare.

Radio Antenna and Cable: Antenna shall be Kathrien YA7-166 series VHF Yagi antenna with pigtail 18" RG 400 TNC Male-n- Male Adaptor, and Lightning Arrestor-Polyphaser DT-NFF. Cable shall be Times Microwave Systems-LMR-400DB or accepted equal cable. The total

installed antenation must be less than 2.7dB loss per 100 ft at 450 MHz.

Radio Antenna Tower: Provide minimum 4" diameter 20-foot tall antenna tower.

The RTU provider shall be:

Quality Controls Corporation
5015 208th St. SW, Unit 1-B
Lynnwood, WA 98036
James Cross
(425) 967-7110

The RTU enclosure shall be:

Stahlin Enclosures
Model #J3024HPL
Type NEMA 4X

The RTU PLC shall be:

Alan Bradley
MicroLogix 1400

The Radio shall be:

CALAMP VIPER SC-100
Frequency 173.3125 MHZ
Part No. 140-5018-502
Accu-Comm, Inc.
1-800-404-9334

The Cellular Ethernet Radio Modem System shall consist of:

Cradlepoint, Part Number IBR900-600M-NA
Cellular Antenna

The Telemetry provider shall coordinate with Kitsap County Public Works Sewer Utility, Electrical Foreman at (360) 337-5630 to obtain necessary Radio and PLC programming and ensure compatibility with County's existing system.

2-1.8.5.2 Alarms

An alarm system shall be provided for all pumping stations. Alarm system activation shall be required for the conditions:

1. Power Fail.
2. Dry Well Flood (if equipped).
3. High Wetwell.
4. Low Wetwell.
5. Pump Fail.
6. Generator Fail (if equipped).

7. Intruder.
8. VFD Fail.
9. Odor control system failure.
10. Pump 1 Run.
11. Pump 2 Run.
12. Pump 3 Run (if equipped).
13. Analog Real Time Effluent Flow

All alarms shall be transmitted from the control panel to the Telemetry System.

The control panel shall be equipped with an exterior alarm light and audible alarm. The audible alarm shall have an "Alarm Silence" switch inside the control panel door.

The High Wetwell alarm shall activate an externally mounted rotating or flashing red light with a placard instructing to call 911.

2-1.9 Final Testing and Acceptance

The following describes the responsibilities of the Developer and/or Contractor to perform testing and startup of the pump station:

2-1.9.1 General

Developer will be provided a Kitsap County Sewer Utility Startup and Testing checklist that will indicate all items that will be verified by County personnel.

Based on the section requirements, the Contractor shall submit 30-days prior to expected field testing a Master Test Plan for approval by the County. This plan shall be a step by step compilation of the specific tests to be performed in the facility test sequence, and the sample forms to be submitted documenting the results of the tests and test information. During the step-by-step testing, these forms will require signing off by specified County representative(s) and the contractor's test representative(s) prior to continuation of the test sequence. All tests shall be successfully completed and signed-off by the County.

Factory representatives will inspect and certify in writing the proper installation of their equipment a minimum of 5 working days prior to startup, witness the startup, and make any necessary adjustments to the equipment for satisfactory operation. These representatives will also be responsible for instructing the County's personnel as to the proper operation and maintenance of the pump station.

The completed pump station shall be given an operational field test of all equipment for leaks in all piping and seals, and for correct operation of the automatic control system and all auxiliary equipment. Developer shall conduct preliminary tests and be assured that the section to be tested is in an acceptable condition before requesting the County to witness the test.

The Contractor is responsible for all utility costs including power, fuel, potable water,

testing/training specialists, and other testing costs, such as generator fuel, communication costs, etc. associated with the facility test sequence until such time that the station is accepted by the County

Operational field tests shall be conducted under both normal and emergency power.

2-1.9.2 Field Testing

The Contractor / Developer will notify the County 10-days prior to scheduled beginning of field testing. The County will witness all field testing activities as agreed to in the approved Master Test Plan.

1. All equipment shall be tested and demonstrated to the County's representative that proper operation and capacity have been fully complied with. For pumps, this shall include measurement of discharge pressure at the valve box and measurement of pumping rate by volumetric means, or through a suitably calibrated meter for two points on the performance curve. Any test equipment or measuring devices required which are not part of the permanent installation shall be furnished by the Contractor.
2. The contractor will demonstrate continuous 8-hour operation of each pump system installed. The contractor will provide the means to recirculate testing water back to the wet well and isolated from the force main during this test.
3. The Work shall be demonstrated to be in full operating order prior to acceptance. Should any equipment or part thereof fail to operate as intended, it shall be immediately removed and replaced at no expense to the County.

2-1.9.3 Acceptance by the County

The Contractor/Developer shall obtain Final Inspection for all required building, fire, electrical, stormwater, and other permits issued for construction of the pump station from the Authority Having Jurisdiction prior to acceptance by the County.

Final testing for County acceptance is required after backfill has been completed and all other utilities have been installed.

Prior to acceptance by the County, developer shall correct all irregularities.

Prior to final acceptance the Developer shall provide to the County all required facility operation and maintenance manuals, and spare parts.

Provide one set of spare parts for each set of two or less pumps of the same model and other mechanical and electrical equipment. Except as specified herein, spare parts shall be as recommended by the manufacturer. The spare parts shall be packed in a hinged wooden box with hasp and clearly labeled for contents.

Final acceptance of the completed pump station including testing and startup shall include approval by the Kitsap County Sewer Utility Inspector, and Sewer Utility Operations Manager.

Only after final testing and acceptance by the County is the pump station allowed to pump sanitary sewage into the County system.

2-1.9.4 Guarantee/Warranty

The Developer will guarantee for one year, from the final acceptance date that the entire station and all equipment is free from defects in design, material, and workmanship.

In addition, a printed guarantee will be supplied by the pump manufacturer concerning the pumps and motors only. This guarantee will provide an additional 4 years, or 48 months, with a prorated sliding scale rate, covering the mechanical shaft seals, bearings, rotors, stators, volutes and impellers within the pump and motor.

A printed copy of this guarantee, showing the 60-month total will be provided as a part of the submittal data.

2-2 Electrical and Control

2-2.1 General

Pump motors and any electrical equipment installed within the wetwell area will have been designed and listed for use therein.

All electrical and controls shall be furnished and installed in accordance with the applicable Federal, State, and local codes and standards including:

1. National Electrical Code (NEC)
2. Occupational Safety & Health Act (OSHA)
3. National Electrical Safety Code (NESC)
4. National Electrical Manufacturers Association (NEMA)
5. Underwriters Laboratory (UL)
6. Insulated Power Conductor Engineering Association (IPCEA)
7. American National Standards Institute (ANSI)
8. Institute of Electrical & Electronic Engineers (IEEE)

The Developer shall prepare shop drawings and product data for all electrical and control cabinets, devices and etc. for approval by the Developer's Project Engineer and Kitsap County Public Works Sewer Utility prior to fabrication. No fabrication shall commence until written approval is received by the Developer's Project Engineer and Kitsap County Public Works Sewer Utility.

2-2.1.1 Standards and Codes

Permits, licenses, approvals and other arrangements for work shall be obtained.

Electrical work shall be executed in strict accordance with the latest edition of the National Electrical Code and local ordinances and regulations.

All electrical equipment, materials, construction methods, tests and definitions shall be in strict conformity with the established standards of the following in their latest adopted revision:

1. Underwriters' Laboratories, Inc. (UL)
2. National Electrical Manufacturers Association (NEMA)
3. Canadian Standards Association (CSA)
4. Electrical Testing Laboratories (ETL)
5. Factory Mutual (FM)
6. All applicable Washington State Codes and local County Codes.

All materials and equipment permanently incorporated into the work shall, within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.

All materials shall be new, free from defects, of current manufacture, and of good quality. Each type of material shall be of the same manufacturer throughout the work.

2-2.1.2 Electrical Design

Provide service entrance equipment with a separate compartment for installation and wiring of the underground service entrance loop and metering equipment for the panel. The meter base and related accessories will be in strict accordance with Puget Sound Energy Company requirements for the area site location.

Power supply voltage shall be 460 volt, 3-phase, 60 cycle, four wire. This is an operating voltage, not a static or net source.

A step down transformer, with a 460 VAC primary, and 120 VAC secondary winding is required. The transformer will be appropriately sized for the anticipated site conditions.

Circuit breakers will be appropriately sized for the transfer and protection of the power and control circuits, per NEC.

All electrical conductors shall be stranded copper.

All exposed conduits shall be rigid aluminum and all buried conduit shall Schedule 40 PVC.

A minimum of one 120V 120 amp GFI service receptacle is to be provided.

For each pump there shall be:

1. Combination circuit breaker/overload unit providing overload protection.
2. Short circuit protection.
3. Reset and disconnect for all phases.
4. Across the line magnetic contactor.
5. 120 volt AC control power transformer.
6. Overload relay to be pre-calibrated to match motor characteristics.
7. Thermal overtemp relay and thermal overtemp reset push-button, each factory sealed to ensure trip setting is tamperproof.
8. Elapse time meter that will count the time pump magnetic starter is engaged. The timer shall count in hours and tenth of an hour.
9. One 120 volt receptacle (15 amp) in the control panel.

No electrical devices, controls, or connection boxes are permitted in a wetwell.

All components within the pump station system, including both internally and face-mounted instrumentation and devices, shall be clearly identified with phenolic nameplates of black background with white letters. Controls, resets, and displays shall be readily accessible without exposing personnel to electrical hazards.

2-2.1.3 Control Panel

The control panel cabinet breaker should have remote operators with lockout devices.

2-2.1.3.1 Control Panel Lighting

Function lights mounted on the inner door and appropriately labeled will light and show the following functions:

1. Pump run light, green lens, two required, one per pump.
2. Power on light, amber or white lens, one required.
3. Seal failure lights, red lens, two required, one per pump.
4. Motor temperature trip, red lens, two required, one per pump.
5. High wetwell level, blinking red lens, one required.
6. Low wetwell level, steady red lens, one required.
7. Amperage gauges, one per pump, and external circuit breakers

Panel function lights will be the low voltage LED type and supplied with "push-to-test" function and will be manually reset.

2-2.1.3.2 Panel Heaters

Each panel compartment will be supplied with a 115 VAC area strip heater with thermostat control for moisture and freeze control. Each heater will be sized appropriately for its compartment.

2-2.1.3.3 Elapsed Time Meters

Elapsed time meters are required and will be mounted on the front of the panel marked with phenolic labels showing equipment name and number. All

meters will be the non-resettable seven-digit type. One meter is required for each pump, to totalize individual pump run time.

2-2.1.3.4 Enclosures

Enclosures are to be free standing of NEMA 4X construction (weather tight) for installation outdoors and made of 316L stainless steel. The enclosures will be of sufficient size to meet all design and space needs as determined in the most recent editions of the NEC and OSHA handbooks. Enclosures will be of door behind door construction, with dead front covers, and of ample size to accept the power distribution circuits, control and instrumentation circuits, service entrance equipment and all accessories specified. This enclosure will also be supplied with drip shield above the outer doors and hinge pins shall be 316L stainless steel. A window shall be provided in the door to view the RTU display.

Special attention will be given to the additional space needed for the RTU. The supplier shall coordinate this item with the Kitsap County Department of Public Works Sewer Utility. The supplier shall coordinate with Kitsap County Public Works Sewer Utility for RTU specifications and provide shop drawing for approval prior to fabrication.

2-2.1.3.5 Wetwell Junction Boxes

Two wetwell junction boxes shall be provided that are located a minimum of 36" horizontal and 18" vertical from the wetwell, in accordance with current Washington State L&I standards.

Junction boxes shall be provided with an air gap between the junction box and wetwell. Air gaps shall be on the bottom of the junction box and cords held in place by a stainless steel or PVC cord grip. Seal-offs are to be located between wetwell junction box and system control panel.

The junction boxes are to be of NEMA 4X construction, 316L stainless steel, and mounted on stainless steel supports

One junction box will receive the float wires from the wetwell, and will be supplied and installed with a "Y" type gas seal off, above grade, between the junction box and the system control panel in this conduit run, allowing float change without "chico" removal. A second junction box will receive the power and sensor cords from both pump motors, with "seal offs" between the junction box and the control panel. Prior to final acceptance by the County, the "Y" type gas seal off fittings will be filled with a sealing compound approved by the State of Washington, Electrical Inspection Division.

All power and control wiring splices shall be made utilizing an insulated tap.

It shall be the contractor's responsibility to obtain any and all electrical permits from Labor & Industries, along with an approved installation.

2-2.1.3.6 Hand-Off-Automatic (HOA) Switches

Hand-Off-Automatic (HOA) switches will be provided, one for each pumping unit. These switches will provide continuous run in the HAND position and a controlled or logic function in the AUTOMATIC position.

2-2.1.3.7 Motor Starter Units/Contactors

Motor starter units shall be of the combination type with components as required to provide a fully functioning system. Magnetic contactors shall be heavy duty NEMA rated, Square-D Type S, Allen Bradley Bulletin 509, Furnas Innova, Cutler Hammer Freedom, or approved equal. All contactors shall be provided with two field convertible auxiliary contacts. An auxiliary switch shall be provided to indicate the circuit breaker is in the "ON" position. Switch shall be open when the CB is open. Motor starters and associated equipment shall be provided to match the load being served.

2-2.1.3.8 Variable Frequency Drives (VFD)

Pump stations designed for a capacity of 100 or greater equivalent residential units shall be provided variable frequency drive (VFD) units for each pump. VFDs shall be Allen-Bradley PowerFlex with full function HIM module, or approved equal. VFDs and associated equipment shall be provided to match the load being served. VFDs shall be arranged to control the pumps such that the pumping rate will match the in-flow rate.

2-2.1.4 Electrical Design

2-2.1.4.1 Automatic Transfer Switch

Acceptable Automatic Transfer Switch Manufacturers are Onan and Cutler Hammer/Westinghouse.

An Automatic Transfer Switch (ATS) shall transfer from normal service to a standby generator in the event of power failure. The switch shall transfer the system back to normal power after power has been restored. The switch shall include all controls and accessories. The switch shall be UL labeled, shall meet the requirements of UL standard 108 and shall be suitable for total system transfer including motor and lighting loads. ATS shall have a separate mechanism with regular throw transfer switch. Commercial power disconnect is to be between meter and transfer switch.

The automatic transfer switch shall include the following controls and accessories:

1. Three-Phase Relay Protection
2. Test Switch: Start, Transfer, Re-Transfer, etc., for simulating power outage.

3. Override Switch
4. Indicating Lights: Normal and Standby
5. Engine Starting Delay: Adjustable up to 2 minutes (set at 5 seconds)
6. Transfer Relay: Set to prevent transfer to standby until the standby power voltage and frequency are 90% of rated values.
7. Retransfer Delay: Adjustable from 1 up to 25 minutes (minimum range)

2-2.1.5 Engine-Generator Set

Acceptable engine-generator manufacturers are Onan/Cummins and Caterpillar, no exceptions.

The engine fuel system shall be as directed by the Kitsap County Sewer Utility Senior Program Manager.

2-2.1.5.1 General

The engine-generator shall be a factory fabricated and assembled package of new and current equipment, and shall consist of an engine, generator, automatic transfer switch, controls, engine block heater, fuel tank and engine mounted fuel pump if applicable, and other accessories as required for a complete and operable assembly, capable of automatic startup and shutdown. The engine-generator shall be permanently installed on a welded steel base for anchoring to a concrete base with vibration isolators provided between the engine-generator and welded base.

The engine-generator shall have only one source of supply and responsibility. The assembly and complete installation shall comply with the current NFPA 70 National Electrical Code (NEC) and the State of Washington Electrical Laws (RCW) and Rules (WAC).

Manufacturer installation affidavits (certificates) shall be provided in accordance with [Section 2-1.1](#).

2-2.1.5.2 Engine

The engine shall be a water-cooled, in-line or V-type, four-stroke cycle, have a maximum of six cylinders, and include a mounted radiator with duct flange and pusher-type fan. The engine shall be fully and completely capable of and equipped for driving electrical generators at a governed speed of 1800 rpm to operate all the features of the pump station.

Engine Controls – All engine controls, signal lights, gauges, and generator instruments shall be housed in one control panel for simplicity and convenience of operation. All meters will be panel mounted with sweep needle indicators. The following items shall be provided:

1. Oil Pressure Gauge
2. Water Temperature Gauge.
3. Transfer Sensor Circuits

4. Three Position Selector Switch (Hand-off-Automatic)
5. High Water Temperature Cutoff and Alarm Light
6. Low Engine Temperature Alarm Light
7. Low Oil Pressure Cutoff and Alarm Light
8. Engine Overspeed Stop and Alarm Light
9. Individual Dry Contacts, Normally Open, and Fault Lights to operate in the Event of Shutdown of any Alarm above.
10. Interior Panel Light
11. Volt Meter, internally connected, dual range
12. Frequency meter, internally connected
13. Engine Elapsed Time Meter

Engine Fuel System – Shall be as directed by the Kitsap County Sewer Utility Senior Program Manager. The Contractor/Developer shall be responsible to coordinate the fuel system requirements with the local building and fire codes for installation. The Contractor/Developer shall verify all necessary space, containment, alarming and monitoring requirements are met. The Contractor/Developer shall provide all necessary equipment, raceway, wiring etc. to meet the requirements of the local codes, Fire Marshall, NEC, and as recommended by the generator manufacture. Specific requirements are as follows:

1. Natural Gas Fuel System: Provide the following:
 - a. Carburetor.
 - b. Secondary Gas Regulator. Coordinate with the natural gas utility and provide regulators and adjustments as needed.
 - c. Fuel-Shutoff Solenoid Valve.
 - d. Flexible Fuel Connector.
2. Diesel Fuel System: Provide the following:
 - a. Fuel tank system shall be double walled, have 48-hour gallon capacity at 75% load and shall be mounted integral to the enclosure base. The fuel tank system shall include:
 - i. Dry contacts wired to terminals in the control panel for a low-level fuel alarm.
 - ii. Critical low fuel alarm which shall also cause the generator engine to shut down.
 - iii. Manual fuel fill cap.
 - iv. Level gage.
 - v. Fuel strainer.
 - vi. Plastic sight glass.
 - vii. Interstitial monitoring, leak detection, and alarming per local requirements
 - b. Provide a fuel tank monitoring, indicating and alarming system for tank gauging and non-discriminating leak detection. The monitor shall operate on a 120v power and shall be microprocessor based, have 4 programmable relay outputs, selectable level indication in inches or gallons, programmable overfill and low-level alarms. The console display

- shall display level and have status indicators for alarms and leak detection.
- c. The low-level fuel alarm shall be set to trip when the fuel tank quantity reaches 33% of capacity.
 - d. Fuel tank venting per local codes – Discharge point at least 12 feet above grade.
 - e. Overfill protection – Device shall meet local code requirements and IFC 340.2.9.6. Fill port spill container shall be a minimum of 5-gallon capacity and made of non-combustible materials.
 - f. Signs for filling procedures, NO SMOKING or OPEN FLAMES WITHIN 25 FT, and contents and as required by the local authority.
 - g. Emergency Vents shall terminate outside of weather housing.
3. Engine Cooling System – The engine cooling shall be accomplished with a skid mounted radiator, provide sheet metal cowling between the generator and exhaust louver. Provide all equipment associated with the radiator for a complete operating system. Provide level switch in radiator for low coolant level alarm. Radiator shall be sized per manufacturer recommendations.
 4. Engine Exhaust System –The exhaust system shall include a flexible stainless-steel bellows exhaust pipe connection to the engine exhaust manifold, exhaust piping, silencer, exhaust pipe flashing, collar and rain cap, and support system. Silencer shall be a critical rated unit, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 5. Air-Intake Filtration System – The air-intake filtration system shall consist of a heavy-duty, engine-mounted air cleaner with replaceable dry-filter(s) element and "blocked filter" indicator.
 6. Lubrication System – The engine shall be equipped with a pressurized oil lubricating system which shall include threaded, spin-on type, full flow lubricating oil filters which are located for easy removal. The lubricating system shall be equipped with spring-loaded bypass valves which will allow oil circulation if the filters are plugged. The crankcase drain shall be arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
 7. Jacket Water Heater – The engine shall be equipped with single-phase water jacket heater(s) with one thermostat. Heaters shall be sized to maintain the coolant temperature at 100 degrees F at 20 degrees F ambient. Heaters having a total wattage of 1,200 or less

shall be 120-volts; larger shall be 208-volt or 240-volt. Operation of the heater(s) shall be stopped while the engine is turning.

8. Batteries – Starting batteries shall be provided and mounted in attached battery racks with non-conducting floor. Batteries shall be guaranteed for two years or more. Batteries shall be the AGM type, selected to provide engine break-away current for one second at a battery temperature of 20 degrees F and to 1-1/2 minutes total cranking without recharging.
9. Battery Charger – Provide fully automatic constant voltage, current limiting battery charger sized for the generator starting batteries. Charger shall have the following features: Protection fuses, DC ammeter, temperature compensating voltage regulator LED alarm lamps indicating AC power fail, Low battery voltage, High battery voltage. Form C contacts for alarm indication, high and low battery alarm adjust pots, float voltage adjustment pot. Charger shall monitor battery voltage and control the SCR to deliver the optimum current level to the battery. The battery shall be permanently connected and when the battery approaches full charge preset voltage, the charging current shall automatically taper to zero amperes or to the steady state load on the battery.

2-2.1.5.3 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 the 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.

2-2.1.5.3.1 General Performance

1. Frequency regulation shall be mechanical or isochronous $\pm 3\%$ nominal, $\pm 5\%$ maximum from no-load to rated load.
2. Steady - state voltage regulation shall be within $\pm 2\%$ of rated voltage, from no load to full rated load. Rheostats shall provide a minimum $\pm 5\%$ 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.
3. The maximum allowable short-term voltage dip shall not exceed 18% of rated voltage (for a total of 20% voltage dip including the steady state allowance).

2-2.1.5.3.2 Control Panel

The alternator control panel shall be wired, tested, and shock mounted on the generating set by the manufacturer. It shall contain panel lighting (with ON/OFF switch), manual reset circuit breaker, frequency meter, running time meter, voltage adjusting rheostat, wattmeter, ac voltmeter, ac ammeter (which includes current each phase), and voltmeter-ammeter phase selector switch with OFF position. Frequency meter, wattmeter, ammeter and voltmeter shall be 250-degree circular switchboard type, 2% accuracy class. The control panel shall include engine controls.

2-2.1.5.3.3 Generator Main Power Circuit Breaker

The circuit breaker shall be sized 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. The 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. A battery and charger shall be provided for shunt trip circuit.

2-2.1.5.4 Testing and Training

2-2.1.5.4.1 General

Tests shall be performed to determine proper operation and capacity of the equipment and to demonstrate compliance with these Standards and the engineered design. All field testing shall be performed by an authorized manufacturer's field representative. All equipment that fails any test will be rejected, and complete re-testing will be required after the Contractor/Developer makes corrections or modifications to equipment which has previously failed any test. All tests shall be witnessed by the County.

2-2.1.5.4.2 Factory Tests

Test the engine-generator in the factory to assure compliance with these Standards, the engineered design, NEMA MG-1, and the manufacturer's quality control provisions. Copies of all factory tests shall be submitted to Kitsap County for review.

2-2.1.5.4.3 Field Tests

1. Fully field test the engine-generator to demonstrate that all components are in compliance with these Standards, the engineered design and are ready for service. Refer to section [2-1.9 Final Testing and Acceptance](#).
2. Installation of the engine-generator shall be complete and the unit shall be serviced, tested, adjusted, and ready for use before the field tests are scheduled.

3. Provide written notice to the County of the scheduled dates for field test at least ten (10) working days prior to the field test date. The notice shall include a written test schedule listing the tests, the test procedure, the criteria for a satisfactory test, and ratings of the load bank to be used, and description of special measurement equipment to be employed.
4. Provide load banks, fuel, test equipment, labor, materials, and all other equipment and services required for all tests.
5. Make repairs and adjustments as required to achieve satisfactory performance of the engine-generator unit. If repairs or adjustments are made during the tests, additional testing shall be performed as required by the County.
6. Make written records of the tests and, within ten (10) days after completion of the field test, submit three (3) copies of the test record to the County. The test record shall indicate the test criteria and arrangement, the time of the test, the results, and pertinent data such as voltage, frequency, kilowatts, power factor, load current, oil pressure, water temperature, and ambient temperature. Pertinent data shall be recorded for each test, and at least every thirty minutes when the test requires more than thirty minutes.

2-2.1.5.4.4 Alarm, Control, and Equipment Tests

Demonstrate each alarm and safety shutdown provision by the abnormal condition, unless an alternative test condition has been approved by the County prior to scheduling of the tests. Operate each control circuit and device to demonstrate its proper operation. Demonstrate the battery charger and jacket water heater operation.

2-2.1.5.4.5 Operational Tests

1. Simulate power failure to demonstrate the proper operation of the automatic transfer switch and engine generator.
2. Demonstrate motor starting capability by starting and running at the specified motor loads. Measure and record voltage dip to demonstrate conformity to these Standards and the engineered design.
3. Show that phase rotation of the engine-generator and the existing power are compatible at the site.

2-2.1.5.4.6 Endurance (Load Bank) Tests

1. Operate the engine-generator for 1/2 hour at one-half its kW rating.
2. Operate the engine-generator for four (4) hours continuously at 100% of its kW or kVA ratings.
3. Measure the temperature rise of the windings of the generator using the resistance method.

2-2.1.5.4.7 Training

The manufacturer's field representative will be made available to provide at least 4-hours of on-site training for the maintenance and operation of the generator and associated equipment.

The Contractor/Developer will provide written notice to the County of the scheduled date(s) for training at least ten (10) working days prior to the scheduled training date.

2-2.1.5.5 Generator Enclosure

Enclosure shall be provided for standby generators to be installed outdoors.

Generator shall be enclosed in a sound attenuating housing which shall be totally weatherproof. The unit shall be skid mounted and the walls and roof shall be adequately reinforced to carry all dead and live loads. The enclosure shall be sized to contain the generator set, fuel tank, batteries and allow adequate room to service the entire unit.

The enclosure shall be a standard sound attenuating protective housing as manufactured by the generator manufacturer.

Doors shall be provided on each side of the enclosure and a control panel access door shall be provided on the end. All doors shall be equipped with handles and latches which are keyed. Each door or opening shall have prewired magnetic type intrusion switch for alarming unauthorized entry. All magnetic switches shall be wired to a common terminal at the main control panel.

The unit shall be primed and finished in accordance with manufacturer's standards. Color shall be approved by Owner.

The sound attenuating unit shall meet the noise level requirements of [Section 2-1.6](#) Noise Control with generator unit under full load running conditions.

The operating louver assembly, including the louver, motor and guard shall be completely factory assembled. Size per generator manufacturer's recommendations. The louver shall be equipped with a motor which shall be spring loaded to open the louver when the generator is called to start, and electrically operated to close the louver when the generator is called to stop.

The generator set shall be mounted in the enclosure using spring type vibration isolators between the generator set mounting skids and the enclosure.

2-2.1.6 Instrumentation and Controls

2-2.1.6.1 Instrumentation

2-2.1.6.1.1 Pressure Sensors and Gauges

Provide annular pressure sensor with gauge on the pump side of the check valve for

each pump.

Provide annular pressure sensor with gauge and transmitter on the discharge side of the pump isolation valves. Only one sensor assembly is required in this location for remote monitoring of forcemain pressure.

2-2.1.6.1.2 Flow Measurement

Provide pump stations with a magnetic flow meter. Acceptable devices for measuring sewage flow are Krohne Enviromag 2000 or Siemens SITRANS F M MAG 5000 with remote wall or panel mounted transmitter.

2-2.1.6.1.3 Liquid Level Sensors

Pump stations with 50 or less equivalent units are to be connected and constant speed pumps shall be controlled by a Multitrode™ Controller, Barrier Module, Conductivity Sensor with ten level points on the probe and relay logic, no equal.

Pump stations with 51 or greater equivalent units are to be connected and constant speed or variable frequency drive (VFD) driven pumps shall be provided a Siemens A1000i Submersible Level Transducer/Transmitter, no equal.

All pump stations must be provided a high-high, high-, and low-level backup float system meeting the following requirements:

1. Float-type level switches used for wastewater applications shall be non-mercury tilt switch type with a minimum 1.22 pounds zinc plated cast iron external weight. Floats shall be of a polypropylene construction with a solid polyurethane foam interior, hermetically sealed. Switches shall be Normally Open (N.O.) or Normally Closed (N.C.) rated at 10A at 120V. Cable shall be #18 AWG 2, Type SJOOW - 300, stranded, with chlorinated polyethylene jacket, integral to float with a minimum 30-foot length or longer as required to meet requirements of the design.
2. Floats shall be mounted on a stainless steel mounting bracket with individual hooks and a float cord wedge clamp (for easy level adjustment) for each float. Wire grip type supports/cord grips are not allowed. Floats shall be easily accessible from outside the wetwell for maintenance and replacement. All mounting hardware shall be type 316 stainless steel or cast aluminum.
3. Float switches shall be Conery NTG Inc. 2900-B8SIC1 (N.O.) or 2901-B8SIC1 (N.C.).

2-2.1.6.2 Controls

All pump stations shall be provided with programmable control equipment.

All pump stations with VFD driven pumps, PLC and an analog level controller shall have a selector switch to by-pass automatic electronic control and go straight to floats and starters for control in case of failure. This shall be both automatic and selectable.

2-2.1.6.2.1 Control Cabinets

Pump control panels for pump stations with control room enclosure shall be NEMA 12 powder coated steel construction.

Pump control panels for pump stations with no control room enclosure shall be a 316L stainless steel NEMA 4X enclosure mounted on a 316L stainless steel pedestal above ground inside a secondary 316L stainless steel vented cabinet. Panel door shall face away from prevailing winds to minimize water entering the enclosure and shall be a minimum of 10 feet from the fence to minimize vandalism. There shall be a heater strip to prevent condensation accumulation in the enclosure. A 120 volt (15 amp) outlet shall be provided in the control panel.

Door latches on all enclosures shall be stainless steel fast operating type 3-point latch door handle. Where a 3-point latch will not meet enclosure rating requirements and for enclosures that are too small for a 3 point latch use fast operating stainless steel clamp assemblies, Hoffman Bulletin A-80 or approved equal. The latch handle shall operate toward the center of the panel to open the door, and be pointing down when closed.

Cabinets shall be hinged with stainless steel pins

Provide all control cabinets with a data pocket and insert the cabinet drawings in the pocket when shipped to the site.

Provide all control cabinets which house PLC equipment with a 12x12" folding shelf HOFFMAN A-CSHELF12 or approved equal.

Provide corrosion inhibitors in all control cabinets prior to shipping. Amount of inhibitor shall be provided for the volume of the enclosure for one year.

2-2.1.6.2.2 Pump Station Controller

Pump stations with 50 or less equivalent units shall be provided a Multitrode™ MutiSmart Pump Station Manager, no equal.

Pump stations with 51 or greater equivalent units shall be provided an Allen-Bradley CompactLogix Programmable Logic Controller (PLC), no equal.

END OF SECTION

Chapter 3 Sewer Standard Details

This chapter covers the standard design details for use in County sewer projects and developer extensions to the sanitary sewer system.

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