

Appendix C – Public Works Sanitary Sewer Standards



CHAPTER 7

Sanitary Sewer

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Sanitary Sewer

7A General Considerations

7A.010 General

Sanitary sewerage refers to wastewater derived from domestic, commercial and industrial pretreated waste to which storm, surface, and ground water are not intentionally admitted. Pretreatment shall follow all the requirements as set forth by LOTT.

Any extension of Tumwater's sanitary sewer system must be approved by the Public Works Department and must conform to the City of Tumwater Comprehensive Sanitary Sewer Plan, Thurston County Health Department, Department of Ecology (DOE), and Washington State Department of Health (DOH) requirements. Specific site conditions may require variance from the Comprehensive Plan and require approval from the Director of Public Works.

All new homes and businesses constructed within the corporate City limits or the City of Tumwater Urban Growth Area shall connect to sewer provided that the sewage from the structure originates within 200 feet of a public sewer main. In the case of private residential or commercial development where the developed property abuts a right-of-way in which a public sewer is located or where a service connection is otherwise provided, all structures generating sewage shall be required to connect to the public sewer regardless of distance from the public sewer.

Anyone who wishes to extend or connect to the City's sewer system should contact the Community Development Department for a sewer extension / connection fee estimate. The design of the proposed sewer shall start from the existing system. The manhole numbers shall start at the cast in place or from the first manhole at the connection point or existing manhole. Mains shall be located on the south and west side of the roadway or easement.

Prior to the operation of any grinder pumps, all Public Works improvements shall be completed and approved and all applicable fees shall be paid. Any sewer connection fee shall be paid prior to issuance of a Building Permit.

See Section 3.040 for definitions of specific sewers. Maintenance of the building or side sewer shall be the responsibility of the property owner. Laterals shall be maintained by the City when a cleanout exists in the right-of-way.

7A.015 Building Sewers

Lots created by plats, re-plats, short plats, or binding site plans shall have a sewer service installed as required below. All new building sewers shall be installed in accordance with these standards and the Uniform Plumbing Code (UPC).

In single family subdivisions, (including mobile home and manufactured home subdivisions) a service shall be provided to each lot or pad.

Duplexes on a gravity, or grinder sewer regardless of the number of units on a lot, shall have a single service provided to each unit.

Services for multi-family and commercial complexes shall be as required in the International Building Code (IBC). Generally, this requires a minimum of one side sewer to each separate building. See Section 7B.050 for more gravity side sewer requirements.

The location of all side sewers shall be marked on the face or top of the cement concrete curb with an "S" 3 inches high and a 1/4 inch into the concrete.

Commercial sewer laterals shall be connected at a manhole. If a manhole does not exist, a new manhole shall be installed.

7A.016 Grease Traps

Commercial buildings that have kitchen or cooking facilities such as churches, community gathering places, restaurants, schools, etc. shall require the installation of a grease trap.

The grease trap shall be designed, installed, and constructed according to Thurston County Health Department requirements and the UBC. Grease traps shall be approved and inspected by the Tumwater Building Section of the Community Development Department. Grease traps shall be maintained by the customer to the satisfaction of the City of Tumwater and DOH requirements. Verification of grease trap maintenance shall be provided to the City annually.

7A.017 Roof Drains and Storm Water Discharges to Sanitary Sewer

Only sanitary wastewater shall be discharged to the sanitary wastewater system. Roof drains and other storm water sources shall be strictly excluded.

7A.020 Sanitary Sewer/Water Main Crossings

See Section 6.130 for requirements regarding sewer and water separation.

7A.025 Casing

The casing shall be as follows: one quarter inch steel casing pipe or ductile iron Class 52. Casing spacers are required. A minimum of four sets of spacers are required per 20 feet of pipe. Spacers shall be as manufactured by Uni-Flange®, Calpico Inc. or approved equal (OAE). No more than one inch of clearance is allowed per set of spacers or insulators.

The joints of the transmission pipe within the casing pipe shall be restrained with a Restrained Casing Spacer made by UniFlange®, or if using Calpico Inc. insulators, the pipe joints shall be restrained with a restraint system approved by the Tumwater Public Works Department. Restrained joints shall be required on the transmission line one pipe length past either end of the casing pipe. Additional restraints may be required by the City.

Directional boring or horizontal directional drilling (HDD) is approved for use with high density polyethylene pipe (HDPE) or CertainTeed Certa-Lok C900/RJ Restrained Joint PVC pipe for the installation of sewer pressure mains. The process, alignment, depth and soil type being drilled shall be called out on the plans and approved by the city during design. Under no circumstances shall gravity sewer mains and or gravity sewer services be installed using the directional boring (HDD) method. The process for HDD shall follow the standard 3 step process of: (1) drilling the pilot hole; (2) enlarging the hole, back reaming; (3) pulling through the transmission pipeline. The use of drill fluid such as bentonite or polymer is required. A proper sized hole and ample amount of drill fluid shall be used to prevent damage to the pipe being installed. During the installation of the transmission pipe a second smaller HDPE CL 200 pipe minimum ¾-inch diameter shall be pulled through alongside the transmission pipe. The smaller pipe shall have a standard 12 gauge green coated copper tracer wire pulled through and connected to the tracer wire of the main at each end. Soils that have too many cobbles may not be approved by the City for HDD.

7A.030 Staking

All surveying and staking shall be performed by engineering or surveying firms capable of performing such work. The surveyor directing such work shall be licensed as a Professional Land Surveyor by the State of Washington.

A preconstruction meeting shall be held with the City inspector prior to commencing staking. All construction staking shall be inspected by the City prior to construction.

The minimum staking of sewer lines shall be as directed by the City Engineer or as follows:

- A. Stake location of mainline pipe and laterals every 50 feet with cut or fill to

invert of pipe.

- B. Stake location of all manholes for alignment and grade with cut or fill to rim and invert of pipes.

7A.040 Trench Excavation

See Section 6.160 for requirements regarding trench excavation.

7A.050 Backfilling

See Section 6.170 for requirements regarding backfilling.

7A.060 Street Patching and Restoration

See Section 4B.170 and 4B.180 for requirements regarding street patching and trench restoration.

7A.070 Testing

Prior to acceptance and approval of construction, the following tests shall apply to each type of construction.

A. Gravity Sewer

1. Prior to acceptance of the project, the gravity sewer pipe shall be subject to a low pressure air test per WSDOT/APWA Specifications. The contractor shall furnish all equipment and personnel for conducting the test under the observation of the City inspector. The testing equipment shall be subject to the approval of the City.

The contractor shall make an air test for his own purposes prior to notifying the City to witness the test. Any failed test witnessed by the City Inspector shall be retested and a re-inspection fee as adopted by the City Council shall be assessed. The acceptance air test shall be made after the trench is backfilled and compacted and the roadway section is completed to subgrade.

The air test shall be performed immediately following the pipe cleaning.

2. Testing of the sewer main shall include a television inspection by the contractor. The camera shall be equipped with a rotating head to allow televising of the side sewers as mainline inspection is occurring. The camera unit shall be equipped with a measuring device that is in plain view ahead of the camera. The device shall be 1 inch in diameter and on a flexible shaft. Television inspection shall be done after the WSDOT air test # 7-17.3(2) F has passed and before the roadway is paved. Prior to a

television inspection, enough water shall be run down the line so it comes out the lower manhole. A copy of the video tape and written report shall be submitted to the City. Acceptance of the line will be made after the tape has been reviewed and approved by the Inspector. Any tap to an existing system needs to be televised as well. Televising shall start at the closest manhole to the tap and extend 15 feet beyond the tap.

3. A vacuum test of all manholes is required prior to acceptance. The structure will be tested in accordance with ASTM-C 1244-93. This test method covers procedures for testing cast in place or precast concrete manhole sections using the vacuum test method to demonstrate the integrity of the installed materials and the construction procedures.

Testing will be done in the following manner:

- a. All lift holes and pipes entering into the manhole will be plugged, taking care to securely brace each plug from being drawn into the structure.
- b. The test head will be placed at the top portion of the structure in accordance with the manufacturers' recommendations.
- c. A vacuum of 10 inches of mercury will be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. With the valves closed, the time will be measured for the vacuum to drop by 1 inch to 9 inches. The manhole will pass the vacuum test if the time is greater than the time shown in Table 1.
- d. If the manhole fails the initial test, necessary repairs will be made by an approved method. The structure will then be retested until a satisfactory test is obtained.
- e. If the manhole joint is displaced during the vacuum test, the manhole will be disassembled, the seal replaced, the structure reassembled, and retested until compliance is obtained.
- f. Testing can be done either before or after backfill operations around the structure; however, if during backfill operations it is found that the structure has been disturbed and it is suspected that the integrity of the joint has been compromised, retesting will be required.
- g. All other requirements stipulated in Section 7-05 of the latest edition of the *Washington State Department of Transportation's Standard Specifications for Road, Bridge and Municipal Construction* that has been adopted by the City will also be adhered to for final acceptance of the manhole structure.

Table 1 below gives allowable time loss in seconds; i.e., test section is acceptable if vacuum does not drop below 9 inches until after the times shown below have expired.

Table 1: Minimum Test Times for Various Manhole Diameters

Depth (ft)	Diameter in Inches								
	30	33	38	42	48	54	60	66	72
	Time in Seconds								
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	29	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	58	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	67	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

4. A mandrel test in accordance with Section 7-17.3 (2)G of the WSDOT/APWA Standard Specifications shall be required on all sewers except laterals as defined in Section 3.040 of these standards as directed by the City.
5. Anytime that testing reveals problems that lead to repairs by the contractor, the City may require complete retesting of the entire system that was repaired. This work will be required to ensure that the integrity of the system was not compromised during the repair work.

B. Lift Station Pressure Main

1. Prior to acceptance of the project, the pressure line and service lines shall be subjected to a hydrostatic pressure test of 200 psi for 4 hours and any leaks or imperfections developing under said pressure shall be remedied by the contractor. No air will be allowed in the line. The main shall be tested between valves. Insofar as possible, no hydrostatic pressure shall be placed against the opposite side of the valve being tested. The 200 psi pressure test shall be maintained while the entire installation is inspected.

The contractor shall provide all necessary equipment and shall perform all work connected with the tests. Tests shall be made after all connections have been made. This is to include any and all connections as shown on the

plan. The contractor shall have successfully performed all tests to assure that the equipment to be used for the test is adequate and in good operating condition, the pipe is in satisfactory condition, and the air in the line has been released before requesting the City to witness the test.

2. A water test for all wet wells in accordance with the manhole water test for gravity sewer shall be required.
3. A mandrel test in accordance with Section 7-17.3 (2) G of the WSDOT/APWA Standard Specifications shall be required as directed by the City.

C. Community/Grinder Pressure Main System

1. Prior to acceptance of the project the pressure mainline and service lines shall be subject to a hydrostatic pressure test of 200 pounds for 4 hours and any leaks or imperfections developing under said pressure shall be remedied by the contractor. No air will be allowed in the line. The main shall be tested between the valves. Insofar as possible, no hydrostatic pressure shall be placed against the opposite side of the valve being tested. The pressure test shall be maintained while the entire installation is inspected.

The contractor shall provide all necessary equipment and shall perform all work connected with the tests. Tests shall be made after all connections have been made. This is to include any and all connections as shown on the plan. The contractor shall perform all tests to assure that the equipment to be used for the test is adequate and in good operating condition and the air in the line has been released before requesting the City to witness the test.

2. A water test of the septic, community S.T.E.P., or grinder tank at the factory, and on site after installation is required in accordance with the criteria outlined in Chapter 7E.060.
3. For the Community system, electrical inspection and testing of all electrical components of the system is required. All tested parts shall pass before the City accepts the system. Additionally all electrical structures shall have a concrete base or floor. The concrete base or floor shall extend 4 feet to the front and 1 foot on all sides. The generator requires the pad be extended 4 feet beyond where the doors are located.

7A.080 Effluent Spills

All discharges from the sewerage collection system and spills of any type that may affect human health or the environment shall be immediately reported by the City of Tumwater to the LOTT dispatcher at (360) 664-2333 and request that

they notify the Department of Ecology of the spill. Provide as much information as possible and be sure to give a detailed spill location description and the name of a person to contact for information.

A complete report on the nature, cause and extent of the spill and steps taken to clean up the spill and prevent future spills shall be made to the Department of Ecology within 24 hours following the initial spill report call. Fill out all the information on the LOTT Wastewater Management Partnership Spill Incident Report located in Appendix G, contact the LOTT dispatcher again and relay the information within the 24 hour deadline. The local operations staff of Lacey, Olympia, Tumwater and Thurston County are responsible for providing timely and complete spill reports on incidents within their service areas. The LOTT dispatcher will serve only as the central contact point to receive spill reports and relay information to the Department of Ecology. LOTT staff cannot be responsible for the completeness, accuracy or timeliness of the spill reports, beyond relaying the information promptly to the Department of Ecology.

7A.090 Effluent Pretreatment and Treatment

Effluent pretreatment and treatment shall comply with the document titled “LOTT Discharge and Industrial Pretreatment Regulations” as set forth in Tumwater Municipal Code 13.08.065. The purpose and policy to this document is as follows. This document sets forth uniform requirements for direct and indirect contributors into the wastewater collection systems and the Regional Wastewater Treatment Facility for the Cities of Lacey, Olympia and Tumwater and for Thurston County. This adopted document enables Lacey, Olympia, Tumwater and Thurston County to comply with all applicable State and Federal laws required by the Clean Water Act of 1977 and the General Pretreatment Regulations (40 CFR, Part 403). The objectives of this document are as follows:

- To prevent the introduction of pollutants into the municipal wastewater system which will interfere with the operation of the system or contaminate the resulting sludge.
- To prevent the introduction of pollutants into the municipal wastewater system which will pass through the system, inadequately treated, into receiving waters or the atmosphere or otherwise be incompatible with the system.
- To improve the opportunity to recycle and reclaim waste waters and sludge from the system; and
- To provide for equitable distribution of the cost of the municipal wastewater system.

This document provides for the regulation of direct and indirect contributors to

the municipal wastewater system through the issuance of permits to certain non-domestic users and through enforcement of general requirements for the other users; authorizes monitoring and enforcement activities, requires user reporting, assumes that existing customer's capacity will not be preempted, and provides for the setting of fees for the equitable distribution of costs resulting from the program established.

Contact LOTT or Tumwater Public Works for further information or a copy of this document. (Ordinance O2008-008).

7B Gravity Sewer

7B.010 General

All sewers shall be designed as a gravity sewer lines or as outlined in the Tumwater Sanitary Sewer Comprehensive Plan. Gravity sewer will extend from the comprehensive plan main line sewers as far as gravity sewer service will allow.

7B.020 Design Standards

The design of any sewer extension/connection shall conform to City Standards, Department of Ecology's "Criteria for Sewage Works Design", and any applicable standards as set forth herein.

The layout of extensions shall provide for the future continuation of the existing system as determined by the City. See Section 3.190 for utility extension information.

New gravity sewer systems shall be designed on the basis of an average daily per capita flow of sewage of not less than 100 gallons per day. See the following DOE "Criteria for Sewage Works Design", Table 2. This figure is assumed to cover normal infiltration, but an additional allowance shall be made where conditions are unfavorable. Generally, laterals and sub-main sewers should be designed to carry, when running full, not less than 400 gallons daily per capita contributions of sewage. When deviations from the foregoing per capita rates are used, a description of the procedure used for sewer design shall be submitted to the Community Development Department for review and approval by Public Works.

Table 2. Design Basis For New Sewage Works

Discharge Facility	Design Units	Flow* (gpd)	BOD (lb/day)	SS (lb/day)	Flow Duration (hr)
Dwellings	Per person	100	0.2	0.2	24
Schools w/showers and cafeteria	Per person	16	0.04	0.04	8
Schools w/o showers and cafeteria	Per person	10	0.025	0.025	8
Boarding schools	Per person	75	0.2	0.2	16
Motels at 65 gal/person (rooms only)	Per room	130	0.26	0.26	24
Trailer courts at 3 persons per trailer	Per trailer	300	0.6	0.6	24
Restaurants	Per seat	50	0.2	0.2	16
Interstate or through highway restaurants	Per seat	180	0.7	0.7	16
Interstate rest areas	Per person	5	0.01	0.01	24
Service stations	Per vehicle serviced	10	0.01	0.01	16
Factories	Per person per 8-hr. shift	15-35	0.03-0.07	0.03-0.07	Operating Periods
Shopping centers	Per 1,000 sq. ft. of ultimate floor space	200-300	0.01	0.01	12
Hospitals	Per bed	300	0.6	0.6	24
Nursing Homes	Per bed	200	0.3	0.3	24
Homes for the aged	Per bed	100	0.2	0.2	24
Doctor's office in medical center	Per 1,000 sq. ft.	500	0.1	0.1	12
Laundromats, 9 to 12 machines	Per machine	500	0.3	0.3	16
Community colleges	Per student and faculty	15	0.03	0.03	12
Swimming pools	Per swimmer	10	0.001	0.001	12
Theaters, drive-in type	Per car	5	0.01	0.01	4
Theaters, auditorium type	Per seat	5	0.01	0.01	12
Picnic areas	Per person	5	0.01	0.01	12
Resort camps, day & night, w/limited plumbing	Per campsite	50	0.05	0.05	24
Luxury	Per campsite	100	0.1	0.1	24
* Includes normal filtration Taken from: "Criteria for Sewage Works Design" By: State of Washington Department of Ecology, December 1998					

The General Notes below shall be included on any plans dealing with gravity sanitary sewer design.

GENERAL NOTES (SANITARY SEWER MAIN INSTALLATION)

1. All workmanship and materials shall be in accordance with City of Tumwater standards and the most current copy of the State of Washington Standard Specifications for Road, Bridge and Municipal Construction (WSDOT/APWA). In cases of conflict, the most stringent standard shall apply.
2. All safety standards and requirements shall be complied with as set forth by OSHA, WISHA and Washington State Department of Labor and Industries.
3. All approvals and permits required by the City of Tumwater shall be obtained by the contractor prior to the start of construction.
4. If construction is to take place in the County right-of-way, the contractor shall notify the County and obtain all the required approvals and permits
5. A preconstruction meeting shall be held with the City of Tumwater Construction Inspector prior to the start of construction.
6. The City of Tumwater Construction Inspector shall be notified a minimum of 48 hours in advance of a tap connection to an existing main. City crews will provide the tapping machine and will perform the tap. No materials are provided by the City.
7. The contractor shall be fully responsible for the location and protection of all existing utilities. The contractor shall verify all utility locations prior to construction by calling the Underground Locate Line at 1-800-424-5555 a minimum of 48 hours prior to any excavation.
8. Gravity sewer main shall be PVC, ASTM D 3034 SDR 35 or ASTM F 789 with joints and rubber gaskets conforming to ASTM D 3212 and ASTM F 477.
9. Precast manholes shall meet the requirements of ASTM C 478. Manholes shall be Type 1-48" manhole unless otherwise specified on the plans. Joints shall be rubber gasketed conforming to ASTM C 443 and shall be grouted from the inside. Lift holes shall be grouted from the outside and inside of the manhole.
10. Manholes shall be furnished with Pamrex metal frame and cover (OAE) and shall be free of porosity, shrink cavities, cold shuts or cracks, or any surface defects which would impair serviceability. Manhole frame and cover units shall be fitted to assure rattling noise from traffic is prevented. All casting shall be coated with a bituminous coating prior to delivery to the job site. Lock-type covers shall be required in all multi-family complexes, on school

grounds, on manholes containing odor control devices or as determined by the City. The manhole openings shall be centered over the outlet.

11. Side sewer services shall be PVC, ASTM D 3034 SDR 35 with flexible gasketed joints. Side sewer connections shall be made by a tap to an existing main or a wye branch from a new main connected above the spring line of the pipe. When a tap is used to connect to an existing sewer main, televising from the closest manhole to 15 feet past the tap is required.
12. All sewer mains shall be field staked for grades in accordance with Section 7A.030 of the Development Guidelines.
13. All plastic pipe and services shall be installed with continuous tracer tape 12 inches to 18 inches under the proposed finished subgrade. The marker shall be plastic non-biodegradable, metal core or backing, marked "sewer" which can be detected by a standard metal detector. Tape shall be Terra Tape "D" or approved equal. The tape and wire shall be furnished by the contractor.
14. All side sewer locations shall be marked on the face of the curb with an embossed "S" 3 inch high and ¼ inch into concrete.
15. Bedding of the sewer main and compaction of the backfill material shall be required in accordance with the above mentioned specification (See Note 1).
16. A 3' x 3' square x 8" thick concrete pad with #4 rebar shall be installed around all cleanouts that are not in a pavement area.
17. Temporary street patching shall be allowed as approved by the City Engineer. Temporary street patching shall be provided by placement and compaction of one inch minimum asphalt concrete hot mix. Contractor shall be responsible for maintenance as required.
18. Erosion control measures shall be taken by the contractor during construction as per the approved plans, specifications and current City Drainage Manual.
19. The contractor shall be responsible for all traffic control in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) as required. Prior to disruption of any traffic, traffic control plans shall be prepared and submitted to the City for approval. No work shall commence until all approved traffic control is in place.
20. A copy of the approved plans shall be on the construction site whenever construction is in progress.
21. Any changes to the design shall first be reviewed and approved by the project engineer and the City of Tumwater.

22. All lines shall be high velocity cleaned and pressure tested prior to paving in conformance with the above referenced specifications (See Note 1). Hydrant flushing of lines is not an acceptable cleaning method. Testing of the sanitary sewer main shall include videotaping of the main by the contractor. Immediately, prior to the videotaping, enough water shall be run down the line so it comes out the lower manhole. A copy of the video tape shall be submitted to the City of Tumwater. Acceptance of the line will be made after the tape has been reviewed and approved by the City Inspector and the Operations Division. A vacuum test of all manholes in accordance with Tumwater standard is also required. Testing shall take place after all underground utilities are installed and compaction of the roadway subgrade is completed. After the paving and raising of manholes are complete, the Developer shall clean and videotape the sewer conveyance system again at the Developer's expense. The method of cleaning shall be high velocity water pressure cleaning. All rocks and debris shall be removed and disposed of at the Developer's expense. The existing sewer system shall be protected during the cleaning operation to prevent any debris from entering.
23. Contractor's shall be responsible for cleanup of any debris in new or existing manholes and mains associated with the project after the new lines are cleaned as outlined above; existing system shall be protected during cleaning operation. The sewer system shall be televised to assure the system is clean.
24. Prior to backfill, all mains and appurtenances shall be inspected and approved by the City of Tumwater Construction Inspector. Approval shall not relieve the contractor for correction of any deficiencies and/or failures as determined by subsequent testing and inspections. It shall be the contractor's responsibility to notify the City of Tumwater for the required inspections.
25. All sanitary sewer mains shall be placed in public right-of-way or if in easement areas, provide 12 foot wide paved (minimum six inch ballast, two inch crushed, two inch asphalt) access to all manholes. No lot line sewer mains will be allowed.
26. All mains will be dedicated to the City for maintenance with appropriate bills-of-sale and easements.
27. When using steel plates over the trench, "Steel Plates Ahead" signs shall be required.
28. A mandrel test in accordance with Section 7-17.3 (2)G of the WSDOT/APWA Standard Specifications shall be required as directed by the City.
29. Encasement material shall include ¼ inch steel, or ductile iron class 52 pipe. Concrete encasement shall not be allowed.

7B.030 Mainline-Gravity

- A. Size: Sewer mains shall be sized for the ultimate development of the tributary area. Nothing shall preclude the City from requiring the installation of a larger sized main if the City determines a larger size is needed to meet the requirements for future service.

The minimum size for sub-mains and mains shall be 8 inch inside diameter. The minimum size for a lateral shall be 6 inches. See definitions in Section 3.040.

The design is subject to all other design requirements as noted in this Chapter.

- B. Material. Sewer main shall be PVC, ASTM D 3034, SDR 35 or ASTM F 789 with joints and rubber gaskets conforming to ASTM D 3212 and ASTM F 477.
- C. Depth. Gravity sewer will typically have a minimum depth of 7 feet to provide gravity service to adjoining parcels. Actual depth will be determined by slope, flow, velocity, elevation of existing system and according to the City's Sanitary Sewer Comprehensive Plan.
- D. Connections. All building sewer connections to the main shall be made with a sweeping tee connection except when tapping an existing main. All new mains connecting to existing mains shall require the installation of a cast-in-place, saddle manhole if not made at an existing manhole.
- E. The maximum deflection angle through a manhole shall not exceed 90 degrees.

7B.040 Connection to Existing System

When connecting to an existing manhole, the new sewer connection shall be physically plugged until all tests have been completed and the City approves the removal of the plug.

- A. Connection of new pipe lines to existing manholes shall be accomplished by using provided knock-outs with sand collars. Where knock-outs are not available, the manhole shall be core drilled. The transition of connecting channels shall be constructed so as not to interrupt existing flow patterns.
- B. Connection of a pipe line to a system where a manhole is not available shall be accomplished by the use of a saddle type or cast-in-place manhole. This is accomplished by pouring concrete base and setting manhole sections. The existing pipe shall not be cut into until approval is received from the City. (See detail)
- C. Connections to manholes requiring a drop shall follow the criteria as outlined in Section 7B.100.

- D. All multi-family, commercial and industrial sewer lateral connections shall be made at the manhole. A manhole shall be installed for lateral connections if one is not available. All new connections to existing manholes shall be channeled to meet existing flow line.
- E. Taps shall not be allowed to protrude into the existing main. The City shall be notified 48 hours prior to requiring any tap of a City sewer. The mainline at the tap location shall be televised from the nearest manhole a minimum of 15 feet beyond the tap after tapping and prior to approval to insure compliance. Taps shall be Romac's style CB sewer saddle with Ductile+Plus saddle (OAE), stainless steel strap and rubber gasket meeting ASTM D2000 3 BA715 or City approved equal. The manufactured bevel on the pipe to be inserted into the saddle shall be cut off to avoid pushing the pipe into the main.

7B.050 Building Sewer

- A. A building or side sewer refers to the extension from a building's sewer beginning two feet outside the outer foundation wall at the structure to the sanitary sewer main or to a clean-out at the right-of-way line. Building sewers shall be minimum 4-inch diameter; laterals shall be 6-inch. Maintenance of the building sewer is the responsibility of the property owner. Prior to connection of a building sewer to the public sewer a connection permit shall be obtained. In addition, city maintenance personnel are required to inspect any existing laterals that are being tied into. Materials and design criteria for a building sewer are covered by the IBC as adopted by TMC 15.04. Inspection of the building sewer prior to connection is the responsibility of the Building Division of the Community Development Department.
- B. Each separate commercial/industrial building shall have its own separate side sewer connection to a manhole (if a manhole does not exist, one shall be installed), see 7A.015 for more information. Side sewers or laterals for single family residential properties shall not be connected to the system at the manhole. Manhole sizing where side sewers or laterals are connected shall be the same as designated in section 7B.060 of this manual.
- C. Locations of clean-outs for building sewers are governed by the IBC as adopted by TMC 15.04.010. There will be a 6-inch cleanout at the property line for all laterals. Laterals at the property line are typically a minimum of 5-foot deep.

7B.060 Manholes

Precast manholes shall meet the requirements of ASTM C478 with either a precast base or a cast-in-place base made from 3000 psi structural concrete. Manholes shall be Type 1, 48 inch diameter minimum. The minimum clear opening in the

manhole frame shall be 24 inches. Joints shall be rubber gasketed conforming to ASTM C443 and shall be grouted from the inside. Lift holes shall be grouted from the outside and inside of the manhole. Manholes constructed of other materials may be approved by the Director of Public Works, provided they meet the requirements of 2.318 of Department of Ecology's "Criteria for Sewage Works Design". Material specifications need to be submitted for review before an alternate material will be considered. See details.

Eccentric manhole cone shall be offset so as not to be located in the tire track of a traveled lane.

Manhole frames and logo lids shall be Ductile iron casting marked "Sewer" conforming to the requirements of ASTM A30, Class 25, and shall be free of porosity, shrink cavities, cold shuts or cracks, or any surface defects which would impair serviceability. Manhole frame and cover units shall be fitted to assure rattling noise from traffic is prevented. All casting shall be coated with a bituminous coating prior to delivery to the job site.

Repairs of defects by welding or by the use of smooth-on or similar material will not be permitted. Manhole rings and covers shall be machine-finished or ground-on seating surfaces so as to assure non-rocking, self seating (easily removed and replaced without the use of a sledge hammer) fit in any position and interchangeable in other standard manhole frames.

Where lock-type castings are called for, the casting device shall be such that the cover may be readily released from the ring and all movable parts shall be made of non-corrosive materials and otherwise arranged to avoid possible binding. Lock-type covers shall be required in all multi-family complexes, on school grounds, on manholes containing odor control devices and as determined by the City.

Safety steps shall be fabricated of polypropylene conforming to an ASTM D4101 specification, injection molded around a 1/2 inch ASTM A615 grade 60 steel reinforcing bar with anti-slip tread. Steps shall project uniformly from the inside wall of the manhole. Steps shall be installed to form a continuous vertical ladder with rungs equally spaced on 12 inch centers above the outfall channel and pipe.

Gravity sewers shall be designed with straight alignment between manholes. Curved alignment of the sewer will not be permitted.

Manholes shall be provided at a maximum of 300 foot intervals for 8 inch to 10 inch sewers, 400 foot intervals for 12 inch to 15 inch sewers, 500 foot intervals for 18 inch to 30 inch sewers, at intersections, and at changes in direction, grade or pipe size. (See also Section 7B.080.)

Minimum slope through the manhole shall be 1/10th of one foot from invert in to invert out.

The manhole opening shall be centered over the outlet channel.

Manholes placed in high ground water areas shall be coated on the outside.

Manhole Sizing shall be determined by the following criteria:

A. 48" Manhole

1. 2 connecting pipes, 8-inch to 12-inch diameter
2. 3 connecting pipes, 8-inch to 10-inch diameter, perpendicular
3. 4 connecting pipes, 8-inch diameter, perpendicular

B. 54" Manhole

1. 2 connecting pipes, 8-inch to 12-inch with more than 45 degree deflection
2. 3 connecting pipes, 10-inch to 12-inch diameter, perpendicular
3. 4 connecting pipes, 10-inch to 12-inch diameter, perpendicular

C. 72" Manhole

1. 2 connecting pipes, 15-inch to 18-inch diameter with less than 45 degree deflection
2. 3 connecting pipes, 15-inch diameter, perpendicular
3. 4 connecting pipes, 15-inch diameter, perpendicular

In the above criteria "deflection" refers to the angle between any 2 pipe channels in the manhole.

For other pipe configurations, the size of the manhole shall be approved by the City.

The above configurations will provide adequate shelves and room for maintenance and televising mains.

7B.070 Slope

All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second based on Manning's formula using an "n" value of 0.013. Use of other practical "n" values may be permitted by the City if deemed justifiable on the basis of research or field data submitted. The following minimum slopes should be provided, however, slopes greater than these are

desirable.

Sewer Size (Inches)	Minimum % Slope % (Feet per 100')
8	0.40 (0.0040 Ft/Ft)
10	0.28 (0.0028 Ft/Ft)
12	0.22 (0.0022 Ft/Ft)
14	0.17 (0.0017 Ft/Ft)
15	0.15 (0.0015 Ft/Ft)
16	0.14 (0.0014 Ft/Ft)
18	0.12 (0.0012 Ft/Ft)
21	0.10 (0.0010 Ft/Ft)
24	0.08 (0.0008 Ft/Ft)
27	0.07 (0.0007 Ft/Ft)
30	0.06 (0.0006 Ft/Ft)
36	0.05 (0.0005 Ft/Ft)

Sewers shall be laid with uniform slope between manholes.

7B.080 Increasing Size

Manholes shall be provided where pipe size changes occur. The crowns of the pipes shall be at the same elevation.

7B.090 High Velocity Protection

Where velocities greater than 15 feet per second are expected, special provisions such as thrust blocking and restrained piping materials shall be installed to protect against displacement by erosion and shock. Cavitation shall also be a consideration in the engineer's design.

7B.100 Drops

Straight grades between inverts are preferred over drop connections whenever possible when connecting to an existing manhole.

An outside drop connection shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert shall be filleted to prevent solids deposition.

Drop structures shall be constructed per detail.

7B.110 Clean-outs

Clean-outs are not an acceptable substitute for manholes, however, they may be used in lieu of manholes at the end of 8-inch diameter lines of not more than 150 feet in length. A manhole shall be installed in those cases where the 8-inch line is anticipated to be extended in the future.

All cleanouts in the City rights-of-way or easements shall be extended to grade. A 3-foot square by 8-inch thick concrete pad with #4 rebar shall be installed around all cleanouts that are not in a pavement area. See clean-out detail.

7C Lift/Pump Stations

7C.010 General

The need for a sewage pump station/lift station, hereinafter referred to as "station, pump station or lift station", as identified in the Wastewater Comprehensive Plan or necessary for a development as determined by the City, shall be presented by the Developer in a design report. If the City determines the area cannot be served by gravity service and is sized at 50 homes or more or in a gravity basin, the Developer shall provide information and design the station to comply with the following minimum standards.

7C.020 Design Report

If a station is determined to be necessary, the Developer shall perform a study prepared and stamped by a Professional Engineer licensed in the State of Washington, to determine that the station installation is sized to serve the overall sewage flows generated within the potential service area. The service area study shall include the Developer’s plat boundary area and shall include adjacent and future service areas as determined by the City. The final service area shall be the entire area which could be served by the installation of the station(s).

The design of any station shall conform to City of Tumwater standards, Department of Ecology’s “Criteria for Sewage Works Design” and applicable standards as set forth in herein and in sections 3.010, 3.060 and 7A.010.

The station’s design flow capacity shall be based on an average daily per capita flow with related peaking factors and inflow/infiltration allowances.

Documentation of present and future service area flow rates for station size and capacity determination shall be included in the report.

The effects of the minimum flow conditions shall be estimated to ensure that retention of the sewage in the wet well will not create a nuisance and that pumping equipment operation will be optimized. The wet well shall be sized to

provide full submergence on the pumps as recommended by the pump manufacturer and a minimum of four (4) minutes between pump cycles at pump design capacity. Cycle times shall be calculated from the top of the pump housing (pump off point) to a point six inches below the invert of the outlet of the last manhole. The design shall provide for a minimum distance between the lowest inlet elevation and the top of the pump motor to provide for proper programming of pump intervals (lead and lag).

The station shall be sized to meet the maximum rate of flow expected. The size of the receiving sewer shall also match the flow expected. A minimum of two (2) pumping units shall be provided at each lift station installation. The pumps shall have sufficient capacity and capability to efficiently handle the peak design flow with 1 pump out of service.

The pressure main shall be sized for a minimum velocity of 2 feet per second and a maximum velocity of 8 feet per second. The minimum inside diameter of the pressure main shall be 4 inches.

Four copies of the Design Report shall be submitted to the City for review. As a minimum, the report shall include:

1. Project description.
2. Projected flows; initial and full buildout including velocity calculations.
3. Connection point with downstream capacity.
4. Wet well sizing and buoyancy calculations.
5. Run time calculation and cycle time; initial and full buildout.
6. Pump station head calculation and system curve.
7. Pump selection and wet well details.
8. Pressure main size, length and material (see section 7D Pressure Sewer).
9. For pressure mains greater than 1,100 feet in length, a transient analysis shall be completed and any identified wastewater hammer conditions shall be mitigated.
10. Electrical requirements and Generator sizing.
11. Pump station voltage (confirmed by Puget Sound Energy).
12. Odor and corrosion calculations.

Information prepared by an engineering firm with experience in hydrogen sulfide formation and remediation shall be provided for the following:

- A. Collection system to the lift station.
- B. Pump station wet well.
- C. Pressure main.
- D. Downstream gravity system.
- E. A statement that odors will not be detected at the station site or at the point of release, or the Developer will provide odor control and corrosion reduction at the appropriate locations in accordance with current City of Tumwater odor and corrosion control methods. See also Section 7D.080.

13. Geotechnical analysis for wet well and station site; including seasonal and historical maximum groundwater elevations.
14. Backfill and compaction specifications.
15. Address storm water from the station site.
16. Preliminary site plan layout.

7C.030 Design Drawings

The drawings shall be prepared by a Professional Engineer licensed in the State of Washington to 1:10 scale to show details of the site.

AutoCAD electronic files of the City Standard Lift Station details and electrical wiring diagrams are available. The Developer's Engineer shall customize the drawings and review all dimensions to ensure the City's lift station layout can be accommodated as per the detail.

The detailed engineering drawings shall accurately depict the equipment selected by the Engineer. The drawings shall include an equipment list showing manufacturer, model number, and size or capacity for all structures and mechanical and electrical components.

The Developer shall furnish a site layout for the lift station installation per details. Minimum setbacks shall be included as depicted on the site layout details.

The lift station shall be located as far as practicable from present and/or proposed residential areas. Sites shall be of sufficient size for access, maintenance and future expansion or addition, if applicable. The entire site shall be at a maximum slope of 2%.

Lift station sites together with access to the site shall be deeded to the City. Sites for lift stations shall not count toward open space requirements.

As a minimum, the following shall be provided on the plans for construction:

1. Complete lift station.
2. Auxiliary power.
3. Electrical wiring diagrams.
4. Telemetry compatible with existing system, including complete start up and revising existing screens at Tumwater Operation Center.
5. A ¾" water meter with RPBA and wash-down hydrant.
6. Odor control, as applicable for location and capacity.
7. Site soil conditions. Excavation, select backfill and compaction requirements as determined by a geotechnical engineer.
8. Cuts and fills to provide level site for maintenance.
9. Asphalt, concrete pavement for access as directed by the City.

10. Concrete within the maintenance area.
11. Landscaping per City of Tumwater development criteria.
12. Eight-foot high vinyl black chain link fence with tension wire on top rail, three strand barbed wire and a bottom bar enclosing the site. Provide black privacy slats and a sixteen-foot wide lockable access roll gate. Set fence 3-inches from the edge of the concrete slab. The equipment within the fenced area shall not be located within 10 feet of the fence.
13. Sign with lift station identification number and street address (to be paid for and installed by the developer).
14. Site lighting.
15. All site enclosures such as the NEMA cabinet, generator, etc., shall be keyed the same.
16. The plans shall include an adequate distance between the last manhole and the wet well to accommodate the approach pipe design per the detail.

7C.040 Submittals

At the time construction plans are submitted for approval, the following information shall be provided:

1. Pump Data
 - Size and type
 - Pump curves
 - Velocity; initial and full buildout
 - Pump volute and impeller coating submittal
 - Weight
 - Head and flow capacity
 - Manufacturer/distributor
2. Motor Data
 - Size and type
 - Service factor
 - Cycle length; initial and full buildout
 - Voltage
 - Manufacturer/distributor
 - Horsepower
 - Motor insulation
 - Full load amps
 - Frame and type of mount
3. Controls
 - Timers and relay mounting
 - Phase monitor
 - Thermal magnetic circuit breaker
 - Indicating lights, switches, resets
 - Telemetry failure points
 - Elapsed time meters and event counters
 - Component manufacturer/distributor
 - Motor starter size
 - NEMA type enclosure
 - GFI outlet
 - Level controller
 - Current transformers
 - Amp meters
4. Telemetry
 - Alarm system (shall be compatible with City system)
 - Lift station radio communication path terrain analysis certified by Accu-Com Inc.

5. Auxiliary Power
 - Diesel generator
 - Automatic Transfer switch
 - Fuel storage tank
 - Battery charger and engine heater

6. Maintenance
 - Warranty
 - Tools and equipment required
 - Staff training upon completion

7. Electrical Service
 - Specifications (service size, voltage, motor size, enclosure type, etc.)
 - Source of power
 - Single line diagram
 - Service entrance
 - Mechanical equipment power Requirements
 - Control diagrams & schematics
 - Calculations
 - Primary distribution equipment
 - Branch circuiting
 - Shop drawings
 - Schedules of fixtures, panel boards & switch gear

8. Lighting
 - Exterior lighting

9. Wet Well
 - Size
 - Access hatch
 - Penetration seals
 - Fiberglass grating with type 316 stainless steel hardware
 - Corrosion protection, material, application, warranty
 - Storage capacity
 - Locking mechanism
 - Safety entry equipment
 - Safety rail system
 - Manufacturer specifications

10. Valve Housing
 - Size
 - Onan

11. Piping
 - Size and material
 - Flow meter
 - Pipe supports
 - Corrosion protection, material, application, warranty
 - Valves
 - Bypass pumping fittings

12. Testing Plan
 - Factory test
 - Pressure test
 - Operational test & start up.
 - Startup & training

The design drawings may be used to provide the information required in the Items above. Design drawings shall be reviewed and verified for completeness and compliance by the Design Engineer prior to submittal to the City.

The City's review does not relieve the Engineer and/or Developer of the responsibility for constructing a lift station that is trouble free and suitable for its

purpose.

As-built drawings, warranties, manufacturer's specifications, electrical plans and operation and maintenance manuals shall be provided for all equipment.

The general notes for gravity sewer and pressure sewer construction found in Sections 7B and 7D of this chapter shall accompany the following Lift Station General Notes on the plans.

GENERAL NOTES (LIFT STATION INSTALLATION)

1. All workmanship, materials and testing shall be in accordance with the most current WSDOT/APWA Standard Specifications for Road, Bridge and Municipal Construction, National Electrical Code, City of Tumwater Development Guide and Public Works Standards unless otherwise specified below. In cases of conflict the most stringent standard shall apply. When the most stringent standard is not clear, the City Engineer will make the determination. The Developer shall obtain all required permits.
2. Any changes to the lift station design shall first be reviewed and approved by the design engineer and the City of Tumwater.
3. Contractors shall be responsible for cleanup of any debris in the wet well, tanks, vaults and site associated with the project prior to start up.
4. Prior to backfill, all mains, tanks, wet well and vaults shall be inspected and approved by the City of Tumwater Construction Inspector. Approval shall not relieve the contractor for correction of any deficiencies and/or failures as determined by subsequent testing and inspections. It shall be the contractor's responsibility to contact City of Tumwater to request the required inspections.
5. The Developer shall coordinate power service with PSE and make arrangements for the service connection.
6. All pipe and fittings in the wet well shall be minimum ductile iron class 52 and shall be epoxy coated or polyethylene lined to a minimum of 10 mils thick on the inside and outside with a coating approved for constant contact with H₂S (hydrogen sulfide). Coatings shall be applied according to the manufacturers' requirements by a certified applicator of the product. Coatings shall not be applied to pipe, fittings or valves in the field. All bolts, fasteners, brackets and hardware in the wet well shall be 316 stainless steel.
7. Prior to testing and start-up of the lift station, three (3) copies of the Operation and Maintenance Manual, together with the number of approved copies required by the Developer, shall be submitted to the City for review and approval. The lift station information checklist found in Section 7C.090 shall be filled out by the developer and included on the face of the engineering drawings and in the Operation and Maintenance manual.
8. The Developer, at its own expense, shall arrange for authorized factory-trained representatives of the company or companies supplying the various items of equipment to check the installation, and adjust and test the equipment furnished before the acceptance of the work by the City. The factory representative shall be responsible to check and resolve any unacceptable vibration of the pump assemblies. Furthermore, the Developer's

representative(s) shall assist and instruct the City's operating staff in adjusting and operating the equipment during the initial start-up period. Said representatives shall be experienced and knowledgeable of the equipment being tested.

9. An instruction program shall be held for City personnel at the Developer's expense. Developer shall furnish the services of qualified instructors from the various equipment manufacturers. Program shall cover basic system operation theory, routine maintenance and repair, and "hands on" operation of equipment. Training shall not proceed until all operation maintenance manuals are complete and accepted by the City.
10. Developer is responsible to construct and start up a complete and trouble-free system. All design errors and/or construction defects discovered during start up or the warranty period stated in the agreement with the City shall be corrected at the Developer's expense. The City will not accept any facility until successful full operation of all components has been demonstrated. The Developer shall conduct a pre-start up without city staff to verify proper operation of all lift station components prior to scheduling a start up with City of Tumwater staff.
11. Developer shall lubricate all equipment as required by the part or component manufacturer.
12. Wet well shall have a safety grate and rail system installed, per Section 7C.050, under hatch opening prior to start up and acceptance.
13. Lift station and generator, site, driveway, access, concrete areas, lighting and water service shall all be completed prior to start up request and inspection.
14. Generator and fuel storage tank shall be mounted on concrete pad. The fuel tank shall be full of fuel at the time of startup. Generator shall have weather proof, sound dampening enclosure; block heater; battery charger; auto exerciser; radiator louvers and shall comply with all requirements in Section 7C.070.
15. Telemetry set up, including revision of telemetry computer monitors at the Maintenance Service Center, shall be coordinated with TSI Inc. Set up shall be completed prior to start up request and acceptance.
16. Spare parts shall be provided for the station at time of startup acceptance.
 - One set of mechanical seals.
 - One set of O-rings.
 - One spare impeller.
 - One set of pump wear rings.

Additionally, any special tools specific to the pump manufacturer shall be provided to the City of Tumwater at start up.

17. Pump data plate information or duplicate pump data plates shall be provided to the City of Tumwater at the time of startup acceptance. Contractor shall be required to pull pumps out of wet well for inspection at time of startup if required by City of Tumwater staff.
18. The developer shall provide test data from a state Department of Health certified backflow assembly tester for all backflow devices on site prior to the start up.
19. A geotechnical analysis shall be performed for the wet well and lift station site by a licensed geotechnical engineer. The analysis shall include: soil compaction, testing methodology, recommended suitable backfill material, and compaction techniques. A compaction report shall be provided to the City inspector.
20. Check valves shall be sewer rated, bronze on bronze style seat with outside lever and spring. Valves shall be epoxy coated on both the inside and outside a minimum of 10 mils thick with a coating approved for constant contact with H₂S (hydrogen sulfide). Check valves shall be ordered and installed in the housing as one right hand and one left hand model with the outside levers furthest away from each other (outside of piping configuration). The valve housing emergency by-pass pumping connections shall be 6 inch aluminum female cam lock style fittings. Fittings shall have an aluminum male plug installed. Cam lock fittings shall face "UP" as shown on detail 7-17 and clearly visible and accessible for connection with 6 inch bypass hose from above.
21. The pump volute and impellers shall be coated with Metalclad Ceramally CP+AC manufactured by ENECON Corporation (OAE).
22. The discharge pressure main shall be equipped with a magnetic flow meter and remote transmitter. A bypass shall be provided for the meter maintenance.
23. Air release valves shall be provided on each pressure line between the pumps and the check valve.

7C.050 Lift/Pump Station

The Lift Station shall be submersible style with non-clog pumps mounted in the wet well, and shall meet all of the criteria outlined in Section 7C.

Requirements:

Furnish and install submersible non-clog wastewater pumps. Each pump shall be equipped with ____ HP, submersible electric motor, connected for operation on ____ volts, 3-phase, 60 hertz, with a minimum of 30 feet of submersible cable (SUBCAB) (OAE) suitable for submersible pump application. The power cable shall be sized according to NEC and ICEA standards and also meet with U.L. and C.S.A. P-MSHA approval. The pump shall be supplied with a mating iron ____ inch discharge connection and be capable of delivering ____ GPM at ____ TDH. Shut off head shall be ____ feet (minimum).

Pump Design:

The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined watertight contact or interface with a diaphragm, O-ring, or profile gasket.

Pump Construction:

Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be ANSI Type 316 stainless steel construction. All metal surfaces coming into contact with the sewage, other than stainless steel shall be protected by a factory applied spray coating of high solids poly-amide epoxy free of any chips, cracks, voids or imperfections.

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

Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

Cable Entry Seal:

The cable entry seal designs shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Hydromatic epoxy barrier style seals shall also be acceptable.

Motor:

The pump motor shall be explosion proof, induction type with a squirrel-cage rotor, shell type design, housed in an oil or air-filled, watertight chamber, NEMA B type. The stator windings and stator leads shall be insulated with moisture resistant, Class F, insulation rated for 155°C (311°F). The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted or mechanically fastened into the stator housing. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of ten (10) to fifteen (15) evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 140°C (250°F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber shall be hermetically sealed from the motor by an elastomer O-ring seal. Connection between the cable conductors and stator leads shall be made with threaded compression type connectors. The motor and pump shall be designed and assembled by the same manufacturer.

The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10% ($\pm 10\%$). The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C (176°F).

A performance chart shall be provided showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

The power cable shall be sized according to the NEC and ICEA standards and shall be U.L. and C.S.A. approved and of sufficient length to reach the

control panel without the need of any splices. The outer jacket of the cable shall be opened and sealed around the individual conductors in the seal-off cabinet. The cable shall be water and oil resistant chloroprene rubber and shall not be cut, stripped or opened in any way prior to entering the seal-off cabinet at the landing point. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of sixty-five (65) feet.

The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shutoff through run-out. The most efficient pump curve for the design criteria shall be utilized as approved by the City.

Pumps, one horsepower or less, shall be 115/230 VAC single phase 60 Hz. Pumps above three and one-half horsepower, shall be no less than 120/208 VAC three phase. Pumps, five horsepower and greater, shall be no less than 277/480 VAC three phase.

Bearings:

The pump shaft shall rotate on two bearings. Motor bearings shall be permanently oil or grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a single or two-row angular contact bearing to compensate for axial thrust and radial forces. Single-row lower bearings are not acceptable.

Mechanical:

Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in an oil reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit located between the pump and the oil chamber, shall contain one stationary ceramic and one positively driven rotating silicon carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub is not acceptable. For special applications, other seal face materials shall be available.

The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring action between the upper and lower seal faces.

Cartridge type systems shall be acceptable. No system requiring a pressure

differential to offset pressure and to affect sealing shall be used. Pumps requiring use of proprietary seals shall not be allowed.

Each pump shall be provided with an oil chamber for the shaft sealing system. The oil chamber shall be designed to prevent overfilling and to provide oil expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication.

The motor shall be able to operate in a dry wet well without damage while pumping under load.

Pump Shaft:

Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The minimum pump shaft requirement shall be AISI type 416F stainless steel.

Impeller:

At the minimum, impellers shall be stainless steel or ductile iron ASTM A-536, dynamically balanced, coated with Metalclad Ceramally CP+AC manufactured by ENECON Corporation, double shrouded non-clogging design having a long through-let without turns. The impellers shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Whenever possible, a full vaned or vortex impeller shall be used for maximum hydraulic efficiency; thus, reducing operating costs. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. The impellers shall be keyed to the shaft, and retained with an Allen head bolt. Impeller wear rings shall be replaceable 304 stainless steel.

Wear Rings:

A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a replaceable 410 stainless steel wear ring insert fitted to the volute inlet.

Volute:

The minimum pump volute material shall be single-piece gray cast iron, ASTM A-48 Class 30, coated with Metalclad Ceramally CP+AC manufactured by ENECON Corporation, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller.

Protection:

All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 120°C (250°F) the thermal switches shall open, stop the motor and activate the alarm.

A leakage sensor shall be provided to detect water in the stator chamber as per the Approved Electrical Materials List. Either a Float/Seal Leakage Sensor (FLS) small float switch used to detect the presence of water in the stator chamber, or resistance-type shall be acceptable. When activated, the FLS shall stop the motor and send an alarm, both local and remote. Use of voltage sensitive solid state sensors and trip temperature above 120°C (250°F) shall not be allowed.

The thermal switches and FLS shall be connected to appropriate relays in the control panel.

Miscellaneous:

The pump guide rails shall be metal to metal M-T-M style with two inch (2") diameter minimum, 316 stainless steel pipe.

All brackets and mounting hardware shall be 316 stainless steel construction.

Each pump shall be fitted with a 316 stainless lifting bracket large enough to be easily attached to with a crane lifting hook without manned entry into the wet well. Attached lifting chains shall not be allowed.

The following spare parts shall be provided:

1. One set of mechanical seals
2. One set of O-rings
3. One set of wear rings
4. One spare impeller coated with Metalclad Ceramally CP+AC manufactured by ENECON Corporation.

Wet Well, Valve Housing, Piping, Fittings and Valves:

The wet well shall be a pre-cast manhole meeting the requirements of ASTM C478 with a flat top cover and aluminum access hatch designed for H-20 loading. The wet well opening shall be fitted with a City approved Ultra GuardRail safety rail system, see detail. Wet well hatch shall be fitted with Flygt Safe Hatch (OAE). The valve housing shall be ONAN or City of Tumwater (OAE). The wet well shall be a minimum of six feet in diameter. Lift stations with Miltronics level controls shall have a minimum eight foot diameter wet well. A larger diameter wet well may be required upon review by the City. The wet well bottom shall have a manufactured hopper bottom that directs sewer toward the pumps, see detail.

The wet well shall be core drilled for all conduit and pipe penetrations. Link-seal shall be used around all pipe and conduit penetrations to the wet well. After Link-seal has been installed the openings shall be sealed on both the inside and outside with non-shrink grout. Inside the wet well the non-shrink grout material shall be mixed with or covered with the high grade calcium aluminate (Sewper coat) wet well coating material.

The wet well shall be designed for the soil conditions on the site including soil bearing conditions and ground water levels. Ladder rungs shall not extend below the high water level line.

Aluminum access hatches shall be hinged, spring-assisted hatches designed for H-20 loading. The hatches for the pump station shall be the size recommended by the pump manufacturer.

As determined by the City during the civil plan review, the inlet of the last manhole prior to the wet well shall be equipped with a sluice gate. The sluice gate and appurtenances shall be fabricated of stainless steel. See detail.

Wet Well Coating:

The wet well coating material shall be ISO 9000 certified high grade calcium aluminate, Kerneos Sewper Coat HS 2000 (OAE).

The inside and the outside of the wet well shall be coated.

The product shall be installed in accordance with the manufacturer's instructions by a factory certified applicator.

The wet well shall be thoroughly pressure washed using a minimum of 3,000 psi in preparation for the application to remove any dirt, debris or loose material.

The sprayed-on material shall be applied to completely and uniformly cover the wet well concrete floor, walls and underside of lid a minimum of one (1) inch in thickness. Finished surface shall be smooth.

All manhole joints and pipe penetrations shall be watertight to prevent infiltration or ex-filtration prior to application of the product.

Any drilling, cutting or fabricating done in the wet well that breaks or disturbs the newly applied coating shall be repaired with the same high grade calcium aluminate coating in accordance with the manufacturer's instructions.

All pipe and fittings in the wet well shall be minimum ductile iron class 52 and shall be epoxy coated or polyethylene lined to a minimum of 10 mils thick

on the inside and outside with a coating approved for constant contact with H₂S (hydrogen sulfide). Coatings shall be applied according to the manufacturers' requirements by a certified applicator of the product. Coatings shall not be applied to pipe, fittings or valves in the field. All bolts, fasteners, brackets and hardware in the wet well shall be 316 stainless steel.

All pipe, fittings and valves in the valve housing shall be ductile iron class 52 and shall be epoxy coated or polyethylene lined to a minimum of 10 mils thick on the inside only with a coating approved for constant contact with H₂S (hydrogen sulfide). Coatings shall be applied according to the manufacturers' requirements by a certified applicator of the product. Coatings shall not be applied to pipe, fittings or valves in the field. The outside of the pipe, fittings and valves in the housing shall be painted with a minimum of 2 coats green high grade enamel after all components in the housing have been assembled.

An additional option for piping in the wet well and valve housing shall be fused or welded HDPE meeting ASTM standard D 3350, SDR 11 3408.

Isolation valves in the valve housing shall be sewer rated plug or knife gate valves. Valves shall be epoxy coated on both the inside and outside a minimum of 10 mils thick with a coating approved for constant contact with H₂S (hydrogen sulfide). 4 inch and 6 inch valves shall have standard 2 inch hub with 10 position operating lever. Valves sized 8 inch and larger shall have gear reduction operation and hand wheels.

Check valves shall be sewer rated, bronze on bronze style seat with outside lever and spring. Valves shall be epoxy coated on both the inside and outside a minimum of 10 mils thick with a coating approved for constant contact with H₂S (hydrogen sulfide). Check valves shall be ordered and installed in the housing as one right hand and one left hand model with the outside levers furthest away from each other (outside of piping configuration).

The valve housing emergency by-pass pumping connections shall be 6 inch aluminum female cam lock style fittings. Fittings shall have an aluminum male plug installed. Cam lock fittings shall face "UP", see detail, and clearly visible and accessible for connection with 6 inch by-pass hose from above.

7C.060 Electrical

General:

Definition of all terms, etc., shall be according to AIA and IEEE standard definitions. Shop drawings shall be submitted during design review on all special equipment, and approval obtained before manufacture. Drawings shall be diagrammatic; locations of all outlets will be checked and verified on project site.

Where conflict occurs with other equipment, consult City for final decision. The engineer is responsible for obtaining rough-in dimensions from supplier for equipment.

All work shall be done per National Electrical Code as amended by WAC. 296-46 and City of Tumwater Standards. The most stringent standard shall apply. The Developer shall obtain all permits and arrange inspections.

The Developer shall coordinate power service with PSE and make arrangements for power service connection.

The pump control and electrical equipment shall be factory manufactured and field installed. It shall be fabricated and assembled by an approved U.L. 508 listed manufacturer.

All electrical equipment within the wet well shall be rated in accordance with the National Fire Protection Agency (NFPA).

Pump Station Telemetry & Controls:

Multiple pump control function: Each pump shall operate in an alternating configuration providing rest for the last lead pump. Each pump shall be provided with a HAND-OFF-AUTO (HOA) selector switch which shall control the pump as follows:

1. Hand Position: When the HOA switch is placed in the HAND position, the pump shall immediately start and run until HOA switch is placed in the OFF position. Pumps shall not be controlled by level sensors when the HOA switch is in the HAND position.
2. OFF Position: When the HOA switch is placed in the OFF position, the pumps shall immediately stop, except when the high water alarm has been tripped.
3. AUTO Position: When the HOA switch is placed in the AUTO position, the pumps shall start and stop automatically in response to the water level and in the sequence determined by the controller. One pump shall start as the lead pump when the water level rises above the Lead Pump-On level. The pump shall run continuously until the water level decreases to the Pump-Off level. When both pumps are called to run, the lag pump will be set to shut off at a point 10% before to the lead pump shut off.

Pump Running Indication: Provide indicating lights (green) that shall indicate the pump running condition. The light shall glow steadily when pump is running and shall be turned off whenever the pump is not running.

Alarms: Alarms shall be reported locally at the control panel Human

Machine Interface (HMI). In the event of an alarm, individual indicating alarm lights on the pump control panel shall be lit to pinpoint the specific trouble. The alarm contact wiring shall be complete to the telemetry box as per Technical Systems Incorporated (TSI) instructions for landing.

The schematic and line diagrams shall show the following telemetry points, if applicable, and a common termination point shall be provided in the lift station to interface between the lift station and the Remote Telemetry Unit (RTU). The telemetry points shall consist of the following:

The controller shall be wired using the following address:

Standard Lift Station	Community S.T.E.P. Lift Station	PLC Input Address
High Water Level	High Water Level	I:0/0
	High Septic Level	I:0/1
Intrusion	Intrusion	I:0/2
Control Volt Fail	Control Voltage Failure	I:0/4
High Water Reset	High Water Reset	I:0/5
	High Septic Reset	I:0/6
Generator Run	Generator Run	I:0/7
Generator Fail	Generator Fail	I:0/8
Water Level	Water Level	I:1/0
Force Main Pressure	Force Main Pressure	I:1/1
Force Main Flow	Force Main Flow	I:1/2
Pump 1 Auto	Pump 1 Auto	I:2/0
Pump 1 Hand	Pump 1 Hand	I:2/1
Pump1 Overload	Pump1 Overload	I:2/2
Pump 1 Seal Fail	Pump 1 Overcurrent	I:2/3
Pump 1 Overtemp		I:2/4
Pump 1 Run-CV SW		I:2/5
Pump 1 Fail Reset	Pump 1 Fail Reset	I:2/6
Pump 1 Jog	Pump 1 Jog	I:2/7
Pump 2 Auto	Pump 2 Auto	I:2/8
Pump 2 Hand	Pump 2 Hand	I:2/9
Pump 2 Overload	Pump 2 Overload	I:2/10
Pump 2 Seal Fail	Pump 2 Overcurrent	I:2/11
Pump 2 Overtemp		I:2/12
Pump 2 Run-CV SW		I:2/13
Pump 2 Fail Reset	Pump 2 Fail Reset	I:2/14
Pump 2 Jog	Pump 2 Jog	I:2/15
Pump 3 Auto	Pump 3 Auto	I:3/0

Pump 3 Hand	Pump 3 Hand	I:3/1
Pump 3 Overload	Pump 3 Overload	I:3/2
Pump 3 Seal Fail	Pump 3 Overcurrent	I:3/3
Pump 3 Overtemp		I:3/4
Pump 3 Run-CV SW		I:3/5
Pump 3 Fail Reset	Pump 3 Fail Reset	I:3/6
Pump 3 Jog	Pump 3 Jog	I:3/7
Pump 4 Auto	Pump 4 Auto	I:3/8
Pump 4 Hand	Pump 4 Hand	I:3/9
Pump 4 Overload	Pump 4 Overload	I:3/10
Pump 4 Seal Fail	Pump 4 Overcurrent	I:3/11
Pump 4 Overtemp		I:3/12
Pump 4 Run-CV SW		I:3/13
Pump 4 Fail Reset	Pump 4 Fail Reset	I:3/14
Pump 4 Jog	Pump 4 Jog	I:3/15

Control Panels shall be UL listed and shall have the following minimum features:

1. Enclosure (cabinet) shall be stainless steel NEMA 3R construction. Cabinet shall be UL approved and labeled accordingly.
2. Intrinsically safe barriers for liquid level sensor circuits within hazardous areas.
3. A short circuit study and Arc-Flash calculations shall be completed. Pertinent Arc-Flash labels shall be applied within the cabinet per OSHA WISHA standards.
4. Indicating light units shall be oil-tight sealed type. Units shall use a full voltage LED lamp and shall be illuminated push-button type with the push-button wired for both the push-to-test function and the reset function as indicated. Lens caps for lights shall be colored as specified in the applicable wiring diagram.
5. Elapsed time meters shall have a 5-digit non-reset register with the last digit indicating tenths of an hour. Lag pump counter shall be a 5 digit resettable meter.
6. Control relays shall be hermetically sealed, industrial grade rated for 600 Volts AC. Contacts shall be silver alloy. Parts shall be corrosion-resistant or treated in an approved manner to resist corrosion. Selector switches shall be 3-position maintained type meeting NEMA Type 13 requirements. Legend plate shall be marked HAND-OFF-AUTO. Each pump power supply wiring shall be equipped with a magnetic circuit breaker within the pump control

panel equipped with a lockable actuator accessible from outside of the control panel.

7. A control power transformer is required for all 277/480 systems. The primary of the transformer shall be protected with the appropriate size circuit breaker and the secondary shall be connected to the load center main breaker only. The transformer shall have 7.5 KVA minimum capacity sized to supply 125% of the total control, heating, lighting, and other miscellaneous 120 VAC loads.
8. Panel wiring shall be Stranded Type MTW rated 90°C with a minimum size of No. 14 AWG. Compression or ring tongue type lugs shall be used for transformers. Wires crossing hinges shall be installed in a manner to prevent chaffing. Plastic wire gutters and nylon cable wrap and wires shall be used to guide and train the wire as necessary.
9. Radio communication and data transfer between lift station and the operations center SCADA system shall be fully operational prior to station acceptance. The contractor or developer shall provide services by Technical Services Inc. (TSI) to have the SCADA screens programmed to the City's specifications to accommodate the new lift station.
10. Main power service disconnect shall be mounted on the outside of the control cabinet. The main circuit breaker and transfer switch shall be mounted inside the enclosure.
11. Radio mast and weather head for telemetry shall be mounted per detail. All mounting hardware shall be 316 stainless steel.
12. Electrical control cabinet shall be wired and supplied with a "Pendant Station" for remote operation of the pumps. Pendant shall be Woodhead model 4052 for two pump systems, Woodhead model 4023 for three pump systems, and Woodhead model 4024 for four pump systems.

High Level Sensors: Level sensors shall be a float switch type utilizing a mercury switch mounted in a chemical resistant casing suspended on its own cable. If the sensor comes in contact with the rising liquid level, the sensor shall tilt and cause the internal mercury switch to close its contact. The sensor shall stay tilted until the liquid level decreases below the sensor. The level sensor shall be designed for intrinsically-safe low power applications. The cable shall be 45 feet long. Sensor shall be provided for high level alarm.

The following list of approved materials shall be shown on the plans and include brand name, model and part numbers.

**CITY OF TUMWATER LIFT STATION
APPROVED ELECTRICAL MATERIALS LIST:**

Wiring / Instrumentation / Controls:

- A. Conduit and fittings - Underground or entering wet well, vaults and cabinets shall be PVC coated rigid steel R.M.C. with polyethylene inner coat.
- B. Supports and mounting brackets - Shall be 12 gauge, 1-5/8 inch, stainless steel or Perma-Green III coated Unistrut channels with stainless steel clamps, nuts, bolts, and mounting hardware.
- C. Control Panel Wire - #14 AWG minimum, stranded copper MTW only.
- D. Enclosure – Stainless Steel NEMA 3R with rain gutter and weather tight seal, standard Burgess Lock #A136 and double entry doors. Minimum cabinet size 72 inch with 12 inch high stainless steel floor stands. Cabinet shall display a permanent mounted identification tag with model, serial number; make manufacturer information and UL electrical fabrication shop information.
- E. Enclosure heater – Hoffman # DAH2002A or properly sized for cabinet, 208/240 VAC.
- F. Enclosure Fan and inlet air filter – Hammond DNMF100AC115, Hoffman A4AXFNPG, ISC-080PFFP-126, or approved equal, or larger sized according to the cabinet. Shroud assembly Hammond XPFA120 or Hoffman AFLTR4LD, or approved equal.
- G. Enclosure Thermostat – Hammond SKT 011419NO.
- H. Enclosure light - Hoffman # ALF16M24R.
- I. Area Light – Lithonia Lighting Model # KAD-100S-R4-120SP-D04 on 12' pole.
- J. Pump control panel – Hammond Eclipse Series or Hoffman CDS Series enclosure, or Orenco duplex community systems shall use standard Orenco large fiberglass control panel box. The door openings shall be coordinated between the separate internal enclosures to avoid interfering with the door openings.
- K. Load center and housing – Cutler Hammer 12 circuit.
- L. Intrusion switch – Cutler Hammer or Square D.
- M. Timers – Crouzet Chronos OUR1 – 120VAC.

- N. Control relays – IDEC RH-B-UL, coil voltage as required.
- O. Intrinsic safe barriers – Turck IM1-22Ex-R DIN rail style mounted intrinsically safe relay barrier. Turck IM31-22Ex-I DIN rail style mounted intrinsically safe analog barrier. 2 inch minimum separation between intrinsically safe wiring and other wiring. All analog wiring shall be shielded twisted pair.
- P. Phase monitor – Crouzet F-W series 120/208 volt part # 84873010; 277/480 volt part # 84873015.
- Q. Transient voltage surge suppressor – GE 9L15ECC001 for 3 phase applications, GE 9L15FCB001 for 120/240 applications.
- R. Indicator lights – Idec HW Series, 22mm, 120VAC LED, push to test. Color as indicated on wiring diagram.
- S. Fuses & holder– Bussmann fuses. Fuse holders with blown fuse indicator light, Bussmann or Idec.
- T. Motor Starters – Sprecher Schuh CA7 series across the line starters, Sprecher Schuh soft starters required for applications using pump motors greater than 20 HP.
- U. Motor Overloads - Sprecher Schuh CEP7 series equipped with CEP7-ERR reset modules. Soft starters shall be equipped with electronic overload protection that can be reset remotely through the designated 120 VAC PLC output addresses. Automatic reset overload protection is not acceptable.
- V. Motor Circuit Breaker – Cutler Hammer HMCPE (Size) R3C with Cutler Hammer EHMVD(length)R lockable operator. Size breaker for motor service factor current draw. Operator shall be on outside of Motor Control Panel door, length is enclosure dependent.
- W. Selector Switches – Sprecher Schuh, Idec HW series, Square-D, or Cutler Hammer, Class 9001, Type TL3, 22 mm.
- X. Float Switch – Rotofloat, mercury style.
- Y. Limit Switches – GO Switch model #11-11120-00 or Cutler Hammer part # E50BLL16P; adjustable arm part # E50KL538.
- Z. Thermal Magnetic Circuit Breakers – Sprecher Schuh, Square D or Cutler Hammer.

- AA. Control Circuit Breakers – Cutler Hammer WMS Series or Square D class 9080 GCB.
- BB. Automatic Transfer Switch – ASCO 300 rated at 125% full load minimum.
- CC. Manual transfer switch – Cutler Hammer or Square D, knife style.
- DD. Generator Plug – Appleton ADR1044RS 250VDC 600VAC.
- EE. Elapsed Time Meter – ATC 800-3-0101 or Yokogawa 240211AAAB, 5 digit non resettable, last digit indicating tenths of an hour.
- FF. Event Counter – ATC or Kessler Ellis, non-resettable.
- GG. Lag Pump Counter – ATC or Kessler Ellis, resettable.
- HH. Ammeters – Yokogawa or ATC, transformer type. Size to read not more than 80% of full scale at full load amp draw.
- II. GFCI Receptacle – Leviton 20A - 120V with weatherproof cover.
- JJ. Level Controller – Siemens Milltronics Hydroranger 200 with hand held programmer and Siemens Echomax XPS-15 level transducer (no splice allowed in cable). The alarm relay sequence is: relay 1 high wet well, relay 2 low level. Provide analog signal to PLC through shielded twisted pair cable. The location of the transducer head shall not be in conflict with pump removal, piping, or components inside the wet well.
- KK. Level Sensor (community STEP systems) – Esterline KPSI 705T14C0A005 with series 815 aneroid bellows vent. No splice in cable allowed between wet well and vent.
- LL. Panel Meter – Red Lion PAXP000 with SFCRUSB1 interface and PAXCDL10 analog output card. All analog signal wire shall be shielded twisted pair, ground shield in control panel.
- MM. Strain Relief Cord Grips – Max-Loc Cord Grip with Plastic Mesh, Type 3R. Manufacturer: Woodhead L.P. Part # 55xxNM (xx = cable size range).
- NN. Uninterruptable power supply – APC or Sola, 650 VA minimum, heavy duty type. Panel mount on controls enclosure backplane.
- OO. Control Power Transformers – Cutler Hammer or Sola, minimum 7.5 KVA or larger sized accordingly, heavy duty.
- PP. Power supply – SOLA SDN9-12-100P. Mount inside pump control panel.

- QQ. Terminal blocks – Sprecher Schuh V7 Series or Entrelec M 4/6 5116
- RR. Pendant station – Woodhead 4052 for 2 pump systems, Woodhead 4023 for 3 pump systems, or Woodhead 4024 for 4 pump systems.
- SS. Plastic wiring duct – Pendant.
- TT. Programmable logic controller – Allen Bradley MicroLogix 1100 P/N 1763-L16DWD base unit.
- UU. PLC input/output expansion cards – Allen Bradley 1762-IF4 analog input, 1762-IQ16 digital input (12 VDC), and 1762-OW16 discreet output.
- VV. HMI Screen – Allen Bradley 2711P-K6C1A PanelView Plus 600 or Red Lion G308A.
- WW. Force Main Pressure Transmitter – Foxboro IGP10-AD1D1F with PSTAD-25USSS2SBS1 NPT seal and flush port, Sea-Port Technical Controls SO 1471880.
- XX. Flow transmitter – Element: Foxboro 9100A. Shall be designed for wastewater, be elastomer lined, and have SS sensors. Transmitter: Foxboro IMT 25.
- YY. Padlocks – BestLock 11-B772 with MA cores. Minimum 6 required, additional locks may be required depending on site layout and security requirements.

Radio Telemetry:

- A. UHF radio – DataRadio Integra – TR wireless modem Part No. 242-4048-510, 9600 KBPS, 2W, 450-470 MHZ 12.5 KHZ Bandwidth, 12 VDC Powered.
- B. UHF antenna – Antenex Y4506, Yagi; 10.2 dB gain 450-470 MHZ.
- C. Lighting Arrestor - Poly Phaser IS-B50LN-C2, -N-Type Fittings 125-1000 MHZ, 125 W. Connect directly to earth ground rod system with #8 AWG or larger Cu wire.

All penetrations made to enclosures, panels, breaker boxes, cabinets, etc. shall be made with water tight fittings such as PVC coated Myers Hub type.

7C.070 Auxiliary Power System

General:

Diesel emergency power generation equipment designed with capacity and rating to safely carry the entire connected lift station load shall be provided at the lift station site and will operate the lift station in the event of a power

outage. The Developer shall provide the City of Tumwater the design load calculations during the submittal process.

The auxiliary power unit shall include, but not be limited to, the following:

1. Generator, control panel and circuit breaker.
2. Engine, radiator and exhaust system.
3. Fuel tank (capacity for 24 hours full load, plus 25%).
4. Locking generator enclosure, keyed with standard City of Tumwater cabinet key for all cabinets.
5. Automatic transfer switch.
6. Radiator protection (as approved by the City) or automatic louvers.
7. Block heater connected to L.S. power supply and not generator.
8. Battery and rack.
9. Battery charger connected to L.S. power supply and not generator.
10. Conduit, wire and piping.
11. Coolant recovery system.

The generator set and transfer switch shall be Cummins/Onan, Katolite, Kohler, or City approved equal complying with the latest edition of Onan Corporation standard specifications and with the City standards.

The generator set shall include the following:

Engine:

- Single phase, 1500 watt coolant heater manufactured by KIM – hot shot 115 volt or 240 volt sized accordingly for the engine and climate conditions.

Generator Set:

- Mainline circuit breaker.
- Weather-protective/sound dampening enclosure with mounted silencer (maximum noise level of 64 dBA at 23 feet).
- 5-year basic power warranty.

Accessories:

- Batteries.
- Vibration Isolators, Pad Type.
- Battery Charger, 2 AMP, 12 VDC, 120 VAC Input. Shall maintain a float charge.

Control Panel:

- Annunciator relays (12).
- Run relay package (3).
- Low coolant level shutdown.
- Anti-condensation space heater, 120 VAC.
- Oil temperature gauge.
- Emergency stop switch.

Fuel System:

- Diesel.

Alternator:

- Anti-condensation heater, 120 VAC.

Exhaust System:

- Exhaust silencer (64dBA AT 23 feet).

Control Features:

- Run-stop-remote switch.
- Coolant temperature gauge.
- DC voltmeter.
- Lamp test switch.
- Fault reset switch.
- 12-light engine monitor with individual 1/2 amp relay signals and a common alarm contact for each of the following conditions:
 - Run (Green Light).
 - Pre-Warning for low oil pressure (Yellow Light).
 - Pre-Warning for high coolant temp (Yellow Light).
 - Low oil pressure shutdown (Red Light).
 - High coolant temperature shutdown (Red Light).
 - Over crank shutdown (Red Light).
 - Over speed shutdown (Red Light).
 - Switch off (Flashing Red Light - indicates generator set not in automatic start mode).
 - Low coolant temperature (Yellow Light).
 - Low fuel (Yellow Light).
- Two customer selected faults (Red Light).
- All lights shall be L.E.D.
- Remote starting, 12-volt, 2-wire.
- Field circuit breaker.
- Running time meter.
- Oil pressure gauge.
- Cycle cranking.

AC Meter Package:

Order with NFPA 110 monitor to meet code requirements.

- AC voltmeter (dual range).
- AC ammeter (dual range).
- Voltmeter/ammeter phase selector switch with an off position.
- Dual scale frequency meter/tachometer.
- AC rheostat (panel mounted) for +5% voltage adjust.

The transfer switch shall include the following:

- Sized for full station and auxiliary equipment load, plus 25%.

Pole Configuration:

- Poles - 3 (Solid Neutral).

Frequency:

- 60 Hertz.

Application:

- Application - Utility to Genset.

System Operation:

- Single-phase 3 wire or three-phase, 4-wire wye, voltage to match utility power supply.

Enclosure:

- B002 Type 3R; Intended for outdoor use (dust proof and rainproof); shall have radiator grill protection or automatic louver system (as approved by the City).

Listing:

- Listing - UL 1008.

Programmed Transition:

- Program Transition - 1-60 sec.

Exerciser Clock:

- 7-day solid-state exerciser clock.

Application Modules:

- Monitor - Phase Sequence/Balance.

Suitable guards shall be provided on all electrical parts to minimize the personal shock hazard.

Generator shall be broken-in sufficiently to permit application of full load immediately upon installation.

Generator supplier shall provide all tools for the generator set as recommended and required by the manufacturer.

Generator installation shall be checked by the supplier after installation to determine that the installation is correct. Written confirmation shall be provided to the City. Generator supplier shall perform a full load test for two (2) hours after installation is complete. Results from the start up load tests and generator checklists shall be provided to the City.

Generator supplier shall provide a minimum of four (4) hours of training for City personnel at the station site during start-up.

Generator manufacturer shall provide three (3) copies of the maintenance and operation manual. These manuals shall be complete and shall include all information necessary to all City personnel to maintain the generator.

The Developer shall provide the following spare parts for the generator: one complete replacement set, combustion air filters, two complete replacement sets, lube oil filters, two complete replacement sets, fuel filter (if required), two complete replacement sets, collant filters (if required), one complete replacement set, all V-belts, one complete replacement set, special tools for engine or generator.

Generator and fuel tank mounting pad shall be per the manufacturer's requirements.

7C.080 Odor Control

Odor control shall be provided at the lift station and/or at the pressure main discharge manhole as determined by the Developer's Professional Engineer and as required by the City; refer to Section 7D.080 for pressure main termination and odor control requirements.

7C.081 Lift Station Safety/Security

Prior to acceptance of the lift station along with the lift station signage, the developer shall be invoiced for six (6) Best Lock 11-B772 with cores. Additional locks may be required depending on site layout and security requirements.

7C.090 Lift Station Inspection Checklist

The lift station inspection checklist on the following pages will be used by the City when doing a final inspection of a lift station. Additional items may be added depending on the type and style of station constructed. This list is provided to help the contractor prepare for the final inspection.

LIFT STATION INSPECTION CHECKLIST

Inspectors: _____ Date: _____

Name of Lift Station: _____

Location: _____

Address: _____

Assigned Lift Station Number: _____ Residential / Commercial / Combo

Type of Pump(s) and Quantity (Submersible), (Dry Well/Wet Well), (Step Submersible)

Type: _____ Quantity: _____

Nameplate Data:

<p>Motor(s) Manufacturer: _____ Model #: _____ Serial #: _____ Voltage/Phase: _____ Horsepower: _____ RPM: _____</p>	<p>Pump(s) Manufacturer: _____ Model #: _____ Serial #: _____ Capacity (GPM): _____ TDH (ft): _____ RPM: _____</p>
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Motor Nameplate Amps: #1 _____ #2 _____ #3 _____ #4 _____

Motor Nameplate SF Amps: #1 _____ #2 _____ #3 _____ #4 _____

Comments: _____

Auxiliary Generator Nameplate Info:

Generator	Engine	Transfer	Switch
Manufacturer: _____	_____	_____	_____
Model: _____	_____	_____	_____
Serial: _____	_____	_____	_____
Voltage/Phase: _____	Spec/CPL#: _____	_____	Voltage/Phase: _____
Size (KW): _____	Fuel Type: _____	Auto: _____	Manual: _____
Phase: _____	Water Cooled: _____	APU Plug: _____	_____
Main Breaker Size: _____	Block Heater: _____	Battery Charger: _____	_____
Auxiliary Generator Operation OK	Yes / No	_____	_____
Transfer Switch Operation OK	Yes / No	_____	_____
Generator Condition OK	Yes / No	_____	_____
Generator Voltage Taken at Terminal Block:	L1 _____	L2 _____	L3 _____

Comments: _____

RP Backflow Device Information:

Manufacturer: _____
Model #: _____
Serial #: _____
Size: _____
Date Inspected: _____
Pass/Fail: _____
Inspected By: _____

Pressure Transducer Info:

Manufacturer: _____
Model #: _____
Serial #: _____
Size: _____
Type: _____
Pressure Gages: _____ Yes / No
of Pressure Gages: _____

Comments: _____

Wet Well Information:

Diameter: _____ Gallons Per Inch: _____
Rim Elevation: _____
Influent I.E.: _____
Bottom I.E.: _____
Influent Pipe Size: _____

Force main Piping:

Diameter: _____
Discharge Elevation: _____
Pipe Length: _____
Type: _____

Wet Well:

Corrosive Resistant Coating Yes / No
Wet Well Hatch & Latch Yes / No
Wet Well Safety Grate Yes / No
Wet Well Safety Railings Yes / No
Debris in Wet Well Yes / No
Infiltration Points Yes / No
Wet Well Ladder Yes / No (Ladder Not To Extend Below High Water Level)
Wet Well Piping Proper Size Yes / No
Piping Epoxy Coated Yes / No

Flow Meter: Yes / No

Manufacturer: _____
Model #: _____
Serial #: _____
Size: _____
Type: _____

Wet Well Mechanical Components Installed: Yes / No
Wet Well (Nuts, Bolts, & Anchors to Spec, Grade (316S.S) and in place) Yes / No
Wet Well Surcharging Upstream Yes / No
Fall Protection Railings: (Installed around Hatch) Yes / No
Motor Leads / Float cord Grips: (Installed & Meet spec.) Yes / No
(Woodhead Max- Log Cord Grip with Plastic Mesh)

Debris Tank:

Debris Tank Size: _____ Gallons.
Risers installed and sealed: Yes / No _____

Lids Install and Screwed in Place No Cracks: Yes / No _____
 Bio Tubes: (Installed and Removable) Yes / No _____
 Sanitary Tees Installed and Functional: Yes / No _____
 External J Box: (Operation Ok) Yes / No _____
 Septic Float: (Installed & Set, Splice Ok) Yes / No _____
 Fall Protection Railings or Grates in Place: Yes / No _____

Comments: _____

Odor Control:

Product Tank: (Installed & sized correctly) Yes / No _____ Tank Size: _____
 Control Cabinet: (Installed & Wired Correctly) Yes / No _____
 Pumps & Bellows: (Installed & Sized Correctly) Yes / No _____
 Calibration Cylinder and Valves: (Installed) Yes / No _____
 Y-Strainer: (Installed and Sized Correctly) Yes / No _____
 (Injection in Force main not Wet Well:) Yes / No _____

Comments: _____

Check Valve Housing:

Operation of Hatch & Latch Yes / No _____
 Isolation Valves Operation Ok Yes / No _____
 Vault Drain/Sump/Clean Yes / No _____
 Isolation Valves Handles Ok Yes / No _____
 Isolation Valves Operation Ok Yes / No _____
 Check Valve Operation Yes / No _____
 Emergency Bypass Operation Yes / No _____
 Check Valve Limit Switches Yes / No _____
 Limit Switches: (Operational Ok) Yes / No _____

Comments: _____

Station Control:

Type: Floats: Yes /No _____ Number of Floats: _____
 Milltronics: Yes / No _____ XPS-15 Ultrasonic Transducer Yes / No _____
 Pulsar: Yes / No _____ Black Box Ultrasonic 130D Yes / No _____
 Red Lion PM Yes / No _____ Submersible Transducer: Yes / No _____

Level Settings:

Set to Engineers Spec.: Yes / No _____
Relay # 1 High Water Alarm: _____ : ft/in. / High Water Off: _____ : ft/in
Relay # 2 Lag Counter: _____ : ft/in. / Lag Counter Off: _____ : ft/in
Relay # 3 Lag Pump On _____ : ft/in. / Lag Pump Off: _____ : ft/in
Relay # 4 Lead Pump On _____ : ft/in. / Lead Pump Off: _____ : ft/in
Relay # 5 Low Level On _____ : ft/in. / Low Level Off: _____ : ft/in
Empty Distance to Transducer: _____ : ft/in. / Wet Well Depth: _____ : ft/in

Comments: _____

Electrical / Controls:

Electrical Service Size: _____ Main Breaker Size: _____
Panel Size: _____ Voltage: _____
Phase: _____

Voltage Taken @ Terminal Blocks: L1 _____ L2 _____ L3 _____
Control Panel Appropriate UL Labels: Yes / No _____
Control Panel Lighting: Yes / No _____
Wiring Schematics for Correlation: Yes / No _____
Legend Plates / Labels: Yes / No _____
Wire Gauge Correct/ Color: Yes / No _____
Raceways & Electrical Conduits for Defects (Ok): Yes / No _____
Terminal Blocks: (Ok for Size and Type) Yes / No _____
All Wires: (Connected & Grounding Ok): Yes / No _____
Panel Wiring: (Labeled and Identified) Yes / No _____
Panel Lights: (Operation Ok / Push to Test) Yes / No _____
HOA (Operation Ok) Yes / No _____
Ammeters: (Installed & Sized Correctly) Yes / No _____
Phase Monitor: (Operation & Set Correctly) Yes / No _____
UPS: (Connected and Operational) Yes / No _____
Power Supplies: (Connected and Operational) Yes / No _____
Transformers: (Sized and Fused Correctly) Yes / No _____
Load Center: (Sized and Labeled Correctly) Yes / No _____
Electrical Cabinet Heater: (Operation Ok) Yes / No _____
Electrical Cabinet Fan & T-Stat: (Operation Ok) Yes / No _____
Disconnect: (Operation Ok) Yes / No _____
Proper Sized Circuit Breakers & Fuses: Yes / No _____
Electrical Control Devices Sized for Motors: Yes / No _____
Overload Devices, Trip Test & Manual Reset: Yes / No _____
Hour Meter Readings: (Operation Ok) Yes / No _____
Pump#1 _____ Pump#2 _____ Pump#3 _____ Pump#4 _____
Event Counter Readings: (Operation Ok) Yes / No _____
Pump#1 _____ Pump#2 _____ Pump#3 _____ Pump#4 _____

Lag Counter: (Operation Ok & Resettable) Yes / No _____
 Pendant Station: (Installed & Operation Ok) Yes / No _____
 All Equipment UL Listed & to City of Lacey spec. Yes / No _____

Comments: _____

Telemetry / SCADA / Alarm Functions:

Antenna: (Installed & Sealed / Aimed at Repeater) Yes/No: _____

(Operation Ok) At Site:

(Operation Ok) At Shop:

Communications: (OK)	Yes / No: _____	Yes / No: _____
RTU Power Fail:	Yes / No: _____	Yes / No: _____
High Wet Well:	Yes / No: _____	Yes / No: _____
Low Wet Well:	Yes / No: _____	Yes / No: _____
Intrusion:	Yes / No: _____	Yes / No: _____
Phase Lose/C-volt Fail:	Yes /No: _____	Yes / No: _____
Pump#1 Run:	Yes / No: _____	Yes / No: _____
Pump#1 Fail:	Yes / No: _____	Yes / No: _____
Pump#1 Motor Over/Temp:	Yes / No: _____	Yes / No: _____
Pump#1 Soft Starter Fail:	Yes / No: _____	Yes / No: _____
Pump#1 Seal Fail Alarm:	Yes / No: _____	Yes / No: _____
Pump#2 Run:	Yes / No: _____	Yes / No: _____
Pump#2 Fail:	Yes / No: _____	Yes / No: _____
Pump#2 Motor Over/Temp:	Yes / No: _____	Yes / No: _____
Pump#2 Soft Starter Fail:	Yes / No: _____	Yes / No: _____
Pump#2 Seal Fail Alarm:	Yes / No: _____	Yes / No: _____
Pump#3 Run:	Yes / No: _____	Yes / No: _____
Pump#3 Fail:	Yes / No: _____	Yes / No: _____
Pump#3 Motor Over/Temp:	Yes / No: _____	Yes / No: _____
Pump#3 Soft Starter Fail:	Yes / No: _____	Yes / No: _____
Pump#3 Seal Fail Alarm:	Yes / No: _____	Yes / No: _____
Pump#4 Run:	Yes / No: _____	Yes / No: _____
Pump#4 Fail:	Yes / No: _____	Yes / No: _____
Pump#4 Motor Over/Temp:	Yes / No: _____	Yes / No: _____
Pump#4 Soft Starter Fail:	Yes / No: _____	Yes / No: _____
Pump#4 Seal Fail Alarm:	Yes / No: _____	Yes / No: _____
Generator Run:	Yes / No: _____	Yes / No: _____
Generator Fail:	Yes / No: _____	Yes / No: _____
Septic High Level:	Yes / No: _____	Yes / No: _____
Control Override:	Yes / No: _____	Yes / No: _____
Flood Alarm:	Yes / No: _____	Yes / No: _____
Smoke Alarm:	Yes / No: _____	Yes / No: _____

Analog Signals:

Wet Well Level: Yes / No: _____ Yes / No: _____
L.S Station Flow: Yes / No: _____ Yes / No: _____
L.S Station PSI: Yes / No: _____ Yes / No: _____
Water System PSI: Yes / No: _____ Yes / No: _____

Comments: _____

Pump/Motor/Operation & Performance Test:

Note: Check that motors are not exceeding their nameplate amperage multiplied by the motor service factor, (i.e., with FLA = 10 and SF = 1.15, the amperage recorded should not exceed 11.5 amps). The motor will operate satisfactorily under the following conditions of voltage and frequency variation, but not necessarily in accordance with the standards established for operation under rated conditions.

- The voltage variation may not exceed 10% above or below rating specified on the motor nameplate.
- The frequency variation may not exceed 5% above or below motor nameplate.
- The sum of the voltage and frequency variations may not exceed 10% above or below motor nameplate rating, provided the frequency variation does not exceed 5%.

Pump #1 Running Amps: L1 _____ L2 _____ L3 _____
Pump #2 Running Amps: L1 _____ L2 _____ L3 _____
Pump #3 Running Amps: L1 _____ L2 _____ L3 _____
Pump #4 Running Amps: L1 _____ L2 _____ L3 _____

Pump Performance during Startup: (In Gallons per Minute) TDH: _____
Pump#1 _____ Pump#2 _____ Pump#3 _____ Pump#4 _____
Pumps# 1&2&3&4: (Running Together) _____ GPM

OPERATION OKAY

Yes No

Unusual Noise or Vibration #1 Pump or Motor: _____

Comments: _____

Unusual Noise or Vibration #2 Pump or Motor: _____

Comments: _____

Unusual Noise or Vibration #3 Pump or Motor: _____

Comments: _____

Unusual Noise or Vibration #4 Pump or Motor: _____

Comments: _____

Proper Pump Rotation: _____

Comments: _____

Sealed Bearings: _____

Comments: _____

Pump Alternator Operation: _____

Comments: _____

Comments: _____

Site Layout & O/M Manuals / Spare Parts:

OPERATION OKAY

Yes

No

2 inch Wash down hydrant and RPBA: _____

Comments: _____

Locks: (Developer Invoiced -Six Locks) _____

Comments: _____

Site lighting: _____

Comments: _____

Fence (7' high) and gate Area: (Min: 15 foot Gate) _____

Comments: _____

Driveway / Access: _____

Comment: _____

Site Paving & Site Rock: (Done to Spec) _____

Comments: _____

O & M Manuals: (3 copies each) _____

Lift Station: _____

Comments: _____

Generator: _____

Comments: _____

Spare Parts Received:

Generator:	Yes	No	Pump:	Yes	No
Filters:	_____	_____	Mechanical seals	_____	_____
Belts:	_____	_____	O-Rings:	_____	_____
Hoses:	_____	_____	Wear Rings:	_____	_____
Spare Pump and Motor:				_____	_____
Keys Received:				_____	_____
Warranty:				_____	_____

Comments: _____

Other Comments: _____

Inspectors Signature of Acceptance:

Project Inspector: _____ Date: _____

Shop Operations: _____ Date: _____

7D Pressure Sewer (Pressure Main)

7D.010 General

Low pressure systems, such as grinder, may be considered for situations where conditions make gravity sewer impractical. Lift station pressure mains will also fall under these same design criteria.

7D.020 Design Standards

The design of any sewer extension/ connection shall conform to City standards, Department of Ecology's "Criteria for Sewage Works Design", and any applicable standards as set forth herein and in Sections 3.010, 3.060, and 7A.010.

The layout of extensions shall provide for the future continuation of the existing system as determined by the City. See Chapter 3 for utility extension information.

The system shall be designed at full depth of flow on the basis of an average daily per capita flow as shown on the table (DOE Criteria for Sewage Works Design) in Section 7B.020. A friction factor of 0.013 shall be used for Manning's "n" value.

New sewer systems shall be designed by methods in conjunction with the basis of per capita flow rates. Methods shall include the use of peaking factors for the contributing area, allowances for future commercial and industrial areas, and modification of per capita flow rates based on specific data. Documentation of the alternative method used shall be provided along with plans.

Grinder mains shall be schedule 80 PVC pipe sized for the basin area. Minimum pressure sewer (pressure main) pipe size for lift stations shall be 4" diameter.

The applicable General Notes in Section 7B.020 shall be included on any plans dealing with pressure sanitary sewer design.

GENERAL NOTES (PRESSURE SEWER MAIN INSTALLATION)

1. All workmanship and materials shall be in accordance with City of Tumwater standards and the most current copy of the *State of Washington Standard Specifications for Road, Bridge and Municipal Construction* (WSDOT/APWA). In cases of conflict, the most stringent standard shall apply.
2. All safety standards and requirements shall be complied with as set forth by OSHA, WISHA and Washington State Department of Labor and Industries.
3. All approvals and permits required by the City of Tumwater shall be obtained by the contractor prior to the start of construction.
4. If construction is to take place in the County right-of-way, the contractor shall notify the County and obtain all the required approvals and permits.
5. A pre-construction meeting shall be held with the City of Tumwater Construction Inspector prior to the start of construction.
6. The City of Tumwater Construction Inspector shall be notified a minimum of 48 hours in advance of a tap connection to an existing main.
7. Any changes to the design shall first be reviewed and approved by the project engineer and the City of Tumwater.
8. The contractor shall be responsible for all traffic control in accordance with the WSDOT/APWA *Standard Plans for Road, Bridge and Municipal Construction* (all applicable "K" plans) and/or the *Manual on Uniform Traffic Control Devices* (MUTCD). Prior to disruption of any traffic, traffic control plans shall be prepared and submitted to the City for approval. No work shall commence until all approved traffic control is in place.
9. The contractor shall be fully responsible for the location and protection of all existing utilities. The contractor shall verify all utility locations prior to construction by calling the Underground Locate Line at 1-800-424-5555 a minimum of 48 hours prior to any excavation.
10. All sewer mains shall be field staked for grades and alignment in accordance with Section 7A.030 of the Development Guidelines.
11. All side sewer locations shall be marked on the face of the curb with an embossed "S" 3 inch high and 1/4 inch into concrete.
12. Bedding of the pressure sewer main and compaction of the backfill material shall be required. Bedding material shall be clean 5/8" minus sand/gravel mixture free from organic matter. (See detail).

13. A 3 foot square x 8 inch thick concrete pad with #4 rebar shall be installed around all valves that are not in a pavement area.
14. Temporary street patching shall be allowed for as approved by the City Inspector. Temporary street patching shall be provided by placement and compaction of 1 inch minimum asphalt concrete hot mix. Contractor shall be responsible for maintenance as required.
15. Erosion control measures shall be taken by the contractor during construction per the approved plans, specifications and current City Drainage Manual.
16. All buried power for grinder systems shall be installed with continuous tracer tape installed 12 inches above the buried power. The marker shall be plastic non-biodegradable, metal core backing marked "power". Tape shall be furnished by contractor.
17. Pressure mains less than 4 inches in diameter shall be Schedule 80 PVC, ASTM D1784, with rubber gasket joints. Pressure mains 4 inches in diameter or greater shall be HDPE SDR 11 or PVC C-900 class 200. Certain-Teed Certa-Lok C-900 R/J pipe is approved for use where restrained joints are required. Welded Poly (HDPE) pipe shall be high density ASTM D 3350, SDR 11 3408 socket welded or butt fusion welded. HDPE pipe shall be sized by inside diameter. Fittings and valves shall comply with Chapter 7 of the Development Guide. Piping for sewer lines shall be green, white or black. HDPE sewer pipe shall have a green stripe manufactured on the pipe.
18. Grinder service line from main connection to service ball valve shall be 1 ¼ inch diameter schedule 80 PVC. HDPE pipe shall be high density ASTM D 3350, SDR 11 3408 socket or butt fusion welded.
19. All plastic pipe and services shall be installed with continuous tracer tape installed 12 inches to 18 inches under the proposed finished sub grade. The marker shall be plastic non-biodegradable, metal core or backing marked sewer which can be detected by a standard metal detector. In addition, pressure mains shall be installed with 12 gauge direct bury, U.S.E. green coated copper wire wrapped around all plastic pipe, brought up and tied off at valve body. Continuity testing of the wire will be done by the City. Tape shall be Terra Tape "D" or approved equal. The tape and wire shall be furnished by the contractor.
20. Prior to acceptance of the project the pressure mainline and service lines shall be subject to a hydrostatic pressure test of 225 pounds for 15 minutes and any leaks or imperfections developing under said pressure shall be remedied by the contractor. No air will be allowed in the line. The main shall be tested between valves. Insofar as possible, no hydrostatic pressure shall be placed against the opposite side of the valve being tested. The pressure test shall be maintained while the entire installation is inspected. In addition, all pressure mains shall be pigged in the presence of the City Inspector prior to placing main in service.

21. Prior to backfill, all mains and appurtenances shall be inspected and approved by the City of Tumwater Construction Inspector. Approval shall not relieve the contractor for correction of any deficiencies and/or failures as determined by subsequent testing and inspections. It shall be the contractor's responsibility to notify the City of Tumwater for the required inspections.

7D.030 Grinder/Lift Station Pressure Main

- A. Material: Pressure mains less than 4 inches in diameter shall be HDPE SDR 11 or Schedule 80 PVC, ASTM D1784, with rubber gasket joints. Pressure mains 4 inches in diameter or greater shall be HDPE SDR 11 or PVC C-900 class 200. Certain-Teed Certa-Lok C-900 R/J pipe is approved for use where restrained joints are required. Welded Poly (HDPE) pipe shall be high density ASTM D 3350, SDR 11 3408 socket welded or butt fusion welded. HDPE pipe shall be sized by inside pipe diameter. Fittings and valves shall comply with section 7E.040 of the Development Guidelines. Piping for sewer lines shall be green, white or black. HDPE sewer pipe shall have a green stripe manufactured on the pipe. For 14 to 24 inch mains, pipe shall be AWWA PVC C905 Class 235 or HDPE SDR 11 with ductile iron fittings and gasket joints. A more rigid pipe may be required where unlimited trench widths occur. All ductile iron fittings shall be either epoxy coated or PE lined both inside and outside. The coating material shall be designed for use with corrosive materials. The use of ductile iron pipe will be limited to the lift station site only. Ductile iron pipe will not be used downstream of the lift station check valve vault.

- B. Depth: Pressure mains shall have a minimum 72 inches of cover to top of pipe. This minimum assumes 42 inches cover to a 12 inch diameter water pipe and 18 inches separation from the bottom of water pipe to the top of the sewer line. See Chapter 6 for sanitary sewer/water main crossing requirements.

- C. Lift Station Pressure Main Velocity: The minimum velocity allowed is 2 feet per second (fps) at average Dry Weather Flow. 2 fps is required to maintain solids in suspension although 3 fps is desired to scour settled solids. Maximum velocity allowed shall be 8 fps.

- D. Welded Poly Pipe: Welded poly pipe shall be high density ASTM D 3350, SDR 11 3408 socket welded or butt fusion welded. Welded poly pipe shall be allowed for pressure sewer sizes 2" through 24". HDPE sewer pipe shall have a green stripe manufactured on the pipe. Butt fuse welded pipe shall be de-beaded on the inside of each weld. HDPE pipe that is directionally bored underground or under the road shall have a locating wire installed with the pipe.

7D.035 Connections to Grinder Pressure Mains.

Connection to existing grinder pressure main shall be done with stainless steel tapping saddle and epoxy coated resilient wedge gate valve.

Grinder sewers may be allowed to connect to gravity sewer mains. Grinder mains shall be sized as directed by the manufacturer.

Taps into existing city grinder system force mains will be performed by the city. The city will provide the force main lateral to the property line and provide the box, ball valve and check valve. It is the applicant's responsibility from the property line to the structure. Installation fees are required to be paid before the work is scheduled.

7D.040 Lift Station Pressure Main Surge Protection

PVC is subject to fatigue failure due to cyclic surge pressures. The pressure main shall be constructed to minimize rapid changes in velocities. A properly sized surge tank may be required on the pressure main.

7D.045 Valves

All valves up to 2 inch shall be red handle Cepex Poly True Union FIPT x FIPT ball valves with appropriate couplings. All valves four to 24 inch shall be M&H, Clow, Pratt or Milliken plug valves or approved equal. Plug valves shall be ductile iron and epoxy coated on the inside and outside as specified in Section 7D.030. All plug valves shall have a 2 inch operating nut. Plug valves 10 inch & larger shall have gear reduction operation. Tapping valves shall be resilient wedge gate valves and be epoxy coated on the inside and outside.

- A. Pressure Main Valve Spacing: Valve spacing shall not exceed 1000 feet for mains up to 10 inch 500 feet for mains over 10 inches. At every lift station, a pressure main isolation valve is required within 10 feet of the station.
- B. Air Release Valves: Air release valves shall be ARI model D-021. Air release valves and air/vacuum valves shall be located at the high points of the line. Air release valves shall be fitted with an activated carbon canister to absorb compounds with disagreeable odors prior to releasing the air to the surrounding area. Grades shall be designed to minimize the need for air/vacuum valves when practical. Vehicular access to valve is required for maintenance. See detail.

7D.055 Fittings

- A. All pipe fittings shall have a minimum working pressure rating equal to the pipe with which they are connected. Fittings shall be PVC 1120, rubber joint complying with ASTM D1784, D2466, or D2467.
- B. Fittings for welded poly pipe shall be electro fusion welded. Tee connections shall be electro fusion branch saddles or side wall fusion reducing tees. Connection to existing poly mains shall be by self tapping electro fusion saddles or Romac SST-H.

7D.060 Pressure Main Low Point Drain

Provisions to drain a pressure main to facilitate repairs or to temporarily remove the pressure main from service shall be provided. This may be accomplished through the use of a valved tee connected to a drain line at the low point of the line. See detail.

7D.065 Grinder/Pressure Main Pigging Ports

A pipeline pig is a projectile that is forced through the inside of a pipe to clean pressure pipelines. A pigging port is used as a point to send or retrieve the pig. Pigging ports shall be required:

1. At every change in pipeline size (or as determined during the plan review).
2. At the end of every dead-end line.
3. At the connection point to the main when the main being constructed will be a secondary main.
4. Location and number of pigging ports required are subject to review and approval by the City of Tumwater. See detail.

7D.070 Thrust Blocking

Location of thrust blocking shall be shown on plans. Thrust block concrete shall be Class B poured against undisturbed earth. A plastic barrier shall be placed between all thrust blocks and fittings.

Designed and approved restraining joint systems may be allowed in lieu of thrust blocking. "Megalug" type joint restraints will not be allowed on PVC pipe. Mechanical restraints shall be split-grip ring type. Restraining joint brand, type, and size shall be specified on the plans.

7D.080 Pressure Main Termination

Sewer odors and gases, hydrogen sulfide odors (H₂S), and the buildup of sulfuric acid (H₂SO₄) occur in the operation of a pressure main and/or grinder system.

Odor and corrosion control measures shall be addressed on pressure sewer systems connecting to a gravity sewer system.

A determination of need for odor and corrosion prevention shall be prepared and stamped by a Professional Engineer licensed in the State of Washington. The report, along with said engineer's history of odor control experience and references shall be submitted during design phase for review by the City of Tumwater. If required, an odor control facility shall be installed in order to inject a treatment product into the system so that both odor and corrosion issues generated by the system are addressed. The pressure main shall be sized to provide adequate contact time for treatment to be effective. Odor control shall also be addressed for a community system. At a minimum, the soil bed system shall be designed and installed according to current method used by Thurston

County Health Department.

All manholes within 400 feet downstream of the out-fall manhole and including the out-fall manhole shall be entirely coated from the top grade ring to the channel flow-line with ISO 9000 certified high grade Calcium Aluminate material, Kerneos Sewper Coat HS 2000 or approved equal. The coating shall be applied under direction of the product representative, by a factory trained/certified applicator of the product. If new gravity manholes are to be installed at the terminus, all of the new manholes shall be coated as well. The pressure main discharge shall be made with a smooth transition of flow into the existing flow so as to not cause splashing of the effluent at the discharge.

7D.090 Manhole/Vault Access

All manholes and vaults are required to have a paved access a minimum width of 12 feet.

7E Community Systems

7E.010 General

In those areas, located within the City of Tumwater's Urban Growth Area boundary, where connection to a permanent public sewerage system is not feasible, a community on-site septic system may be constructed to serve residential and non-residential locations when approved by the City. No community systems are allowed within the Tumwater city limits. Approval for construction of a community on-site, interim sewerage facility shall be secured from the City prior to engineering and design. Approval by Thurston County Environmental Health shall not constitute City of Tumwater approval. In cases of conflict between the County and City, the more stringent criteria shall apply. In certain cases, a value engineering study may be required by the City prior to granting approval for an interim sewerage facility; See Section 7E.020.

Community on-site systems shall be maintained and operated by the City. At a minimum, the connection and monthly sewer service charge will be assessed as if connecting to the City/LOTT system. A ULID Waiver of Protest and a Waiver of Protest to Annexation shall be required of the Developer to facilitate the extension of a public sewer trunk line to the site.

Five sets of manuals complete with maintenance and operating instructions for the drain fields, filters, pumps and all plumbing associated with the system shall be supplied to the City of Tumwater at time of start up. Operating instructions shall define and address dosing and pumping requirements for initial flows as well as build out flows for the system designed.

Maintenance and pumping of the community on-site system shall be the responsibility of the City only after the system has been inspected and approved by Thurston County Environmental Health and City of Tumwater. A two-year maintenance guarantee as outlined in Chapter 3 is required.

The building sewer between the building and the clean-out at the property line shall be the responsibility of the property owner.

7E.020 Criteria for Use

A. Cost Effectiveness

In order for the City to allow a community on-site system, the cost of construction of a gravity sewer line(s) must significantly outweigh the cost of construction of an on-site system(s) to serve the subject development. The difference in cost is typically dependent upon the number of units to be served and the distance of the proposed development to City sewers. This distance is measured as the length of sewer required to reach existing City sewers as prescribed in the City sewer plan.

A proposed residential development would need to be located a minimum distance from existing sewers as listed below before a community on-site system would be allowed. These distances are as follows:

<u>Number of Residential Units</u>	<u>Minimum Distance</u>
2	400 feet
3	600 feet
4	800 feet
5-15	1,000 feet
> 15	Up to mile *

* For developments involving greater than 15 units, the proposals must be examined on a case-by-case basis considering development density and costs.

A proposed commercial/industrial development would need to be converted to equivalent residential units (ERU's) and the above criteria applied. However, if the total daily flow from a commercial/industrial site is greater than 14,500 gallons per day, an on-site system will not be allowed.

The City may choose to participate in the cost of the sewer line extension, subject to available funds.

The City will coordinate or require the developer to coordinate with other proposed developments in the area to determine if multiple community

on-site systems are planned along the subject sewer line. If the aggregate number of residential units indicates a distance greater than the distance to the existing City sewer as prescribed in the above mentioned criteria, the City will require the construction of the sewer line and deny the use of the community on-site systems. The City could assist by supporting the formation of a ULID or authorizing a latecomer's agreement.

B. Other Issues

1. If the proposed community on-site system is within the one-year time of travel zone for established wellhead protection areas for a public water supply well, the use of a community on-site system will not be allowed.
2. If the proposed community on-site system is within the five-year time of travel zone, the system must fulfill the requirements of the wellhead protection ordinances.
3. If there are plans to construct a sewer line that would be completed within 18 months and would provide service to developing property, the use of a community on-site system will not be allowed.
4. If the total flow from industrial and/or commercial projects, including all adjacent parcels in the same ownership, exceeds 14,500 gallons per day of wastewater flow, the use of a community on-site system(s) will not be allowed.
5. Any industrial and/or commercial projects that require the issuance of an "Industrial Discharge Permit" as established by ordinance shall be required to connect to the public sewer, and the use of a community on-site system(s) will not be allowed.

7E.030 Design Standards

The design of any community on-site system shall conform to City standards, Department of Ecology's "Criteria for Sewage Works Design" and any applicable standards as set forth herein and in Chapter 3. As-built drawings shall comply with Thurston County Environmental Health requirements and City of Tumwater standards.

If a community on-site system is required, the Developer shall perform a study prepared and stamped by a Professional Engineer licensed in the State of Washington, to determine that the community system installation is sized to serve the overall sewage flows generated within the potential service area. The service area study shall include the Developer's plat boundary area and shall include adjacent and future service areas as determined by the City. The final

service area shall be the entire area which could be served by the installation of the community system.

The station's design flow capacity shall be based on an average daily per capita flow with related peaking factors and inflow/infiltration allowances.

Documentation of present and future service area flow rates for community system size and capacity determination shall be included in the report.

The wet well shall be sized to provide full submergence on the pumps as recommended by the pump manufacturer and a minimum of four (4) minutes between pump cycles at pump design capacity. The design shall provide for a minimum distance between the lowest inlet elevation and the top of the pump motor to provide for proper programming of pump intervals (lead and lag).

The community system shall be sized to meet the maximum rate of flow expected. The size of the receiving sewer shall exceed the flow expected. At least two (2) pumping units shall be provided at each community system installation. The pumps shall have sufficient capacity and capability to efficiently handle the peak design flow with 1 pump out of service.

The minimum inside diameter of the pressure main shall be 2 inches.

Four copies of the Design Report shall be submitted to the City for review. As a minimum, the report shall include:

1. Project description
2. Projected flows
3. Connection point
4. Wet well sizing
5. Run time calculation and cycle time
6. Pump station head calculation and system curve
7. Pump selection and wet well details
8. Pressure main size, length and material (see section 7D Pressure Sewer)
9. Electrical requirements and Generator sizing
10. Community system station voltage
11. Odor control calculations

Information prepared by an engineering firm with experience in hydrogen sulfide formation and remediation shall be provided for the following:

- A. Collection system to the community system station
- B. Community system station wet well
- C. Pressure main
- D. Downstream gravity system
- E. A statement that odors will not be detected at the community system site or at the point of release or the Developer will provide odor control at the appropriate.

12. Geotechnical analysis for wet well and community system drain field.
13. Backfill and compaction specifications
14. Preliminary site plan layout

The community system shall be located on an adequately sized tract or easement created solely for sewer purposes. An additional 15 foot shall be part of the above tract or easement and shall be granted around all sides of the facility for maintenance access. A driveway and/or adequate parking shall be provided at the facility for City maintenance vehicular access. Driveway shall be constructed as a permanent all weather surface capable of supporting an 80,000 lb. vehicle. The City of Tumwater will own and maintain the community system; however, the developer may retain ownership of the tract. An easement over the tract will be required; however, the easement may be dissolved when the system is taken off-line and abandoned by the City. The City however, shall have no responsibility, obligation, or liability regarding the removing of the drain field and reserve areas.

All collection lines, dry lines, pumping stations and other sewer appurtenances and sizing shall conform to the criteria as set forth in the "Comprehensive Sanitary Sewer Plan", most current copy, and the City's Guidelines.

Community systems shall use the applicable criteria outlined in Section 7B for the design and construction of the gravity sewer and Section 7C for the design and construction of the pump station and components. The drain field shall be designed using alternating pods. Cleanouts are to be provided on all lines.

The community system shall be designed so that each residential or nonresidential unit will discharge into a gravity sewer collection system. The gravity system will then convey sewer to a community septic tank. At a minimum, the community septic tank will discharge the effluent into a designed pretreatment system depending on site conditions prior to discharge of the effluent to a pressurized community drain field. See detail. The location of the community system shall result in easy connection to the future City system and shall be in an area that can lend itself to easy expansion by future developments.

The site shall be flat with a maximum slope of 2%. The area for the site shall be measured from the outer edges of the tank; distance shall equal a 1:1 ratio for the tank depth. For example, a tank that is 17 feet deep will require a 17' reach from the outer edge of the tank. All sites shall be fenced per City pump station requirements. All sites shall have a lift station wash hydrant with a double check valve assembly. If water is not owned by the City of Tumwater, the developer shall be responsible for connection fees to a meter associated with the lift station hydrant.

The site for the drain field shall not exceed 5% and shall be easily accessible.

The applicable General Notes in Section 7B.020 shall be included on any plans dealing with gravity sanitary sewer design.

When a conflict arises between these standards and the Thurston County Environmental Health requirements, the more stringent criteria shall apply and shall be specified on the plans.

7E.040 Drainfield Piping

Pipe shall be 2-inch minimum, Schedule 80 PVC water pipe, solvent weld joint. Solvent cements and primer for joining PVC pipe and fittings shall comply with ASTM D2564 and shall be used as recommended by the pipe and fitting manufacturers. Poly pipe shall be high density ASTM D3350, SDR 11 3408 socket or butt fusion weld. Pipe shall have minimum 24-inches of cover to top of pipe.

All pipe shall be installed with continuous tracer tape installed 12 to 18 inches under the proposed finished grade of the drain field. The marker tape shall be plastic; non-biodegradable, metal core or backing which can be detected by a standard metal detector. Tape shall be Terra Tape “D” or approved equal. In addition to tracer tape, install 12 gauge green coated copper wire, wrapped around the pipe, brought up and tied off at all blow-offs and distribution valve boxes.

7E.045 Fittings

A combination of solvent weld and threaded fittings shall be required and called out on the approved plans

7E.050 Valves

- A. All ball valves shall be Cepex Poly True Union (OAE). Other special valves shall be reviewed and approved by the City of Tumwater during design.
- B. Valve box lids shall be specified to be marked “SEWER”.
- C. Valve boxes shall be Carson 1730 for earth bury and Midstates Plastics BCF 1730SL in traffic areas (OAE) .

7E.060 Fiberglass Septic Tanks

Single-wall fiberglass septic tanks approved for use in the City of Tumwater shall meet UL 1316 and ASTM D4021 specifications.

All tanks shall be guaranteed in writing by the tank manufacturer for a period of two years from the date of delivery to the project. Manufacturer’s signed

guarantee shall accompany delivery.

The tank gallon size used shall be designed similar to the standards in Section 7C. Actual diameter and length of the tank shall be determined by site conditions such as gravity system depth requirements feeding the primary tank, space available, or groundwater and soil conditions.

Fiberglass tanks shall be installed by persons who have attended an installation class sponsored by the manufacturer of the tank being installed.

All factory requirements shall be strictly adhered to during delivery, storage and installation process of the fiberglass tank(s).

In areas of high groundwater concrete dead man anchoring of the fiberglass tank(s) may be required. All factory anchoring installation requirements of the tank(s) shall be met.

All fiberglass tanks must be air-tested for leakage at the factory prior to shipment. A second air-test shall be done at the job site and witnessed by the City of Tumwater Inspector prior to backfilling to verify no damage or leakage has occurred during shipment or during storage at the job site. All air-tests shall be done according to factory specifications.

A standard hydrostatic test for the riser connection shall be required and witnessed by the City of Tumwater inspector immediately after installing and backfilling the tank(s) by filling the tank riser with water to the top or to a level that equals 3 PSI against the tank riser seal (approximately 7 feet) for a 2 hour period. Water loss during the test shall not exceed 1 gallon.

Only sanitary wastewater shall be discharged into the tank. Roof drains and other storm water sources shall be strictly excluded. The effluent shall be discharged by gravity to the community dosing station.

7E.070 Tank Risers and Lids

Pump chamber risers shall be fiberglass ribbed or PVC as manufactured by ORENCO SYSTEMS, INC., 2826 Colonial Road, Roseburg, Oregon 97470 (OAE). All tank riser lids shall be set to grade for maintenance access.

Riser in inlet of community tanks shall be 24 inch diameter. Bio-tube compartment risers on community system tanks shall be 30 inch or 48 inch diameter as required. Primary tanks shall have 24 inch risers evenly spaced along tank to facilitate pumping. Spacing of risers shall not exceed 8 feet to center of risers. No shrubs, bushes, ground cover or trees shall be planted within a 3 foot radius of the tank lids. Community system tank riser height shall not exceed 96 inches from top of tank to finished grade. All tank riser lids shall be set to grade for maintenance access.

Pump chamber risers shall be factory equipped with the following:

- A. Appropriately sized (IPS) neoprene grommets shall be installed no less than 8 inches from the top of the riser and no more than twelve inches from the top of the riser around the pump discharge pipe(s) and electrical splice box conduits where they exit the riser and create a seal to prevent the infiltration of groundwater into the tank.
- B. Splice box in community systems shall be SB5 for the floats. Motor leads shall exit riser and be housed in a standard concrete electrical junction box. There shall be a slack loop in the junction box along with Erickson union and seal off. Motor leads shall be continuous from motors to electrical cabinet without splices.

A lid shall be furnished with each riser. It shall be latching and constructed of fiberglass with an aggregate finish. Riser and lid combination shall be able to support 2500 pound wheel load. This does not imply that PVC risers are intended for traffic areas.

Each riser shall be bonded to the flanged tank adapter with a two-part epoxy that shall be supplied with the riser by the manufacturer. The epoxy shall be applied in accordance with the manufacturer's recommendations. The epoxy shall be allowed four hours curing time at 64 degrees Fahrenheit; otherwise a greater time shall be allowed based on the manufacturer's recommendations before backfill is placed over tank. Care shall be exercised during the curing period to avoid dislodging the riser. Fiberglass tanks shall have a portion of the risers manufactured as part of the tank and sized to fit the standard Orenco risers and lids. The two part epoxy mentioned above shall be used to attach the Orenco riser to the fiberglass riser along with the adapter ring. Attachment of Orenco riser to PRTA tank adapters, FRTA tank adapters and fiberglass tank adapters shall be done using OSI ADH100 adhesive or adhesive required by the tank manufacturer.

7E.080 Pumping Tank Equipment

Pumps shall be UL listed for use in effluent. All pumping systems shall be Orenco Systems Model OSI S4000 Series High Head Pumping Assemblies (OAE).

All pumping systems shall be installed in accordance with the manufacturer's recommendations.

7E.090 Control Panel Power

The control cabinet for community systems shall be a free standing stainless steel enclosure mounted on a concrete pad at the pump tank site; See Section 7C

for all applicable requirements.

All buried power shall be installed with continuous tracer tape installed 6 inches above the buried power. The marker tape(s) shall be plastic non-biodegradable and be labeled with the appropriate marking.

Wiring from the pump control panel to the splice box in the wet well riser shall be a minimum #14 stranded wire and colored insulation matching the manufacturer's diagram. Connections in the riser junction box shall be installed as per the manufacturer's specification. A good quality heat shrink shall be used on all leads. Splices shall be capable of lifting out of the junction box a minimum of six inches. The motor and control circuits will be megered as part of the inspection procedure and shall be no less than 50 megohms before acceptance by the City.

7E.095 Control Panels

Control panels for community systems shall be designed, assembled and ordered as a packaged unit from Orenco Systems Inc. (OAE).

7E.100 Testing

All testing of the gravity sewer, pump facility & tanks and the pressurized drain field shall be witnessed by the City of Tumwater Inspector. Testing of the pressurized drain field shall be per Thurston County standards. Testing of the pumping facility, the septic tank, and the sewer lines shall be per the appropriate section of the City standards for that appurtenance.

