



**CITY OF PORT ST. LUCIE  
UTILITY SYSTEMS DEPARTMENT**

**UTILITY STANDARDS MANUAL**

**2011 EDITION  
(Effective 10/01/11)**

PSLUSD Doc No 74

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1 **PREFACE**

2  
3  
4 The design and construction standards set forth in this manual and all subsequent supplemental  
5 standards, herein after referred to as the **Utility Standards**, are the minimum City of Port St.  
6 Lucie Utility Systems Department (PSLUSD) requirements. It is the intent that utility standards  
7 and the standard construction details shall be applicable in all cases where the utilities being  
8 constructed will be connected to water, wastewater and/or reclaimed water facilities owned by  
9 the PSLUSD. These requirements do not apply to individual single family dwellings connecting  
10 to existing PSLUSD facilities. Pre-design meetings are strongly encouraged.

11  
12 All utility projects, whether privately or publicly owned, shall be constructed in accordance with  
13 the utility standards. Any supplemental standards adopted by the PSLUSD will supersede the  
14 standards adopted in this manual. If there is a conflict between the standards included in this  
15 manual and any supplemental standards, the requirements of the latest supplemental standards  
16 will take precedence.

17  
18 The Engineer-of-Record (EOR) shall be responsible for assuring that the design details, notes,  
19 and requirements presented herein meet all local, state and federal government regulations. If a  
20 provision of the utility standards is in conflict with the requirements of any state agency or local  
21 government having primary jurisdiction, the more stringent requirements shall prevail.

22  
23 The minimum requirements of the utility standards shall not be modified excepting when unique  
24 circumstances exist, the public health and safety is not adversely affected, and written approval  
25 has been obtained from the Utility Director or designee. Any proposed modification to the  
26 minimum requirements must be substantiated by an engineering report prepared by a  
27 Professional Engineer licensed in Florida, which would indicate compliance with the intent of  
28 the utility standards.

29  
30 In case of a disagreement in the interpretation of any provision of this manual, or the  
31 supplemental standards, the decision of the Utility Director shall prevail.

32 PSLUSD reserves the right to impose additional field requirements not addressed in the utility  
33 standards, when those requirements will improve the integrity of the utility system.

34  
35 The terms “shall” and “must” are used when the requirement is mandatory. Other terms such as,  
36 “recommended” and “preferred” indicate desirable procedures or methods, with deviations  
37 subject to individual consideration.

38  
39 The latest revision of regulations, codes, standards and technical publications referenced in the  
40 utility standards shall be used.

41  
42 Copies of the PSLUSD “Utility Standards Manual”, Supplemental Standards, Standard Details,  
43 Applications, Standard Documents and forms may be downloaded from the PSLUSD website at  
44 <http://www.cityofpsl.com/utility/commercial-development/utility-commercial-development.html>.

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**CHAPTER I**  
**APPLICATION PROCESS**

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**A. GENERAL**

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1. In order to obtain utility services from the City of Port St. Lucie, the property owner must make an Application for Service to the PSLUSD. A completed Application for Service must be submitted with the fee and other items noted on the application form. The application form can be downloaded from the PSLUSD website <http://www.cityofpsl.com/utilitycommercial-development/utility-commercial-development.html>.

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2. Applications for services requested by firms, partnerships, associations and corporations shall be tendered only by their duly authorized agents and the official title of the agent shall be shown on the application. Failure to submit all the required information shall result in a rejection of the application, which will then be returned to the owner or designated agent.

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36

**B. SITE PLANS**

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The following information shall be included with the site plan when submitted to the PSLUSD for approval:

- 41  
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43  
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45
1. Location and size of existing water and wastewater facilities, which are available to serve the proposed project.
  2. Approximate location of proposed on-site and off-site water and wastewater mains.
  3. Location of any existing or proposed well and septic tank system, if approved by the PSLUSD.
  4. Location of nearest fire hydrant within 1,000 feet of property.
  5. Location of any public wells within 1,000 feet of property. The City Code, Chapter 53 restricts certain uses and development within the zone of protection. Confirmation shall be provided that the project is not within the zone of protection, either by a statement on the plan or in a separate document.

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**C. CONSTRUCTION PLANS**

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1. All construction plans require review by the PSLUSD. A full set of plans shall be submitted by the applicant together with plan review fees. Plans shall be prepared on 24" x 36" sheets utilizing the following scales:

- 52  
53  
54  
55
- a. 1" = 50' horizontal or larger for water, wastewater and reclaimed water lines
  - b. 1" = 5' vertical or larger for gravity wastewater profile sheets
  - c. 1" = 10' or larger for pump station site plans

Drawings submitted on other size sheets or at other scales shall be returned without review.

- 1 Detailed drawings shall be provided for areas with poor legibility. For clarity, utility plans may  
2 be required on separate sheets (not combined with paving and drainage).
- 3 2. The construction plans shall be in compliance with the design, specifications and construction  
4 standards included in this document and shall be sealed and signed by a Professional Engineer  
5 licensed in the State of Florida. The engineer shall submit the design report, calculations and  
6 other pertinent information required in Section H, Chapter II, along with the construction plans.  
7
- 8 3. Construction plans shall include the following:  
9
- 10 a. Cover sheet with the name of project, developer and engineer; detailed location map with  
11 street names and legal description; PSLUSD standards and details utilized (indicate effective  
12 date); an index and a revision block.  
13
  - 14 b. A revision block on all construction plans  
15
  - 16 c. A north arrow and scale.  
17
  - 18 d. Phase lines and match lines must be clearly delineated with no overlapping.  
19
  - 20 e. A base line with stationing and offsets from permanent structures.  
21
  - 22 f. Elevations shall be referenced to the North American Vertical Datum of 1988 (NAVD 88).  
23 The location and elevation of at least one NAVD 88 benchmark shall be indicated.  
24
  - 25 g. Rights-of-way, all existing and proposed easements, lot lines, and the Official Record Book  
26 and page number, if applicable.  
27
  - 28 h. Lot and block numbers, if applicable.  
29
  - 30 i. Each new lot, bay, and building; type of use and number of floors; each lot/bay shall have a  
31 separate water service line with a meter or lockable shut off valve and an individual sanitary  
32 sewer service cleanout .  
33
  - 34 j. Driveway locations for all developments.  
35
  - 36 k. Existing and proposed water, wastewater and reclaimed water mains and easements; proposed  
37 mains shall be in City owned road rights-of-way or utility easements.  
38
  - 39 l. Size, length and type of material used to construct all mains and casings.  
40
  - 41 m. Distance of mains from buildings or structures within 20 feet of the main.  
42
  - 43 n. Storm sewers including yard drains.  
44
  - 45 o. The location (station and off sets) of all facilities and appurtenances shall be clearly labeled  
46 (pipe, valves, fire hydrants, fire sprinkler lines, water meters, fittings, sampling points, manholes,

- 1 service lines, etc.) with associated elevations, sizes, types, composition, and slopes. All  
2 manholes, fire hydrants, sample points, and valves shall be numerically identified.
- 3 p. The point of service for water and sewer shall be labeled as Point of Service or “P.O.S.”.  
4
- 5 q. Separation between water mains, gravity sewer, force mains, reclaimed water mains and storm  
6 sewers.  
7
- 8 r. Elevations of conflicting pipes shall be shown to indicate top and bottom pipe elevations.  
9
- 10 s. Field verified data (sizes, materials, elevations and locations) for existing utilities including but  
11 not limited to water mains, force mains, gravity sewers, storm sewers, reclaimed water mains,  
12 electric, gas, fiber optic, and telephone.  
13
- 14 t. All paved non-asphalt surfaces (pavers, stamped concrete, etc.) proposed over PSLUSD owned  
15 facilities shall be identified on plans. \* **Please see note in Section B.5, Chapter II.**  
16
- 17 u. The plan view and profile of gravity sewer indicating the length and slope of pipe between the  
18 manholes; elevation of each manhole rim and inverts; location and elevation of connection to  
19 existing sewage collection system or proposed pump station; finished grade elevation; and  
20 elevation of water, storm sewer and reclaimed water lines crossing the sanitary sewer.  
21
- 22 v. Facilities with interceptors shall be individually identified and metered; the type, capacity and  
23 location of interceptors shall be indicated.  
24
- 25 w. The details indicated hereunder shall be provided if a wastewater pump station is proposed.  
26
- 27 (1) A plan and section view of the pump station with dimensions and size of the wet well,  
28 showing the placement of all components and clearances; elevation of wet-well bottom, top and  
29 at ground adjacent to wet-well; elevation of all influent inverts; elevation of emergency off  
30 (back-up), pump off, lead pump on, lag pump on and high water alarm levels; pump information  
31 including model, impeller diameter, horse power, motor speed, operating point, operating  
32 voltage, and control panel.  
33
- 34 (2) A detailed site plan drawn to scale for the pump station including all applicable structures,  
35 components and appurtenances such as wet-well, valve vault, telemetry, generator, fuel tank,  
36 odor control equipment; water service and reduced pressure principle backflow prevention  
37 assembly; gravity sewer, manhole and pressure main; landscaping and irrigation system; control  
38 panel, auxiliary electrical enclosure, and all buried electrical conduit including electrical service  
39 to control panel, as applicable; concrete and gravel areas; easements; fence; and access driveway.  
40 Proposed grade elevations shall be indicated on the site plan in the proximity of the pump  
41 station.  
42
- 43 x. The PSLUSD Standard Detail ([http://www.cityofpsl.com/utility/commercial-  
44 development/utility-commercial-development.html](http://www.cityofpsl.com/utility/commercial-development/utility-commercial-development.html)) shall be utilized, but do not have to be  
45 included in the construction plans submitted for review. If the standard details are included in  
46 the construction plans, the detail sheets shall not be reduced in scale. If the standard details are

1 not included in the construction plans, the contractor and EOR shall ensure that a copy of the  
2 Utility Standards Manual, including Standard Details, is available at the project at all times.  
3 y. After the initial PSLUSD plan submittal, all revisions shall be noted in revision block on cover  
4 sheet and clouded on corresponding plan sheets.

5  
6 4. Landscaping plans shall be submitted for the project indicating the location of landscape areas,  
7 perimeter walls, foundations, berms, tree wells, fences, gates, signs, decorative rocks, sculpture,  
8 fountains, and any other features that may influence the location of water/wastewater/reclaimed  
9 water facilities; also, existing and proposed water/wastewater/reclaimed facilities shall be shown.

10  
11 5. Within thirty days of acceptance of the completed Application for Service, including fees and  
12 applicable plans, the PSLUSD will provide review comments to the applicant. The applicant  
13 shall address the comments and submit revised construction plans to the PSLUSD for review.  
14 The PSLUSD will notify the applicant when the construction plans are in compliance with the  
15 utility standards, however, the plans will not be approved until the Utility Service Agreement has  
16 been executed, all fees are paid and a Construction Permit/Approval is issued by the PSLUSD.

17  
18 6. No changes shall be made to the approved plans after a Construction Permit/Approval has  
19 been issued without specific concurrence of the PSLUSD in writing. Revisions which directly or  
20 indirectly impact utility design void the plan approval; such revisions include but not limited to  
21 changes in use from retail to restaurant, adding or deleting bays in buildings, site plan changes  
22 and changes from single family homes to multiple family homes. Revised plans are required for  
23 approval and are subject to new plan review fees

### 24 **C. UTILITY SERVICE AGREEMENT**

25  
26  
27 1. When the Application for Service and construction plans have been completed satisfactorily,  
28 the applicant/property owner is required to enter into a Utility Service Agreement with PSLUSD.  
29 The agreement shall be binding on the applicant/property owner, successors and assigns.

30  
31 2. The Utility Service Agreement shall detail the terms, conditions and responsibilities of the  
32 applicant/property owner, including but not limited to warranty of all work and equipment for  
33 the project.

34  
35 3. If utility construction has not been initiated within one year of execution of the utility service  
36 agreement or inspections by the PSLUSD indicate that utility construction activity has not  
37 occurred for a period of 12 months, a re-approval of the project is required. For re-approval of  
38 project by the PSLUSD, construction plans shall be revised to meet the current standards and  
39 submitted with the appropriate charges/fees; also, an amendment to the utility service agreement  
40 may be required.

41  
42 4. The applicant shall pay all required charges and fees prior to execution of the Utility Service  
43 Agreement by the PSLUSD. The "Guideline for Estimating New Commercial Project  
44 Charges/Fees" can be obtained online at [http://www.cityofpsl/utility/commercial-  
45 development/utility-commercial-development.html](http://www.cityofpsl/utility/commercial-development/utility-commercial-development.html).

1 **D. CONSTRUCTION PERMITS**

2  
3 1. A permit must be obtained from the PSLUSD prior to construction of water and wastewater  
4 facilities, except utility facilities mentioned in D3 below. A completed application for a  
5 construction permit shall be submitted on a PSLUSD form with a copy of the signed utility  
6 service agreement and applicable charges and fees.  
7

8 2. PSLUSD is authorized by the FDEP to independently regulate the construction of water  
9 distribution mains of 12”or less in diameter, gravity wastewater collection systems of 12” or less  
10 in diameter, wastewater force mains of 12” or less in diameter, and pump stations appurtenant to  
11 such force mains. Construction of these projects is exempt from FDEP permit requirements.  
12

13 3. Applications for FDEP permits for construction of mains larger than 12” and pump stations  
14 appurtenant to such mains can be submitted concurrently with the construction plans; however,  
15 PSLUSD will not sign the FDEP application form until PSLUSD has executed a Utility Service  
16 Agreement, and approved the construction plans.  
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1 **CHAPTER II**  
2 **DESIGN, SPECIFICATIONS AND CONSTRUCTION STANDARDS**  
3

4 **A. GENERAL**  
5

6 1. The standards set forth in this manual are intended to provide a basis for design and  
7 construction. Applicable federal, state and local laws and regulations should be considered  
8 concurrently with this text. Any variation from these standards shall be specifically requested by  
9 the Engineer of Record (EOR) and requires a written approval from the PSLUSD prior to  
10 construction plan submittal. Approval of construction plans by the PSLUSD does not constitute  
11 written approval of deviations from the utility standards.  
12

13 2. All references to stainless steel shall refer to grade 316 unless otherwise noted.  
14

15 3. Water, wastewater and reclaimed water lines shall not be constructed without first obtaining  
16 an approval or permit, as applicable, from the PSLUSD.  
17

18 4. All construction shall be in accordance with this manual, the City of Port St. Lucie Code of  
19 Ordinances, and with all applicable Florida Department of Environmental Protection (FDEP)  
20 rules and regulations. If any conflict exists between the standards, the more stringent governs, as  
21 determined by the PSLUSD. Copies of City Code of Ordinances are available with the City  
22 Clerk's office and can also be accessed online at [www.cityofpsl.com/city\\_clerk/index.html](http://www.cityofpsl.com/city_clerk/index.html). The  
23 FDEP rules are available online at [www.dep.state.fl.us/legal/Rules/rulelistpro.htm](http://www.dep.state.fl.us/legal/Rules/rulelistpro.htm).  
24

25 5. Construction shall be in accordance with the utility standards in effect at the time the project  
26 was approved by the PSLUSD and will not be subject to changes in the standards during the life  
27 of the project. However, if utility construction has not been initiated within one year of  
28 execution of the utility service agreement or inspections by the PSLUSD indicate that utility  
29 construction activity has not occurred for a period of 12 months, a re-approval of the project is  
30 required.  
31

32 6. Wastewater discharge shall be subject to Port St. Lucie wastewater system user rules in  
33 accordance with the City of Port St. Lucie Code of Ordinances - Title VI.  
34

35 7. All abandoned mains and service lines shall be removed or filled with cement grout. Asbestos  
36 cement pipe (ACP) must be handled in compliance with applicable federal, state and local  
37 regulations. All cutting, removal, and disposal of ACP shall be performed by a Florida licensed  
38 Asbestos Abatement Contractor.  
39

40 8. The design and construction of privately owned fire lines shall conform to the St. Lucie  
41 County Fire District standards ([www.slcfcd.com](http://www.slcfcd.com)) pertaining to dedicated fire sprinkler systems;  
42 the District has final jurisdiction on all hydrant and fire sprinkler line requirements. A plan  
43 approved by the District is required to be submitted at the pre-construction meeting with any  
44 revision that relocates a hydrant or a fire line connection.  
45

1 9. Cross connection control shall be provided in compliance with City of Port St. Lucie Code of  
2 Ordinances – Title VI and FDEP regulations.

3  
4 10. Permits shall be obtained for sub-aqueous and aerial pipe crossings canals and other surface  
5 waters from jurisdictional agencies and construction shall be in accordance with the permitted  
6 plans and conditions.

7  
8 **B. EASEMENTS/RESTRICTIONS/CONVEYANCE TO PSLUSD**

9  
10 1. Water, wastewater and reclaimed water facilities shall be placed in a city owned right-of-way  
11 (ROW) or utility easement. Placement of facilities on or adjacent to interior property lines or  
12 between structures is discouraged but may be considered by the PSLUSD on a case-by-case  
13 basis.

14  
15 2. A minimum 10' wide easement is required adjacent to any non-city owned ROW for future  
16 PSLUSD facilities.

17  
18 3. Utility easements must be a minimum of 20' wide for gravity sewer and transmission mains. A  
19 minimum of 10' wide easement shall be provided for standard pressure mains. For mains deeper  
20 than 6', the easement shall be calculated using the equation:  $Easement = 1 + 1.5D$ , where D is  
21 the depth from the finished grade to pipe invert.

22  
23 4. Utility easements shall extend a minimum of 10' beyond a manhole and 7.5' beyond a  
24 hydrant.

25  
26 5. Sidewalks, concrete slabs, roadways, parking lots or other paved areas; structural landscape  
27 features such as rock, sculpture and tree wells; berms, signs, walls, foundations, fences and gates,  
28 are not allowed in a utility easement but may be considered by PSLUSD on a case-by-case basis.

29 **\* The PSLUSD shall not be responsible for the restoration of any landscaping, aesthetic or**  
30 **structural features, and surfaces in the event of damage during maintenance of its water**  
31 **and wastewater facilities.**

32  
33 6. No landscaping shall be planted in a manner that would adversely affect utility easements.  
34 Landscaping shall be in compliance with Chapter 153 of the City of Port St. Lucie Code of  
35 Ordinances. Approved shrubs and ground cover listed in the Landscape Requirements may be  
36 planted in the easement.

37  
38 7. Minimum easements shall be provided for pump systems as follows:

- 39  
40 a. Grinder system – 20' x 20'  
41 c. Duplex Lift station – 30' x 45'  
42 d. Triplex Lift station – 45' x 50'

43  
44 Larger easements may be needed based on the site plan prepared by the EOR for the pump  
45 station, as required under Section C.3.v. of Chapter I.

1 8. The developer/property owner shall convey easements and/or property essential to the  
2 operation of the utility at no cost to the city by fee simple deed. Conveyance may be needed for  
3 the construction of water wells, mains, pump stations, storage tanks, etc.  
4

### 5 **C. SETBACK REQUIREMENTS**

6

7 All water, wastewater and reclaimed water facilities, which require an excavation with a depth  
8 of 6' or less, as measured from the bottom of the excavation to finished grade, shall be installed  
9 a minimum of 10' horizontally from any structures. This setback requirement also applies to  
10 new structures being constructed in the vicinity of existing PSLUSD facilities. The 10'  
11 horizontal setback shall be measured from the outside edge of the utility facilities to the nearest  
12 part of the structure, including underground (e.g. footers) or above ground (e.g. roof overhangs)  
13 features. In addition, the 10' setback applies only to mains skirting a single structure. Where  
14 utility facilities deeper than 6' are installed adjacent to or between structures, setback shall be  
15 calculated using the equation;  $Setback = 1 + 1.5D$ , where D is the depth from the finished grade  
16 to bottom of the excavation.  
17

### 18 **D. SEPARATION BETWEEN PSLUSD MAINS AND OTHER UTILITIES**

19

20 The minimum separation between PSLUSD mains and other utilities, as measured from the  
21 outside of each pipe, shall be as follows:  
22

23 1. Water mains shall be located a minimum of 10' from a gravity sewer, force main and  
24 reclaimed water main. The vertical separation shall be at least 18" with the water main crossing  
25 over the other pipes.  
26

27 2. All PSLUSD pipes shall have a minimum horizontal separation of 5' from all other  
28 underground utilities and a vertical separation of at least 18".  
29

30 3. When gravity sewer is to be installed parallel to a drainage pipe greater than 15" in diameter, a  
31 minimum horizontal separation of 15' shall be maintained. A greater separation may be required  
32 for drainage pipes larger than 24" in diameter, as determined by PSLUSD.  
33

34 4. When force main or reclaimed water main is to be installed parallel to a drainage pipe, a  
35 minimum horizontal separation of 8' shall be maintained. A greater separation may be required  
36 for drainage pipes larger than 48" in diameter.  
37

### 38 **E. REPLACEMENT AND UPGRADING OF EXISTING FACILITIES**

39

40 1. Upon development or improvement of a property, the owner shall be required to replace any  
41 existing onsite PSLUSD water and wastewater facilities constructed of asbestos cement (ACP) or  
42 'transite' pipe, cast iron (CIP), vitrified clay (VCP) or any facilities that do not meet the  
43 specifications of this manual within the proposed development, with currently approved  
44 materials at no cost to PSLUSD. Replacement easements shall be shown on construction plans  
45 and conveyed to the City in proper form.  
46

1 2. When development or improvement of a property cause offsite drainage and/or road  
2 improvements to be constructed, the property owner shall be required to replace any existing  
3 ACP, CIP, VCP pipes or any pipe located within the road/drainage right-of-way or easements  
4 that does not meet the utility standards. All such installations, whether planned or unplanned,  
5 shall be subject to review by PSLUSD prior to actual commencement of any site/road work.  
6

7 3. When a proposed project causes existing PSLUSD facilities to be hydraulically overloaded or  
8 at risk of damage or contamination, the developer shall be required to upgrade and/or relocate the  
9 facilities in compliance with the current utility standards.  
10

11 4. In case of road surfacing and other improvements, adjustments shall be made to manholes,  
12 valves, fire hydrants and other appurtenances, to meet the current utility standards at no  
13 additional cost to the PSLUSD. The work shall be inspected by PSLUSD for compliance.  
14

15 5. Developments with privately maintained water and wastewater utility systems may request  
16 PSLUSD to accept ownership of the systems subject to the following conditions:  
17

18 a. The property owner submits information regarding the system to the PSLUSD, including:  
19

20 (1) As-built drawings of the system prepared by a Professional Land Surveyor, licensed in the  
21 State of Florida.  
22

23 (2) An engineering report with details on the condition of the system. The report shall be  
24 prepared by a Professional Engineer, licensed in the State of Florida and shall contain results of  
25 inspection and testing of the mains, appurtenances, structures and equipment.  
26

27 b. The system is repaired or replaced to meet current utility standards by the property owner.  
28

29 c. Utility easements are conveyed to PSLUSD.  
30

31 d. PSLUSD is given access to perform inspections and testing to determine the condition of the  
32 system and conformity to current utility standards.  
33

#### 34 **F. RELOCATION OF EXISTING FACILITIES** 35

36 Relocation of existing facilities shall conform to the design and construction standards of this  
37 manual. All materials used in construction shall be on the PSLUSD Qualified Products List  
38 (QPL). Design for relocation of existing facilities must provide for continuity of service to  
39 existing customers as well as verification that the relocated facilities will not cause additional  
40 operation and maintenance expense to PSLUSD.  
41

#### 42 **G. WASTEWATER QUALITY/PRETREATMENT REQUIREMENTS** 43

44 1. City of Port St. Lucie Code of Ordinances – Title VI, prohibits the discharge of commercial  
45 and industrial wastewater into the city’s wastewater collection system if the wastewater contains  
46 pollutants and contaminants that are:

- 1 a. Harmful to the operation of wastewater facilities,
- 2 b. Untreatable and will result in violation of city, state and federal standards,
- 3 c. Hazardous or harmful to the health and safety of city personnel and the general public.
- 4
- 5 2. Any wastewater that has the potential of causing the above adverse effects will require
- 6 treatment and/or disposal in compliance with the city, state and federal regulations.
- 7
- 8 3. Discharge of wastewater from commercial and industrial establishments may be allowed in
- 9 some cases if pretreatment is approved by FDEP and PSLUSD.
- 10
- 11 4. Interceptors are required for certain establishments specified in Section H.3.
- 12
- 13 5. All waste streams, other than domestic wastewater, shall be identified by the applicant. The
- 14 information regarding the quantity and quality shall be submitted to the PSLUSD with the
- 15 application for wastewater service.
- 16

17 **H. DESIGN OF WATER, WASTEWATER AND RECLAIMED WATER FACILITIES**

18  
19 Water, wastewater and reclaimed water facilities shall be designed by a Professional Engineer  
20 licensed in the State of Florida. It is recommended the Developer and EOR meet with the  
21 PSLUSD staff to determine feasibility, conformance with the PSLUSD Master Plan and any  
22 other special project requirements, prior to beginning of any design work on a project. In areas  
23 where master plan facilities have not been constructed, the design of such facilities shall be  
24 incorporated in the overall design of the project. A Master Plan for the development may be  
25 required prior to the submittal of construction plans. Construction plans prepared without regard  
26 to the PSLUSD requirements shall not be accepted for review.

27  
28 The design criteria specified herein is applicable to PSLUSD facilities, including, potable water  
29 mains, gravity sewer, wastewater pump stations, force mains, reclaimed water mains and  
30 appurtenances, which fall within the service area of the PSLUSD. The criteria shall be used in  
31 conjunction with the design guidelines and technical references required in FDEP regulations.  
32 Deviations shall not be made without first receiving written approval from the PSLUSD; if  
33 special circumstances or conditions necessitate deviation from the criteria, the EOR shall submit  
34 documentation to show that deviation is based on good engineering practice and provide  
35 reasonable assurance that public health and safety will not be compromised.

36  
37 **1. DESIGN CRITERIA FOR WATER MAINS**

38  
39 Water mains shall be designed in accordance with Chapter 62-555 of the Florida Administrative  
40 Code (FAC), St. Lucie County Fire Department standards and provisions of this manual.

41  
42 **a. Sizing:**

43  
44 The EOR shall submit a report including the design and calculations for sizing of the water main,  
45 on the basis of following considerations:

- 46 (1) The PSLUSD Master Plan

1 (2) The development Master Plan

2  
3 (3) The mains shall be sized to provide at least maximum day domestic requirements plus fire  
4 flow at residual pressures of not less than 20 psi at all points in the system.

5  
6 (4) Domestic flows shall be based on 250 gallons per single-family dwelling unit, which equates  
7 to one Equivalent Residential Connection (ERC); the ERC factors for residential, commercial  
8 and institutional establishments.

9  
10 (5) The velocity shall be less than 6 feet per second (fps) at peak hour.

11  
12 (6) Distribution mains shall be at least 6" in residential areas. A 4" water main may be proposed  
13 for non-hydrant lines serving cul-de-sacs where additional development will not occur. In non-  
14 residential areas, distribution mains shall be a minimum of 8".

15  
16 **b. Layout:**

17  
18 (1) All developments may be required to extend water mains across existing or proposed streets,  
19 whether public or private, for future extension of other developments. In order to facilitate  
20 potable water service for all properties within the service area, the developer/owner shall extend  
21 the water main along the full length of all fronting boundaries of the property, and may be  
22 required to extend it through the property.

23  
24 (2) Water mains shall be looped at all locations. A looped line shall have two separate branches  
25 at least 500' apart with an isolation valve in between. Grid spacing shall not exceed  
26 approximately 100 feet per inch of pipe diameter. Multiple feed lines may be required at the  
27 discretion of PSLUSD.

28  
29 A written approval must be obtained from the PSLUSD for dead-end water mains. Dead ends  
30 shall be planned and located such that new or existing pavement will not have to be cut in the  
31 future when the main is extended. In such instances, mains less than 16" shall end with a valve,  
32 plug and a blow-off assembly; water mains 16" and larger shall end with a tee off fire hydrant,  
33 inline valve and plug. Permanent dead ends shall be equipped with an automatic flushing valve.

34 (3) Water mains shall be located to maintain the minimum separation required in Section D and  
35 the standard detail, unless a deviation is approved in writing by the PSLUSD. Separation less  
36 than the minimum required in Chapter 62-555, FAC, shall not be permitted.

37  
38 (4) Water mains shall not be placed in ditches, landscape buffers, wetlands, storm water  
39 management areas or under sidewalks, concrete slabs and paved areas, unless specifically noted  
40 on the plans and approved by the PSLUSD.

41  
42 **c. Design Working Pressure** – Water mains shall be designed for a minimum working pressure  
43 of 150 psi. The normal working pressure should be 60-80 psi and not less than 35 psi.

44  
45 Where system water main pressures meet the minimum requirements but additional pressure is  
46 desired by individual customers (such as for high-rise buildings), individual booster pumps may

1 be installed subject to approval by the PSLUSD. The engineer shall submit design information to  
2 the PSLUSD to assure that the booster pump facilities will not adversely affect the pressures in  
3 the utility mains and/or result in cross-connection. Appropriate features shall be incorporated in  
4 the design to prevent a drop in pressure in the utility mains below 40 psi.

5  
6 **d. Cover** – Water mains shall have a minimum cover of 36” and a maximum of 60”, unless  
7 otherwise approved by PSLUSD in writing.

8  
9 **e. Valves:**

10  
11 (1) Valves shall be designed to facilitate the isolation of each section of pipeline between  
12 intersections of the grid system. The number and location of valves shall provide for flexibility  
13 of operation and maintenance, while minimizing the number of customers out of service. In all  
14 instances, effectiveness of placement shall be primary criteria in determining valve location.

15  
16 (2) Valves shall not be placed in curbs, gutters, sidewalks, parking spaces, and handicap ramps.

17  
18 (3) Generally, the number of valves at an intersection shall be one less than the number of pipes  
19 forming the intersection.

20  
21 (4) Inline valves shall be installed for mains near each side of a canal crossing and/or major road  
22 crossing.

23  
24 (5) Valves shall be located at not more than 500’ intervals in multi-family residential, industrial  
25 and commercial districts and at not more than 800’ intervals in single-family residential districts.  
26 On transmission water mains less than or equal to 16” in diameter, valves shall be installed at a  
27 maximum of 1000’ intervals and at distribution branches. On transmission mains greater 16” in  
28 diameter, valves shall be located at a maximum of 2500’ intervals and at distribution branches.

29  
30 (6) Air valves shall be placed at all canal crossings, high points and at other locations specified  
31 by the PSLUSD. The EOR shall consult with the PSLUSD regarding the type of valve to be used  
32 and its location. The valve shall be located inside a maintenance access structure as shown in the  
33 PSLUSD standard details. Automatic valves shall not be used in situations where flooding of the  
34 maintenance access structure may occur. Valves shall be sized per the manufacturer’s  
35 recommendations.

36  
37 **f. Fire Hydrants and Fire Sprinkler Systems:**

38  
39 (1) The St. Lucie County Fire District has final jurisdiction on all fire hydrants and fire sprinkler  
40 line requirements. A written approval must be obtained from the Fire Chief and submitted to the  
41 PSLUSD.

42  
43 (2) Unless specifically provided in the Utility Service Agreement, all new fire hydrants shall be  
44 owned and maintained by the PSLUSD.  
45

1 (3) Hydrants shall be located so as to provide complete accessibility and minimize the possibility  
2 of damage from vehicle, or injury to pedestrians. The following setbacks and clearance shall be  
3 observed for fire hydrants:

- 4
- 5 (a) On or near side lot line
- 6 (b) No more than 15' from edge of pavement
- 7 (c) Clearance of 7.5' in front and sides and 4' to the rear
- 8 (d) No less than 2' from curb/edge of pavement/sidewalk
- 9 (e) No less than 3' from storm sewers
- 10 (f) No less than 6' from a gravity sewer, reclaimed water main or force main
- 11 (g) No less than 10' from wastewater pump stations and onsite sewage treatment and disposal  
12 systems.
- 13

14 **g. Water Meters and Service Lines**

15  
16 Water meters and service lines shall be sized by the EOR in accordance with AWWA Manual of  
17 Water Supply Practices - M22. The size of the service line shall be a minimum of 2". The  
18 location of meters and service lines shall be shown on the plans per the standard details and as  
19 follows:

- 20
- 21 (1) Water service lines to each lot, parcel or building.
- 22
- 23 (2) All services lines after the meter shall be located on the property, outside of any easements.
- 24
- 25 (3) Water meters shall be located in accessible areas, outside of landscaping and pavement, a  
26 minimum of 5' from buildings and electric transformers, adjacent to parking areas or roadways  
27 and a minimum of 3' from the edge of pavement.
- 28
- 29 (4) Water meters shall not be located within 10' of wastewater and reclaimed water service lines.
- 30
- 31 (5) Each lot/bay shall have a separate water service line with a meter or lockable shut off valve.  
32 A separate water meter shall be provided for businesses required to have an interceptor.
- 33

34 **h. Cross Connection Control/Backflow Prevention:**

35  
36 Cross connection control/backflow prevention shall be incorporated in the design of facilities, in  
37 compliance with the City of Port St. Lucie Code of Ordinances – Title VI. The specifications are  
38 included in Section J.5 of this Chapter and the approved backflow prevention assemblies are on  
39 the Qualified Products List.

40  
41 **i. Sampling Points:**

42  
43 Bacteriological sampling points shall be located at the point of connection to existing water  
44 main, at all dead ends, on the far side of all loops and no more than 1200' apart.

1 **2. DESIGN CRITERIA FOR GRAVITY SEWERS**

2  
3 **a. General**

4  
5 (1) The property owner of existing and proposed developments shall provide a gravity  
6 wastewater collection system. A pump station will be used when connection to the PSLUSD  
7 wastewater collection system is not possible due to the elevation or other constraints of the  
8 receiving gravity sewer, as determined by the PSLUSD. The PSLUSD may require submittal of  
9 an economic analysis by the EOR to compare the cost of gravity sewer versus a pump station  
10 over a period of 30 years, including capital and maintenance costs.

11  
12 (2) Gravity sewers shall be designed in accordance with Chapter 62-604, FAC, and provisions of  
13 this manual.

14  
15 **b. Size:**

16  
17 (1) The size shall conform to the Master Plan for the development.

18  
19 (2) The minimum allowable size for a gravity sewer, other than a service connection, shall be 8".

20  
21 (3) Lateral sewers shall be designed with capacities of not less than four times the average flow.  
22 Trunk lines shall have capacities of not less than 2.5 times the average flow.

23  
24 (4) The minimum service pipe size shall be 6" in diameter.

25  
26 **c. Layout:**

27  
28 (1) In order to facilitate wastewater service for all properties within the PSLUSD service area,  
29 wastewater gravity sewers shall be extended by the developer/owner along the full length of all  
30 fronting boundaries of a property and through the property.

31  
32 (2) All wastewater mains shall terminate with a manhole. In "phased" projects, pavement must  
33 be in place over stub-out runs a minimum of 5' past the end manhole.

34  
35 **d. Slope:**

36  
37 (1) All gravity wastewater lines shall be designed with hydraulic slopes sufficient to give mean  
38 velocities, when flowing full or half full, of not less than 2 fps and not more than 5 fps, based on  
39 Manning's formula using an "n" value of 0.013. The upsizing of sewers to reduce slopes will not  
40 be permitted unless justified by calculated flows.

41  
42 (2) The following minimum slopes will be used:

43  
44 (a) 8" 0.40%

45 (b) 10" 0.28%

46 (c) 12" 0.22%

1 **e. Cover**

2  
3 The minimum cover over gravity sewers shall be 4'.  
4

5 **f. Manholes:**

6  
7 (1) Manholes shall be installed at the end of each sewer; at every change in grade, size, or  
8 alignment; at all sewer intersections; and at distances not greater than 400' apart.  
9

10 (2) Manholes shall be placed in accessible locations, preferably in pavement flush to the surface.  
11 Manholes in roadway pavement shall not be located in low areas and wheel paths (i.e. structures  
12 shall be located centered in the travel lane, crown of road, paved shoulder or off the pavement).  
13 Manholes located in unpaved areas shall have the rim elevation 2" higher than the surrounding  
14 ground and a concrete collar shall be placed around the manholes; the concrete shall be sloped  
15 from the rim and taper out to the existing ground.  
16

17 (3) Manholes shall not be placed in low-lying areas where storm water inflow may occur. The  
18 manhole cover and frame shall prevent inflow of storm water and shall be on the Qualified  
19 Products List.  
20

21 (4) The design depth of the manhole from rim elevation to invert elevation shall be no less than  
22 4.5' and no more than 20', unless specifically approved by the PSLUSD in writing.  
23

24 (5) Standard manholes shall be provided with a minimum 0.1" drop in the invert.  
25

26 (6) Where the drop in invert exceeds 0.1" but is less than 2', a channel shall be constructed to  
27 prevent solids deposition in the manhole.  
28

29 (7) An inside drop connection shall be provided when a sewer enters a manhole 2' or higher than  
30 the main invert channel as shown in the standard detail.  
31

32 (8) A collector service connection shall not be directed into a manhole.  
33

34 **3. DESIGN CRITERIA FOR INTERCEPTORS**

35  
36 **a. GENERAL**

37  
38 (1) Interceptors shall be provided when, in the opinion of the Utility Director, they are necessary  
39 for the pretreatment of wastewater containing excessive amounts of grease, oil, hair, lint, sand or  
40 other solids and substances that are harmful or hazardous when discharged into wastewater  
41 facilities.  
42

43 (2) Interceptors are specifically required for establishments with food service, laundry, car wash,  
44 services for repair or maintenance of vehicles/mechanical equipment, barber shops, beauty  
45 salons, and animal care facilities. Interceptor may be required for institutional facilities and other  
46 establishments based on the characteristics of the wastewater, past experience, field inspections,

1 maintenance records and operational issues. Separate plumbing shall be provided for the  
2 wastewater to be treated through an interceptor (see example on page 26).

3  
4 (3) An interceptor shall be provided in compliance with these requirements when an existing  
5 establishment, listed in (2) above, is expanded or remodeled.

6  
7 (4) Interceptors are not required for single-family homes and private dwelling units.

8  
9 (5) Interceptors shall not be shared. Each business required to have an interceptor shall have its  
10 own separate plumbing, interceptor and water meter (see example on page 27). When the same  
11 establishment has multiple uses requiring an interceptor, such as an institutional facility with a  
12 kitchen and laundry, each use shall be provided with separate plumbing and interceptor.

13  
14 (6) Wastewater from toilets, urinals, showers, and other similar plumbing fixtures for human  
15 waste shall not discharge into an interceptor for kitchen, laundry, animal care or facilities for  
16 servicing vehicles/mechanical equipment (see example on page 28).

17  
18 (7) Wastewater required to be treated in an interceptor shall enter the interceptor through an inlet  
19 pipe only.

20  
21 (8) All equipment and plumbing fixtures in a food service facility that may introduce fats, oil or  
22 grease into the PSLUSD wastewater facilities must be connected through the grease interceptor,  
23 including but not limited to:

24 (a) Scullery sinks (two or three compartment)

25  
26 (b) Pots and pan sinks

27  
28 (c) Floor drains in kitchen, walk-in coolers and washing areas (not including public restrooms).

29  
30 (d) Pre wash sinks

31  
32 (e) Dishwashers and other washing machines

33  
34 (f) Automatic hood wash units

35  
36 (g) Indoor garbage can washes

37  
38  
39 (9) Establishments with facilities for servicing of vehicles/mechanical equipment shall connect  
40 all plumbing (other than the restroom) from the area where repairs and maintenance is being  
41 performed into a sand/oil interceptor; this includes but is not limited to floor drains and hand  
42 wash sinks. Engine oil, transmission oil, coolant, solvents, additives, brake fluid and any other  
43 fluid collected in the process of servicing vehicles/mechanical equipment shall not be discharged  
44 into the interceptor or other plumbing; the handling and disposal of these fluids shall be in  
45 compliance with the FDEP and PSLUSD rules and regulations.  
46

1 (10) Concrete interceptors shall be designed in accordance with ASTM C 890-91 (Re-approved  
2 1999), Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional  
3 Pre-cast Concrete Water and Wastewater Structures, for the appropriate loading.  
4

5 (11) Grease, oil and sand interceptors shall be provided with an access manhole over the inlet  
6 and outlet ends. Traffic rated lids shall be installed with manhole covers to finished grade.  
7

8 (12) The wastewater collection system for commercial projects shall be designed to  
9 accommodate the installation of interceptors for future uses and phases of the project (see  
10 example on page 28). Construction plans submitted to the PSLUSD shall indicate areas reserved  
11 for the placement of future interceptors. Physical property restrictions or lack of sewer gradient  
12 shall not be a defense for failure to provide adequate interceptors.  
13

14 (13) A sampling and inspection manhole may be required downstream of grease, oil and sand  
15 interceptors.  
16

## 17 **b. DESIGN CONSIDERATIONS**

18  
19 Interceptors shall be designed by a Professional Engineer licensed in Florida, in accordance with  
20 applicable building codes, state regulations and provisions of this manual. The design shall be  
21 based on the characteristics of the wastewater and the peak flow rate. The EOR shall take into  
22 consideration the specifications for interceptors in Section J.7 of this Chapter, the PSLUSD  
23 standard details and the criteria indicated below.  
24

### 25 **(1) Location (Not Applicable to Interceptors for Barber Shops & Beauty Salons)**

26  
27 The site plan shall provide for area(s) conducive to the installation of an exterior, in-ground  
28 interceptor for all spaces, bays or suites. Proper planning of areas for interceptors is particularly  
29 essential when designing a new strip center, strip mall, plaza, shopping center or any other  
30 commercial project where the type of tenancy is uncertain. The location shall be based on the  
31 following criteria:

32 (a) Interceptors shall be located in proximity of the building and the sewer lateral to allow  
33 gravity flow.  
34

35 (b) Interceptors shall be located underground, outside building structures and shall not be  
36 placed in any type of enclosure.  
37

38 (c) Interceptors shall be located in grass/non-traffic areas, unless approved in writing by the  
39 PSLUSD.  
40

41 (d) Interceptors shall not be located in low areas subject to flooding. The site shall be sloped to  
42 drain storm water away from the interceptor.  
43

44 (e) Interceptors shall be located as to be easily accessible at all times for routine inspection,  
45 cleaning and maintenance, and to pose no hazard to public health or safety. Interceptors shall not  
46 be placed in parking spaces or sidewalks.

1 **(2) Size**

2  
3 The PSLUSD will specify the minimum capacity and the type of interceptor that will be  
4 required, based on the information submitted by the applicant and the EOR; the EOR may  
5 specify a larger capacity.  
6

7 **(3) Design Criteria**

8  
9 The design criteria shall include but not be limited to the following, depending on the type of  
10 facility:  
11

12 **(a) Food Service Facilities**

13  
14 (i) A grease interceptor shall be provided in accordance with the standard detail. A baffle  
15 is required, as shown in the detail, unless multiple tanks are used.  
16

17 (ii) When the size specified by the PSLUSD is greater than 1250 gallons, the installation  
18 of multiple tanks in series may be required.  
19

20 (iii) When food wastes containing grease or oil are processed through a garbage disposal,  
21 the waste from the garbage disposal shall be directed to a solids separator for separating  
22 the solids before discharging into the grease interceptor (see example at the end of this  
23 Section). A combination solids and grease interceptor may be installed if the effective  
24 capacity of the interceptor is increased to accommodate the waste from the garbage  
25 disposal.  
26

27 (iv) The water temperature for the dishwasher shall be limited to 120° F.  
28

29 **(b) Laundry Interceptor** - Interceptors for commercial laundries shall be equipped with a  
30 wire basket or similar device removable for cleaning that prevents passage of solids ½” or larger  
31 in size, strings, rags, buttons or other materials detrimental to the wastewater facilities.

32 **(c) Interceptor for car washes and facilities servicing vehicles/mechanical equipment** - All  
33 such facilities shall install a combination sand and oil interceptor.  
34

35 **(d) Interceptor for barber shops and beauty salons** – a hair interceptor shall be installed  
36 under the sinks used for shampoo.  
37

38 **(e) Interceptor for institutional facilities that include uses such as schools, child care,**  
39 **adult congregate, assisted living, nursing homes, hospitals, labor camps, juvenile detention,**  
40 **prisons, etc.** – When required by the PSLUSD, an interceptor for such facilities shall be  
41 designed to remove rags, clothes, diapers, toys or other objects that would cause overflow of  
42 sewage or damage to the PSLUSD wastewater facilities. Separate plumbing and interceptors  
43 shall be provided for the human, kitchen and laundry wastes.  
44

45 **(f) Interceptor for animal care facilities for housing, holding, hygiene or medical**  
46 **treatment of animals, i.e. kennel, pet grooming, pet shop, shelter, hospital, etc.-** Such

1 facilities shall, as a minimum, install an interceptor for retention of hair; a combination hair and  
2 solids interceptor may be needed depending upon the characteristics of the wastewater.

3  
4 **c. SUBMITTAL**

5  
6 The following information shall be submitted by the EOR to the PSLUSD:

7  
8 (1) A site plan showing the proposed service line, location of the interceptor and area(s) reserved  
9 for future interceptors; this is not required in case of interceptors for barber shops and beauty  
10 salons.

11  
12 (2) Detailed calculations for the peak flow rate of commercial/industrial wastewater;

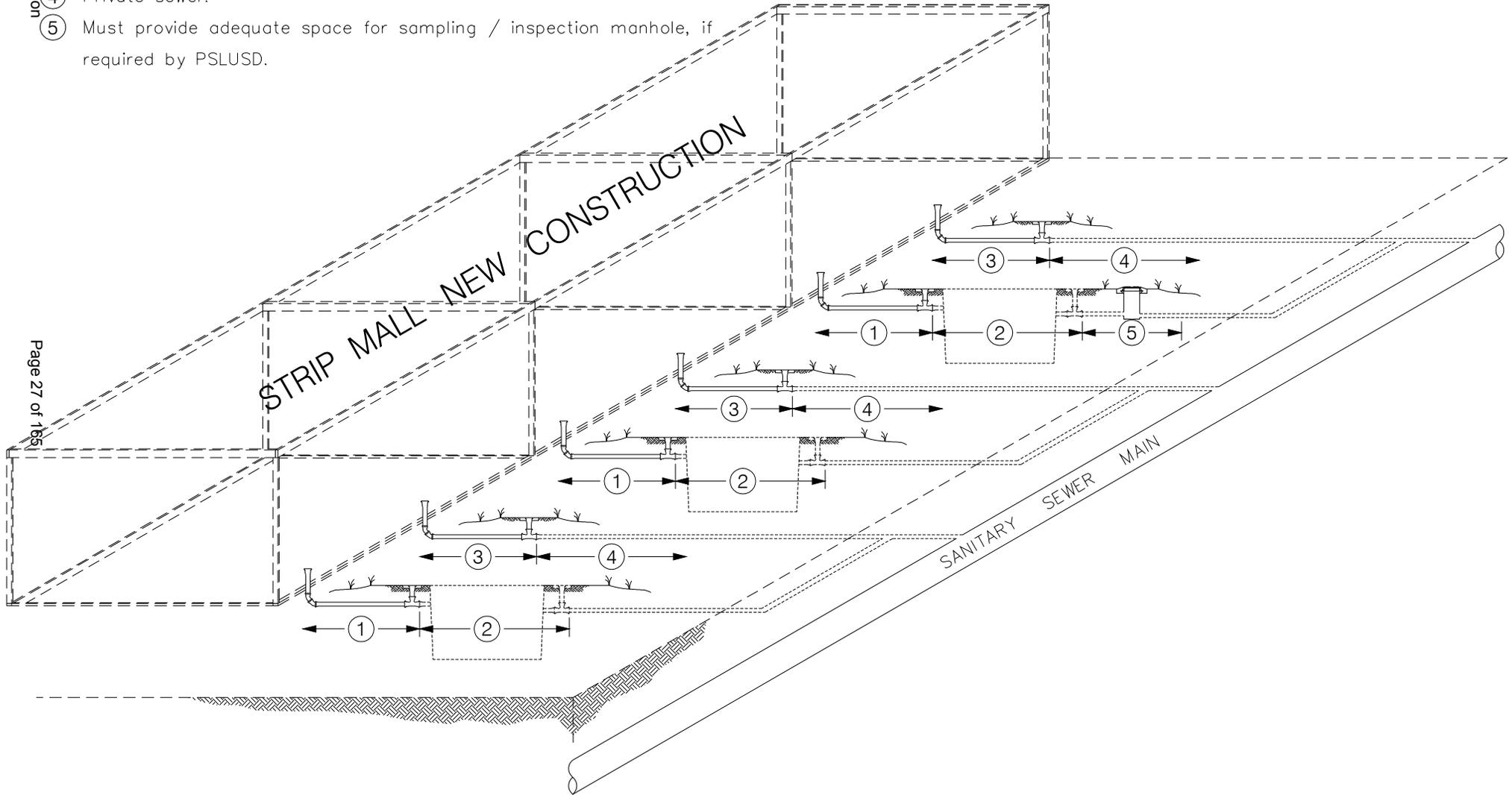
13  
14 (3) Characteristics of all commercial/industrial wastewater from proposed and potential uses of  
15 the project.

16  
17 (4) A copy of the floor plan plumbing plan and plumbing configuration, as shown in the  
18 examples on pages 26, 27, and 28.

19  
20 (5) The capacity of the interceptor, manufacturer and model number shall be specified prior to  
21 the preconstruction meeting. The interceptor shall be on the Qualified Product List or shop  
22 drawings shall be submitted to the PSLUSD.



- 2011 Edition
- ① REQUIRED: Stub-out must be provided for future line to Interceptor.
  - ② REQUIRED: Must provide adequate space to install future Interceptor.
  - ③ Sanitary sewer stub-out.
  - ④ Private sewer.
  - ⑤ Must provide adequate space for sampling / inspection manhole, if required by PSLUSD.



**Notes**

- If ② is an oil / grease / sand interceptor refer to Standard Detail for installation.

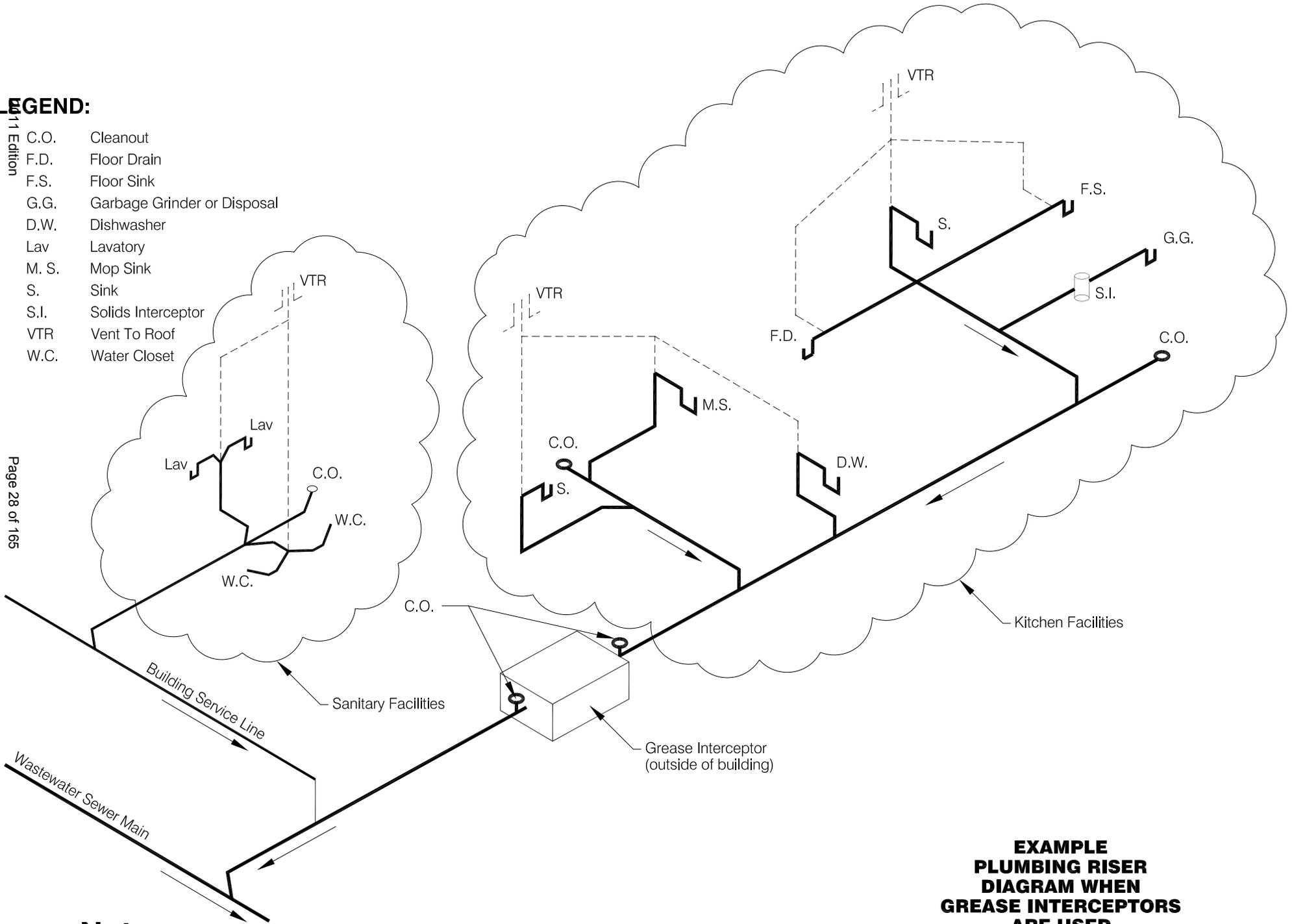
**EXAMPLE  
NEW CONSTRUCTION  
- FLEX SPACE/STRIP MALL -  
PLUMBING CONFIGURATION**

**LEGEND:**

11 Edition

- C.O. Cleanout
- F.D. Floor Drain
- F.S. Floor Sink
- G.G. Garbage Grinder or Disposal
- D.W. Dishwasher
- Lav Lavatory
- M. S. Mop Sink
- S. Sink
- S.I. Solids Interceptor
- VTR Vent To Roof
- W.C. Water Closet

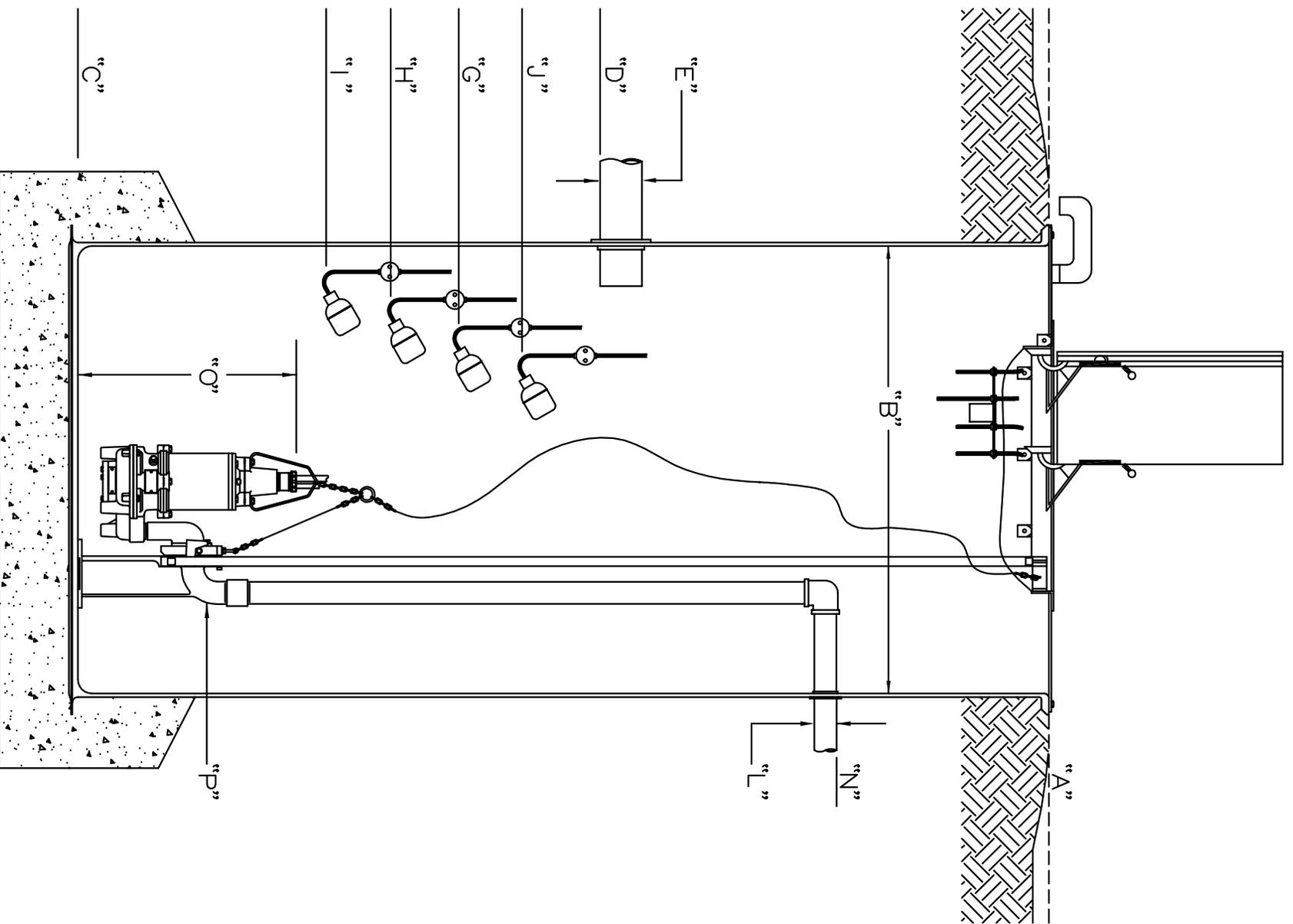
Page 28 of 165



**Notes**

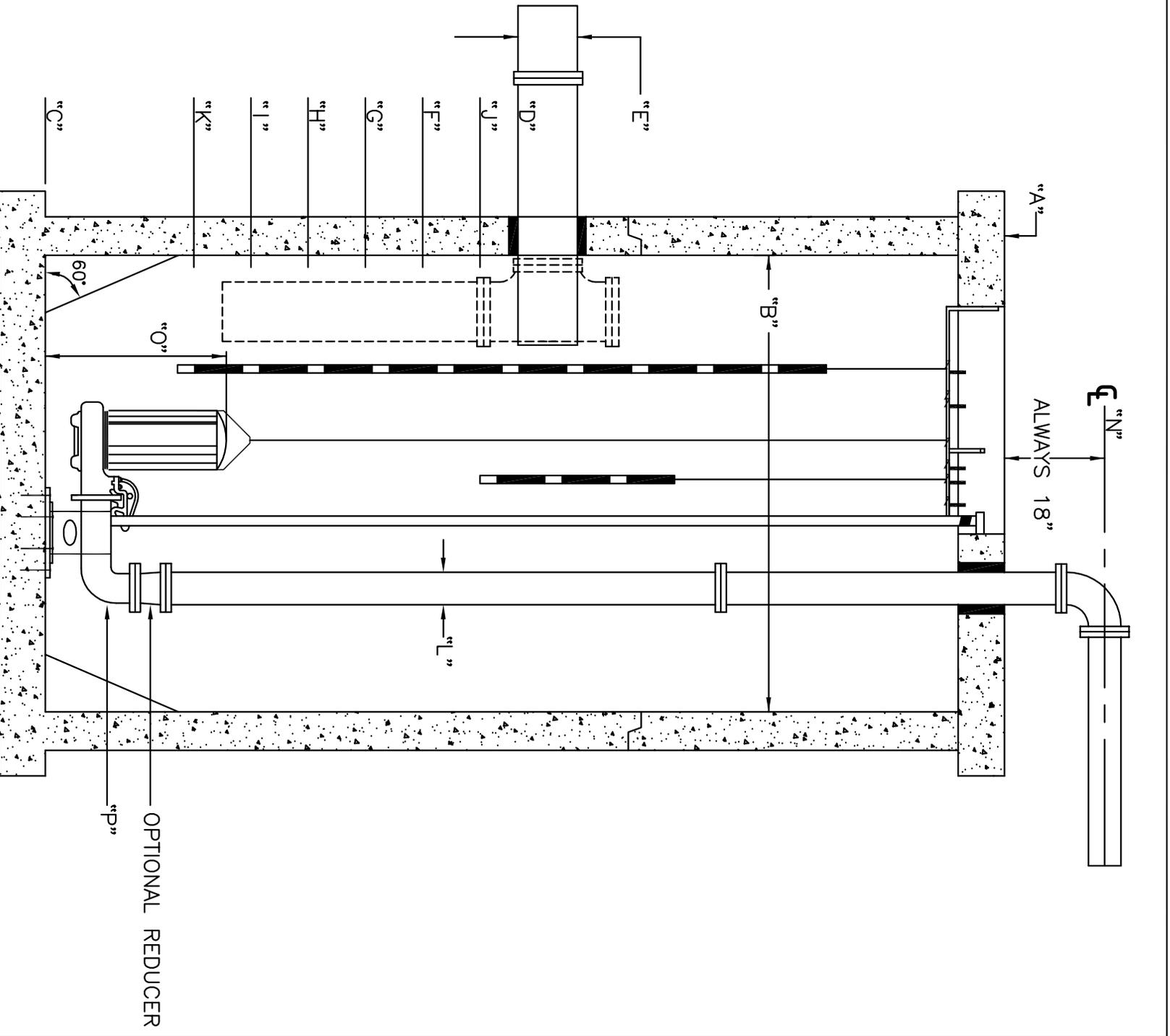
- This EXAMPLE PLUMBING RISER DIAGRAM is intended for informational purposes only. It does not match the Example Grease Interceptor Site Plan

**EXAMPLE  
PLUMBING RISER  
DIAGRAM WHEN  
GREASE INTERCEPTORS  
ARE USED**



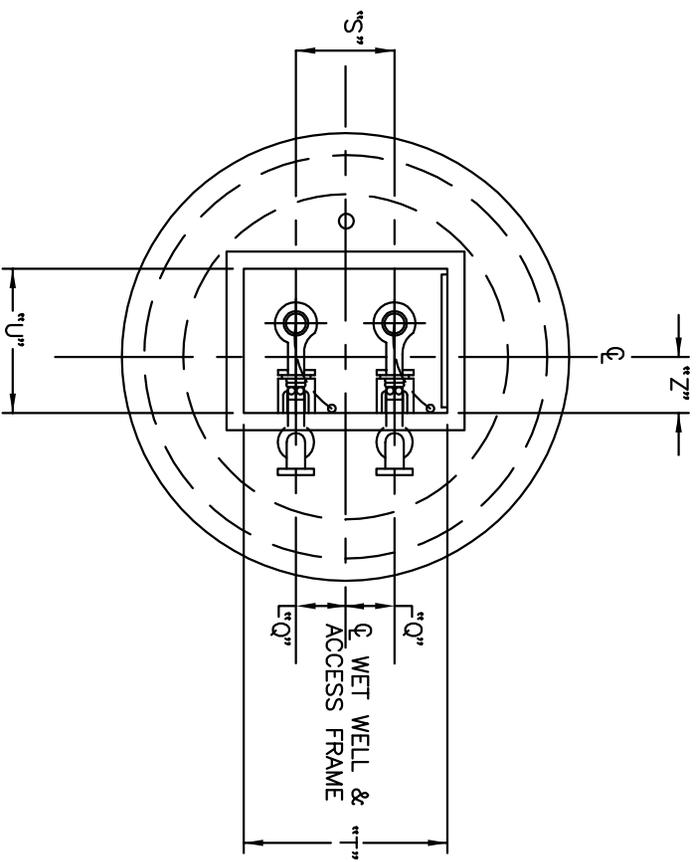
NOTE: INFORMATION RELATING TO THE DIMENSIONS AND/OR ELEVATIONS NOTED IN " " SHALL BE SUBMITTED BY ENGINEER-OF-RECORD TO THE PLSUSD.

**GRINDER SYSTEM WET WELL**

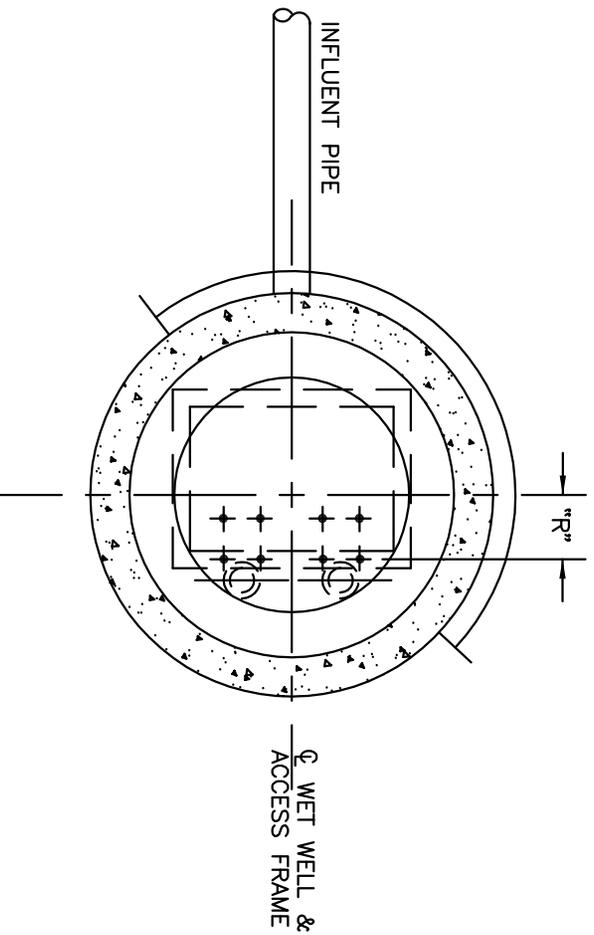


NOTE: INFORMATION RELATING TO ITEMS "A" THROUGH "P" SHALL BE SUBMITTED ON PSLUSD FORM NO. 29 BY THE ENGINEER-OF-RECORD TO THE PSLUSD WITH THE CONSTRUCTION PLANS.

### LIFT STATION WET WELL



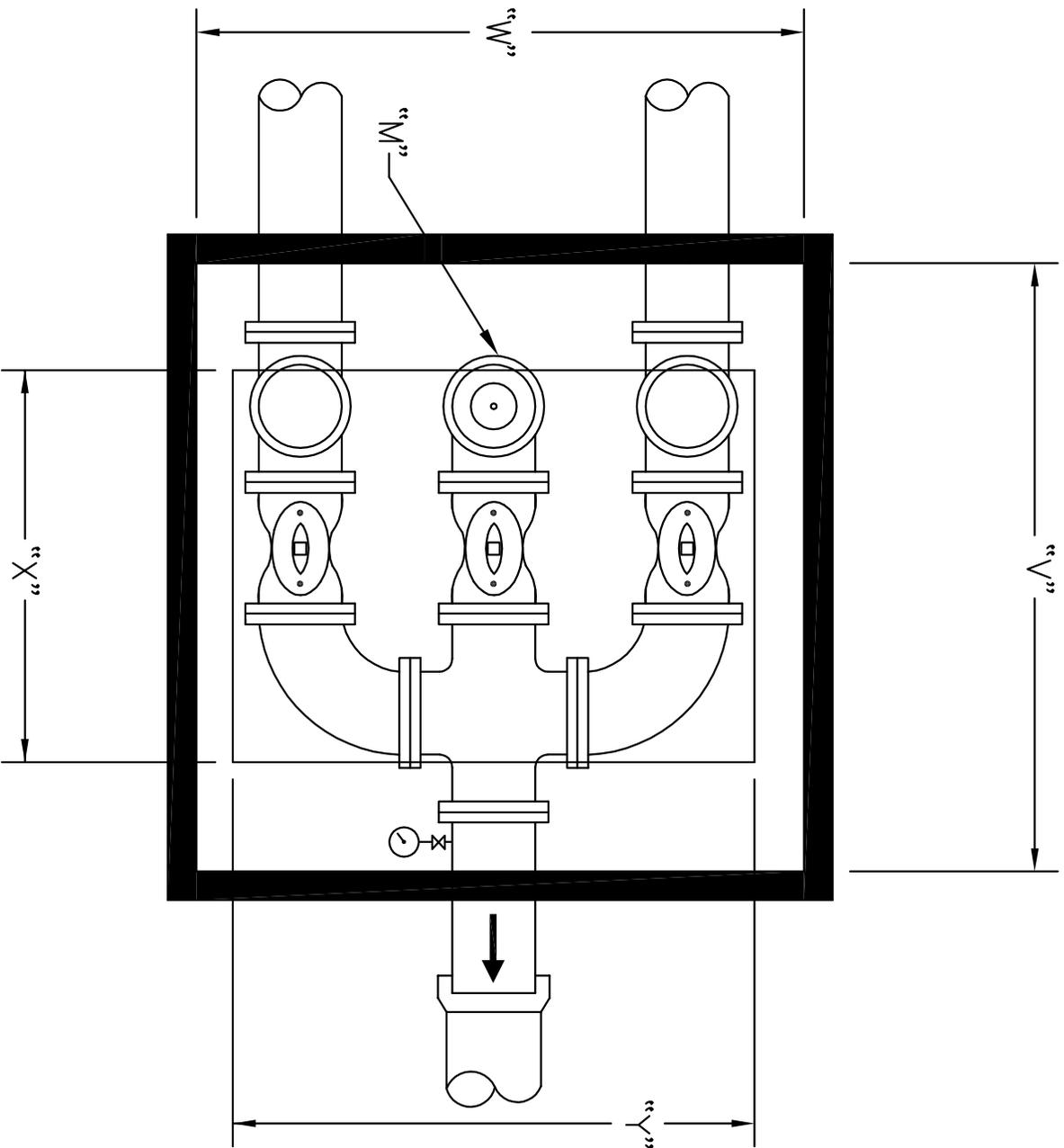
PLAN VIEW GRADE ELEVATION



PLAN VIEW BASE ELEVATION

NOTE: THE DIMENSIONS SHOWN SHALL BE SUBMITTED BY THE ENGINEER-OF-RECORD TO THE PSLUSD WITH THE SHOP DRAWINGS.

**PUMP STATION WET WELL**



NOTE: DIMENSIONS FOR ITEMS "M" AND "V" THROUGH "Y" SHALL BE SUBMITTED BY THE ENGINEER-OF-RECORD TO THE PLSUSD WITH THE SHOP DRAWINGS.

## VALVE VAULT

1 **4. DESIGN CRITERIA FOR WASTEWATER PUMP STATIONS**

2  
3 **a. GENERAL**

4  
5 (1) The property owner of existing and proposed developments shall provide a gravity  
6 wastewater collection system. A pump station will be used only when connection to the  
7 PSLUSD wastewater facilities is not possible due to elevation of the receiving gravity sewer.  
8 The PSLUSD may require submittal of an economic analysis by the EOR to compare the cost of  
9 gravity sewer versus a pump station over a period of 30 years, including capital and maintenance  
10 costs.

11  
12 (2) Pump stations shall be designed in accordance with Chapter 62-604, Florida Administrative  
13 Code and provisions of this manual. The specifications for the various components (Section J.8)  
14 and the PSLUSD standard details shall be used in conjunction with the design criteria specified  
15 herein.

16  
17 (3) All wastewater pump stations shall be owned, operated and maintained by the PSLUSD. An  
18 exclusive utility easement shall be provided as required under Section B of this Chapter.

19  
20 (4) Pump stations shall be designed for a 30-year useful life and shall conform to the PSLUSD  
21 Master Plan. The PSLUSD shall have the right to require the design and construction of the  
22 pump station to allow other properties to connect to the system.

23  
24 (5) The developers/owners of adjoining properties shall coordinate to provide a common pump  
25 station.

26  
27 (6) Pump stations shall be designed and located so as to minimize the adverse effects resulting  
28 from odor, noise and lighting. The installation of an odor control system may be required if a  
29 long cycling time, or close proximity to occupied structures may create an odor problem.

30  
31 (7) Pumps shall be designed, at a minimum, with capacity to handle the anticipated peak hourly  
32 flow with one pump out of service.

33  
34 (8) Electric power, which meets the voltage and phase requirements of the pump station, shall be  
35 made available to the pump station site. All pumps shall be either 230 or 460 volts.

36  
37 (9) Pump stations shall be protected from lightning and transient voltage surges. As a minimum,  
38 stations shall be equipped with lightning arrestors, surge capacitors or similar protection devices  
39 and phase protection.

40 (10) The potential for damage or interruption of operation because of flooding shall be  
41 considered in the location of new pump stations. Pump stations shall be designed to stay fully  
42 operational and accessible during a 25-year flood. The electrical and mechanical equipment shall  
43 be protected from physical damage by a 100-year flood. Design shall include measures to  
44 withstand floatation forces when empty.

45  
46 (11) Pump stations shall be equipped with submersible pumps.

1 (12) Pump stations shall be equipped with an audible and visible high water level alarm.

2  
3 (13) Water service shall be provided to the pump station site and protected with an approved  
4 backflow prevention assembly.

5  
6 (14) A fall through prevention system is required for the wet well access opening. The system  
7 shall be installed by the manufacturer or by a contractor approved by the manufacturer.

8  
9 (15) Explosion proof motors, lights, cables, conduits, switch boxes, and other electrical  
10 equipment shall be used in areas where fire or explosion hazards may exist due to flammable  
11 gases, vapors, or liquids, combustible dust or ignitable fibers or flyings. The electrical  
12 components shall comply with the National Electrical Code requirements for Class I, Division I,  
13 Group D locations.

14  
15 **b. SUBMITTAL**

16  
17 (1) Design report prepared by the Engineer of Record (EOR) must be submitted with the  
18 following information:

19  
20 (a) Construction plans as required under Section D, Chapter I.

21  
22 (b) Calculations including, but not limited to:

23  
24 (i) Average daily flow (ADF) and Peak Hourly Flow (PHF) - Average daily flow shall be  
25 based on the type of use and the number of hours of operation. Engineering references,  
26 historical flows or other acceptable methods may be used to determine ADF; the method  
27 used shall be specified. The design average flow for facilities subject to seasonal high use  
28 (e.g., recreational areas, resorts, campuses, industrial facilities) shall be based on the daily  
29 average flow during the seasonal period.

30  
31 (ii) A maximum storage retention time of 30 minutes.

32  
33 (iii) ADF/PHF cycle / run times and starts per hour - Cycle time calculations for pump  
34 starts between 2 and 10 per hour, not to exceed the manufacturer's recommendation.

35  
36 (iv) Total dynamic head (TDH).

37  
38 (v) Analysis of system pressure for current and future (30 year projection) conditions,  
39 including highest and lowest system pressures.

40  
41 (vi) Protection against floatation with a minimum safety factor of 1.1.

42  
43 (vii) The size of the emergency power equipment based on capacity to start and maintain  
44 the total rated operating capacity of the pump station. Electrical sizing calculations shall  
45 assume loading based on the starting and full operation of pumps and all electrical  
46 equipment associated with the pump station.

1 (c) The information listed on the Pumping Station Data Table (Table 2, pages 35-39),  
2 including but not limited to the dimensions of wet well and valve vault, size of piping, pump  
3 specifications, operating levels, and elevations. The table is intended to provide a basis for  
4 design and construction. The EOR shall modify the information, as necessary, and provide  
5 additional details not shown as may be required by applicable codes and standards. All changes  
6 shall be clearly identified.

7  
8 The Pumping Station Data Table and accompanying details can be downloaded from the  
9 PSLUSD website at [http://www.cityofpsl.com/utility/commercial-development/utility-](http://www.cityofpsl.com/utility/commercial-development/utility-commercial-development.html)  
10 [commercial-development.html](http://www.cityofpsl.com/utility/commercial-development/utility-commercial-development.html).

11  
12 (d) Pump data including the performance curve, capacities and efficiency based on the  
13 manufacturer's shop testing of like units. Curves shall be submitted in an 8 1/2" x 11" format, at  
14 as large a scale as practical. Curves shall be plotted from zero flow at the pump's shut off head to  
15 the pump's capacity. The EOR shall plot the specific system design on the manufacturer's curve,  
16 plotting from zero flow at the designed static head, to and through the selected pump  
17 performance curve. Pump family curve tables are not acceptable.

18  
19 (e) The availability of electric power compatible with the pump voltage and phase  
20 requirements. The EOR shall address whether existing electrical service is adequate or will need  
21 to be extended to the site. The details for extension of service shall be included.

### 22 23 **c. TYPE OF PUMP STATIONS & RELATED DESIGN CONSIDERATIONS**

24  
25 The type of pump station required depends on the size of the project and whether the connection  
26 is into a low-pressure sewer system or a force main. Table 1 and the details provided herein shall  
27 be used as design criteria.

#### 28 29 **(1) Grinder Station**

30  
31 A grinder pump system is typically used for small projects with 7500 gallons per day (gpd) flow  
32 or less. The requirements for single phase and three phase grinder systems are detailed below.

33  
34 **(a) Single-Phase Duplex Grinder Station** consists of a dual pump system that operates on  
35 230-volt, single-phase electrical power, with a 2 Horse Power (HP) motor. The single-phase  
36 duplex system may be approved on a case-by-case basis by PSLUSD if the wastewater generated  
37 by the project is limited to 1000 gpd and an interceptor is not required for the proposed use;  
38 written approval must be obtained from the PSLUSD.

39  
40 **(b) Three-Phase Duplex Grinder Station** consists of a dual pump system that operates on  
41 230-volt three-phase electrical power with a 2, 3 or a 5 HP motor. The three-phase duplex system  
42 may be used in commercial applications in accordance with Table 1.

1 (c)

2 **Minimum Design Requirements**

3  
4 (i) The wet well shall be 4' diameter fiberglass basin; depth shall be site specific and a  
5 minimum of 6' deep.

6  
7 (ii) The wet well shall have only one influent pipe.

8  
9 (iii) A check valve and gate valve is required on the discharge line of each pump.

10  
11 (iv) An emergency pump-out connection with a gate valve is required on the discharge  
12 piping.

13  
14 (v) A separate valve vault is required for grinder stations.

15  
16 (vi) An approved generator receptacle shall be provided for connecting to a portable  
17 generator during extended power failure.

18  
19 (vii) A 10'x 45' unobstructed area for a vacuum truck within 10' of the wet well. The  
20 slope of unobstructed area for the truck and access driveway shall not exceed 10%.

21  
22 **NOTE: See Sample Location for Maintenance Truck**

23  
24 **(2) Lift Stations**

25  
26 (a) A lift station shall be designed for 230/460 volt, 3-phase, and 60-cycle electric service.  
27 Each pump shall have a horsepower rating between 10 HP and 47 HP and a speed rating between  
28 1700 and 1800 rpm. A lift station shall be provided in accordance with Table 1, when the project  
29 does not meet the requirements of a grinder system or the constraints of the PSLUSD wastewater  
30 collection system.

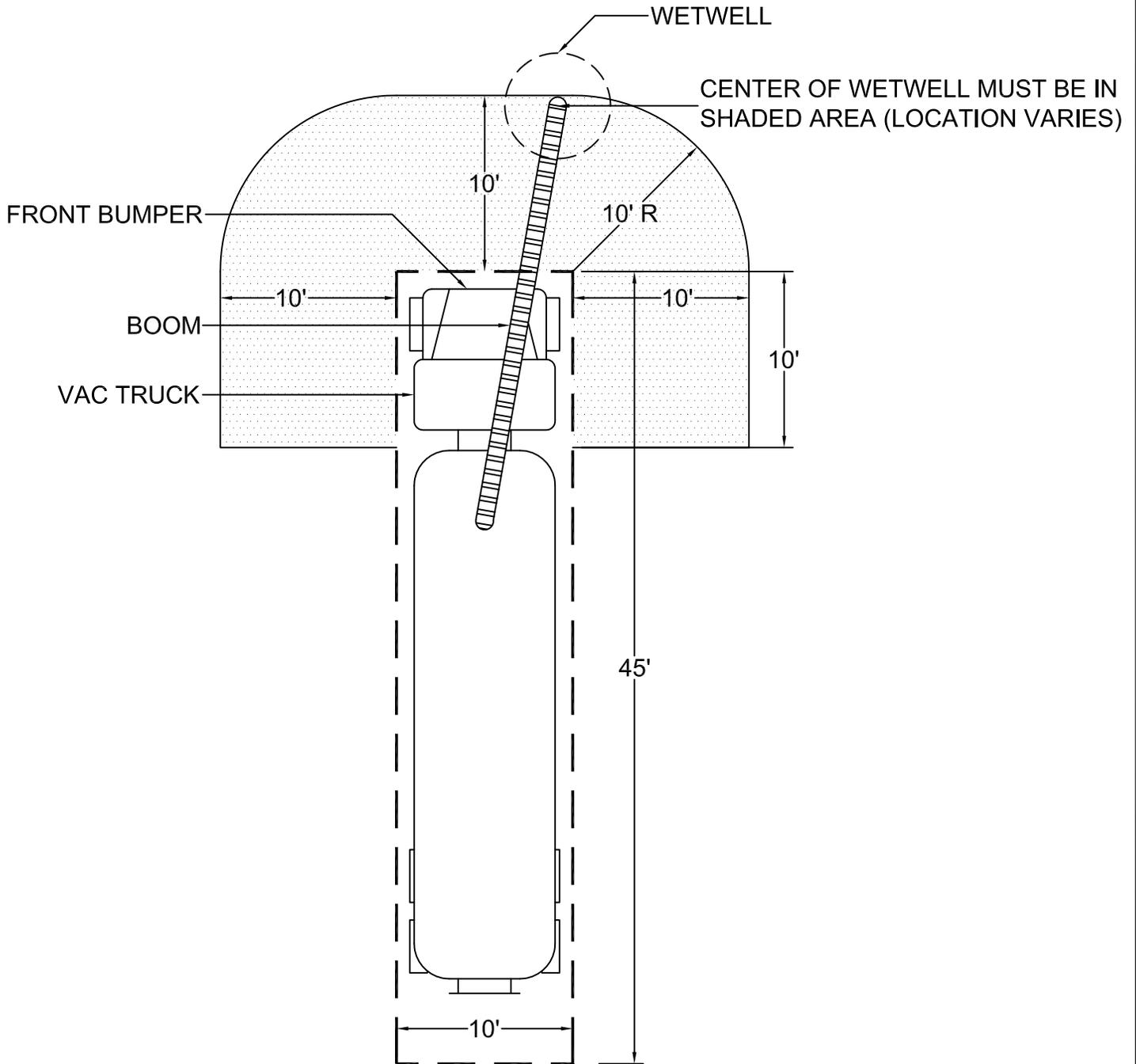
31  
32 (b) Minimum Design Requirements:

33  
34 (i) A duplex lift station shall be provided for projects with a flow of up to 250,000 gpd.  
35 For projects over 250,000 gpd or peak flows over 700 gallons per minute (gpm), a triplex  
36 lift station shall be provided.

37  
38 (ii) In projects constructed in phases, master lift stations that will have minimal flows for  
39 a considerable time shall be equipped with temporary impellers with reduced capacity,  
40 though not less than 50% of a permanent pump. The installed electrical equipment, pump  
41 housing and motor shall meet the ultimate flow condition. A second set of impellers for  
42 full flow conditions will be required to be furnished prior to lift station start-up. The  
43 selected pumps and electrical system must allow for a minimum of one impeller upgrade  
44 in the future.

1 (iii) The station shall include a wet well, control valves, generator pad, telemetry system,  
2 a 6' chain link fence with a lockable gate opening and a 10' x 45' unobstructed area for a  
3 vacuum truck within 10' of the wet well.  
4

5 **NOTE: See Sample Location for Maintenance Truck**  
6  
7  
8  
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NOTE:  
 CONSTRUCTION PLANS OR LIFT STATION DETAIL TO SHOW 10' X 45'  
 DASHED AREA

**LIFT STATION / MAINTENANCE TRUCK LOCATION**

1 (iv) The minimum diameter of the wet well shall be 8'; the depth of wet wells shall not  
2 exceed 25', unless approved in advance by the PSLUSD. The wet well and access cover  
3 shall be as per the specifications included in Section J.8 of this Chapter.  
4

5 (v) A liquid level control system shall be provided. The system shall be composed of a  
6 multi-sensored or single sensed liquid detection probe used in conjunction with various  
7 monitoring, indicator and logic control devices. The one-piece multi-sensored probe shall  
8 have the capability to control several pumps and alarms, as well as indicate levels using  
9 discrete set points. The probe length shall allow for multiple operating ranges over a  
10 period of 30 years, as noted within the PSLUSD Master Plan Model.  
11

12 (vi) The wet well's operating water levels shall be arranged to insure pump operation  
13 without cavitation and insure the gravity sewer system is not surcharged. The operating  
14 levels for High Water Level Alarm, Lag Pump On, Lead Pump On, Pumps Off and  
15 Emergency Off (back-up) shall be established in increments as explained below.  
16

17 (vii) The depth of the wet well shall be adequate to provide for the necessary incremental  
18 set points of the probe, i.e. 6", 8", 10" and 12", without surcharging the influent line. The  
19 High Water Alarm elevation shall be set at a minimum of 6" below the lowest influent  
20 pipe invert elevation. The Pumps Off elevation shall be set so that the pumps are  
21 completely submerged at all times. The first point of the probe is not to be used for  
22 normal operations and shall be reserved for the redundant "emergency off" point on the  
23 back-up control system; this shall be set above the manufacturer's recommended  
24 submergence at all times.  
25

26 (viii) The valve assembly shall be designed per the PSLUSD standard detail. A plug  
27 valve is required on the discharge line of each pump with a pressure gauge on the  
28 discharge side of the plug valve. A check valve is required between the pump and plug  
29 valve. An emergency pump connection device shall be provided and shall be a male  
30 aluminum or bronze "Cam-loc" fitting with a dust cap and an isolation plug valve. A  
31 stainless steel ball valve shall be provided on the dust cap.  
32

33 (ix) The pump station site shall be well drained and graded to prevent flooding or inflow  
34 of surface runoff after a storm event. The exterior top of the wet well shall be designed at  
35 or above the 100 year/3-day flood elevation and shall not be below the crown elevation of  
36 an adjacent roadway.  
37

38 (x) Emergency pumping capability shall be provided for all lift stations. Stations that  
39 receive flow from one or more pump stations through a force main, triplex stations and  
40 pump stations discharging through pipes 12" or larger, shall provide for uninterrupted  
41 pumping capabilities, including an in-place emergency generator. For other stations  
42 emergency-pumping capability may be accomplished by connection of the station to at  
43 least two independent utility substations or by providing an approved generator  
44 receptacle and a portable generator. Such emergency standby system shall have sufficient  
45 capacity to start up and maintain the total rated running capacity of the station. In-place  
46 generators shall be equipped with an automatic transfer switch. The lift station site shall

1 include extension of the concrete driveway such that the emergency power system can be  
 2 operational on the driveway inside the fence and still allow access for operation and  
 3 maintenance of the wet well, control valves and control panel.  
 4

5 (xi) A telemetry and communication system shall be provided in accordance with the  
 6 specifications in Section J.8 of this Chapter. Extension of fiber optic cable may be  
 7 required when deemed necessary by the Utility Director.  
 8

9 **Table 1 - PUMP STATION DESIGN CRITERIA**  
 10

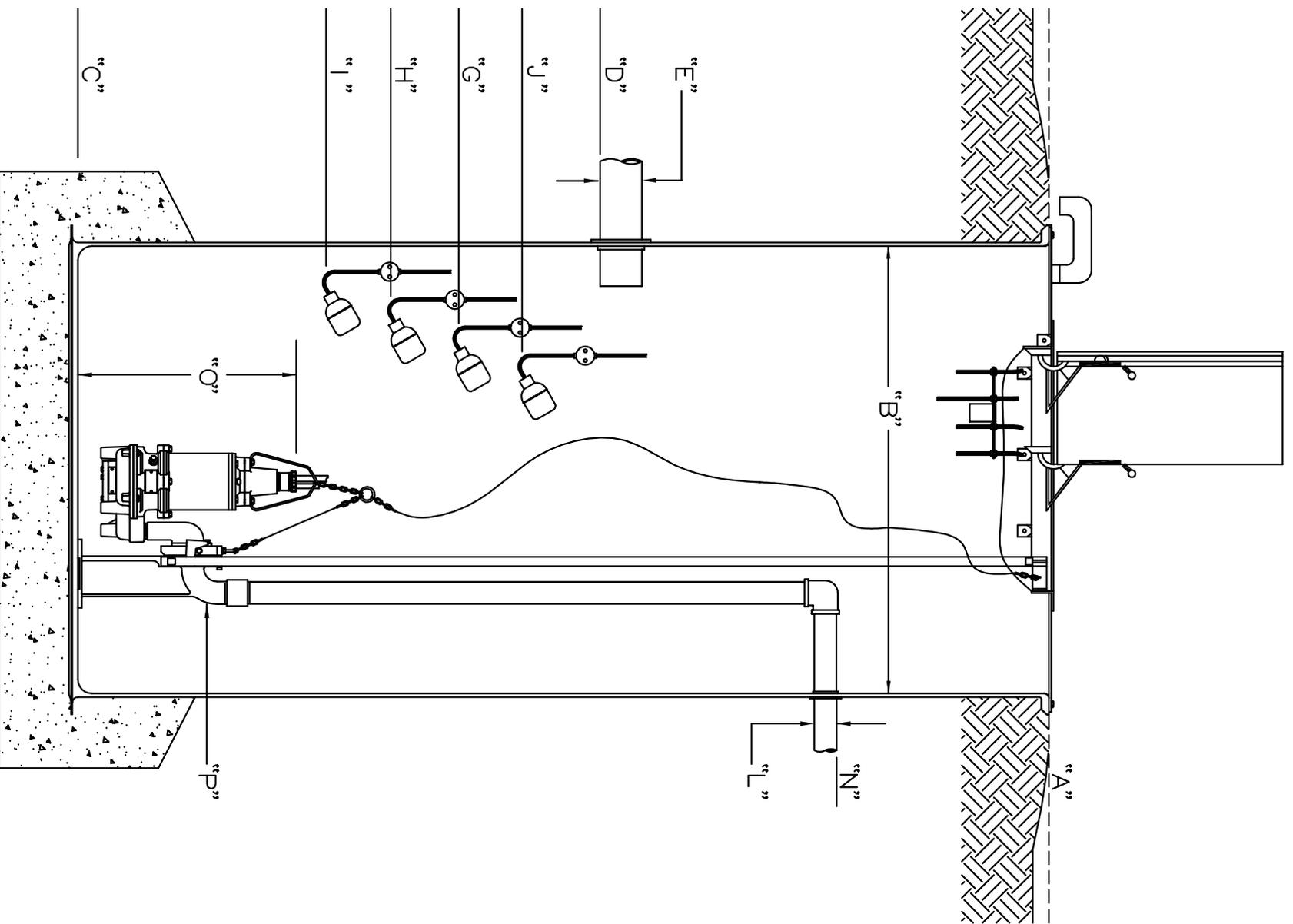
Design Basis	Low Pressure System		Force Main	
	7500 Max. *	7500 Max. *	7500 Max.	<= 250000 (Duplex) >250000 (Triplex)
<b>ADF (gallons/day)</b>				
<b>Type</b>	Grinder	Grinder	Grinder	Lift Station
<b>Size(HP)</b>	2	3	5	10 -47
<b>Voltage</b>	230	230	230	230/460
<b>Phase</b>	Three	Three	Three	Three
<b>Wetwell Diameter</b>	4'	4'	4'	8'-12'
<b>Wetwell Depth</b>	6'-10'	Varies	Varies	Varies
<b>Wetwell Material</b>	Fiberglass	Fiberglass	Fiberglass	Concrete
<b>Valve Vault</b>		Inside Vault	Inside Vault	Above Ground
<b>Easement (Min.)</b>	20'x20'	20'x20'	20'x20'	No Vault
				Duplex -30'x45'
				Triplex -45'x50'

11  
 12 \* Limited by capacity of the Low Pressure Sewer System  
 13  
 14  
 15  
 16  
 17  
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 30

**PUMPING STATION DATA TABLE**

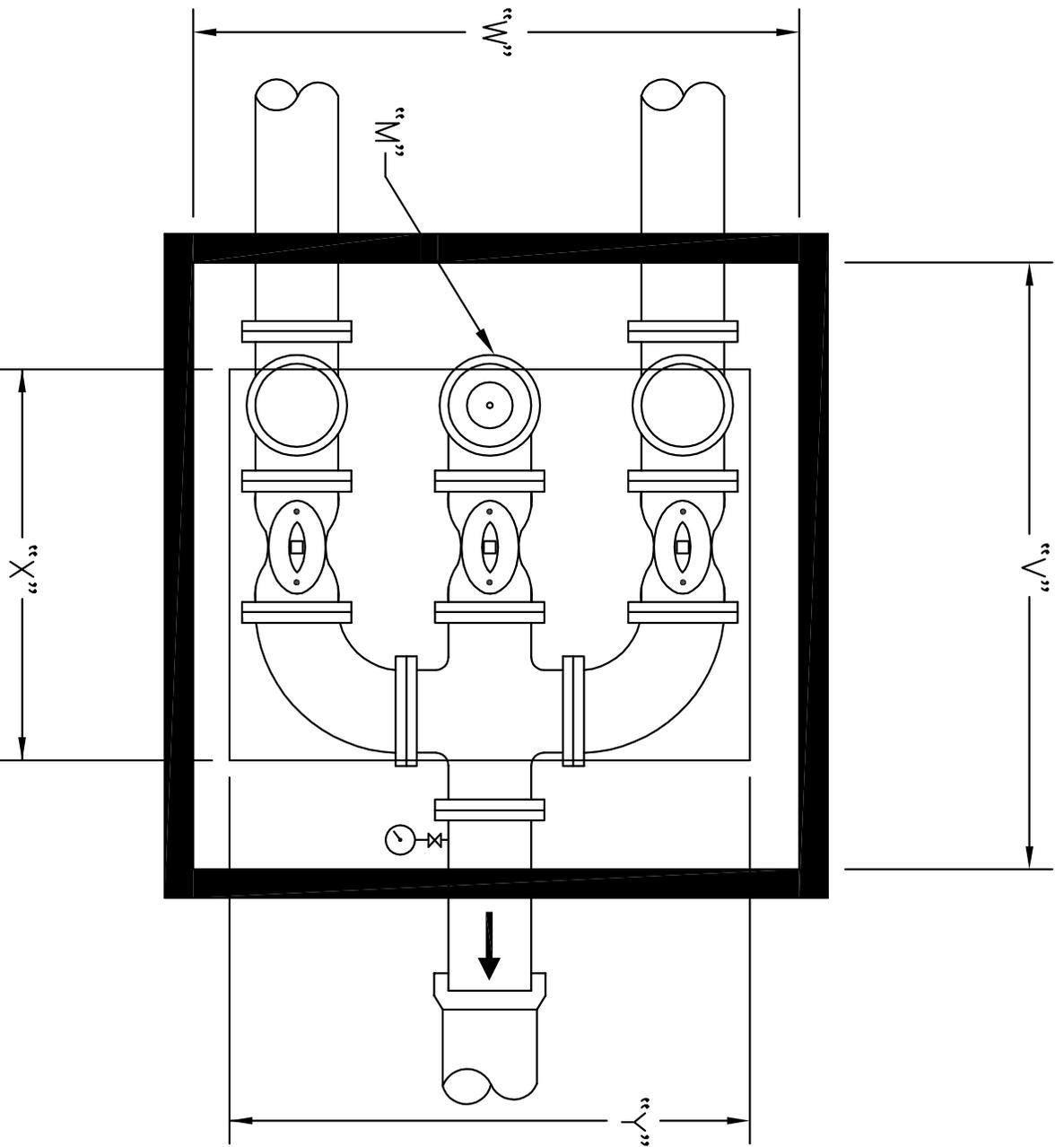
PSLUSD Lift Station ID #

						<b>Soft Start</b>				
Pump Model Number	WGL20	WG30H	WG50H	CP3127	CP3127	NP3153	CP3152	CP3170	CP 3201	CP 3201
Pump Manufacturer	Myers	Myers	Myers	Flygt	Flygt	Flygt	Flygt	Flygt	Flygt	Flygt
Pump Type	Grinder	Grinder	Grinder	Non-Clog	Non-Clog	Non-Clog	Non-Clog	Non-Clog	Non-Clog	Non-Clog
Horse Power	2	3	5	10	10	15	20	30	47	47
Impeller	5.5"	5.25"	5.5"	485	483	464	454	464	452	457
Phase	3	3	3	3	3	3	3	3	3	3
Voltage	230	230	230	230	230	460	460	460	460	460
Cycles (Hz)	60	60	60	60	60	60	60	60	60	60
RPM	3450	3450	3450	1745	1745	1745	1745	1745	1745	1745
Shut Off Head (ft)	105	105	120	72	90	112	123	135	168	148
Best Effecincy Point Flow (gpm)	N/A	N/A	N/A	333	480	580	809	799	1060	1054
Best Efficiency Point Head (ft)	N/A	N/A	N/A	36.5	50	63	64	78	99	90
Pump Efficiency @ BEP Point (%)	N/A	N/A	N/A	48	64	70	67	58	59	59
Run Out Flow (gpm)	40	97	95	700	900	1100	1400	1300	1800	1900
Run Out Head (ft)	20	28	60	10	11	20	18	40	23	20
"A" Wet Well Rim Elevation (NAVD)										
"B" Wet Well Diameter (ft)	4'	4'	4'	6' min	6' min	8' min	8' min	12' min	12' min	12' min
"C" Wet Well Bottom Elevation (NAVD)										
"D" Influent Pipe Invert Elevation (NAVD)										
"E" Influent Pipe Diameter (in)										
"F" Lag Pump 2 On Elevation (Tri-plex only)										
"G" Lag Pump On Elevation (NAVD)										
"H" Lead Pump On Elevation (NAVD)										
"I" Pumps Off Elevation (NAVD)										
"J" Alarm Elevation (NAVD)										
"K" Emergency Off Elevation (NAVD)										
"L" Discharge Pipe Diameter (in)	2	3	3	6	6	6	8	8	8	8
"M" Pump Out Diameter (in)	3	3	3	4	4	4	6	4	6	6
"N" Discharge Pipe Elevation (NAVD)										
"O" Pump Submergence (in)	23"	34	34	28	28	38	39	55	56	56
"P" Pump Discharge Diameter (in)	2	3	3	4	4	6	6	6	6	6
"Q" C/L of wetwell to C/L of pump (in)	N/A	N/A	N/A	16	16	16	18	18	18	18
"R" C/L of wetwell to C/L of pump bolts (in)	N/A	N/A	N/A							
"S" C/L of pump to C/L of pump (in)	20	22.75	22.75	32	32	32	36	36	36	36
"T" Wet Well Hatch (in)	24	24	24	48	48	60	60	72	72	72
"U" Wet Well Hatch (in)	36	36	36	36	36	36	36	42	42	42
"V" Exterior Valve Vault (in)	N/A	40	40	N/A	N/A	N/A	N/A	N/A	N/A	N/A
"W" Exterior Valve Vault (in)	N/A	50	50	N/A	N/A	N/A	N/A	N/A	N/A	N/A
"X" Valve Vault Hatch (in)	N/A	30	30	N/A	N/A	N/A	N/A	N/A	N/A	N/A
"Y" Valve Vault Hatch (in)	N/A	36	36	N/A	N/A	N/A	N/A	N/A	N/A	N/A
"Z" C/L of Wet Well to Inside Edge of Hatch	N/A	N/A	N/A	18	18	18	18	21	21	21



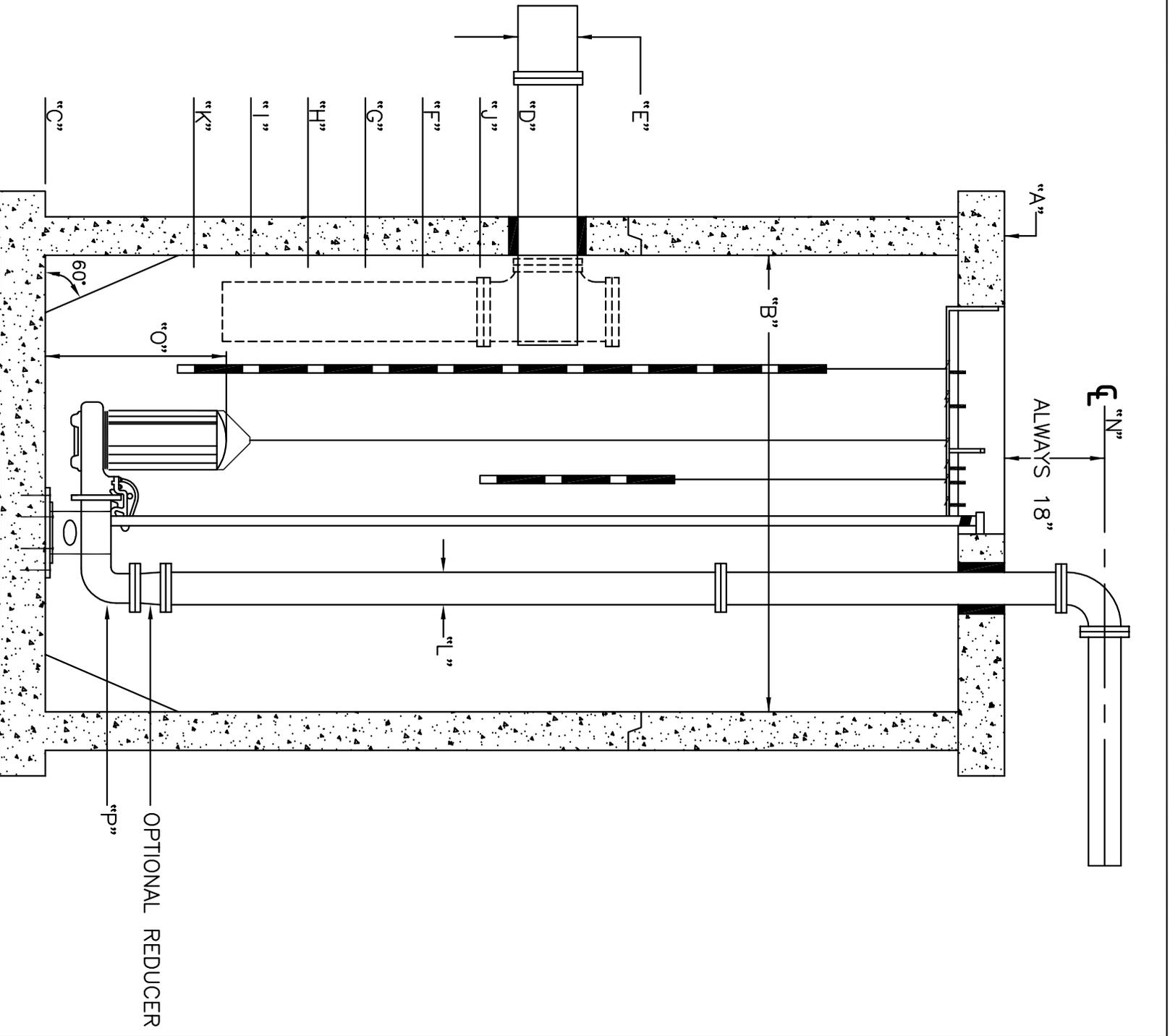
NOTE: INFORMATION RELATING TO THE DIMENSIONS AND/OR ELEVATIONS NOTED IN " " SHALL BE SUBMITTED BY ENGINEER-OF-RECORD TO THE PLSUSD.

**GRINDER SYSTEM WET WELL**



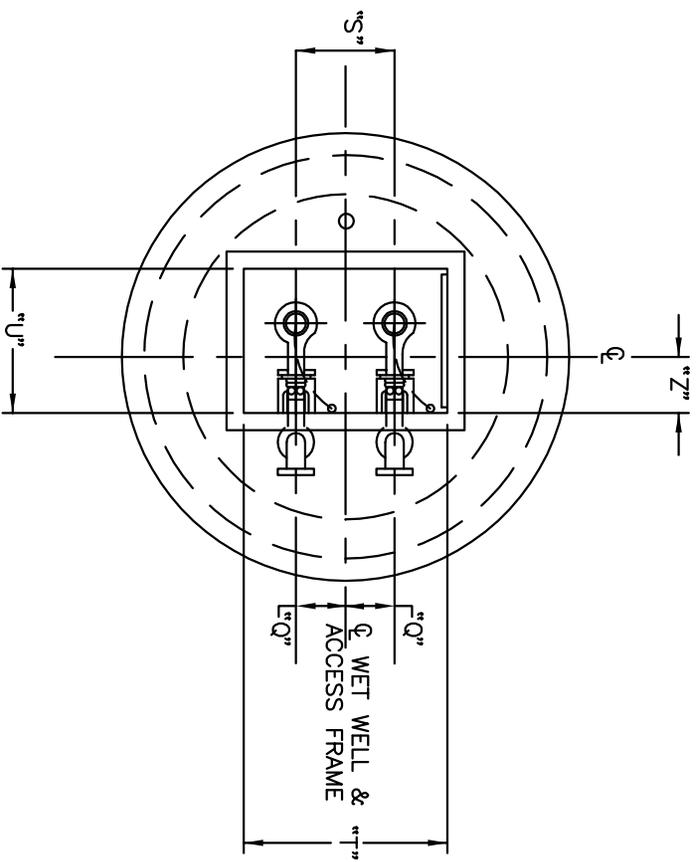
NOTE: DIMENSIONS FOR ITEMS "M" AND "V" THROUGH "Y" SHALL BE SUBMITTED BY THE ENGINEER-OF-RECORD TO THE PLSUSD WITH THE SHOP DRAWINGS.

**VALVE VAULT**

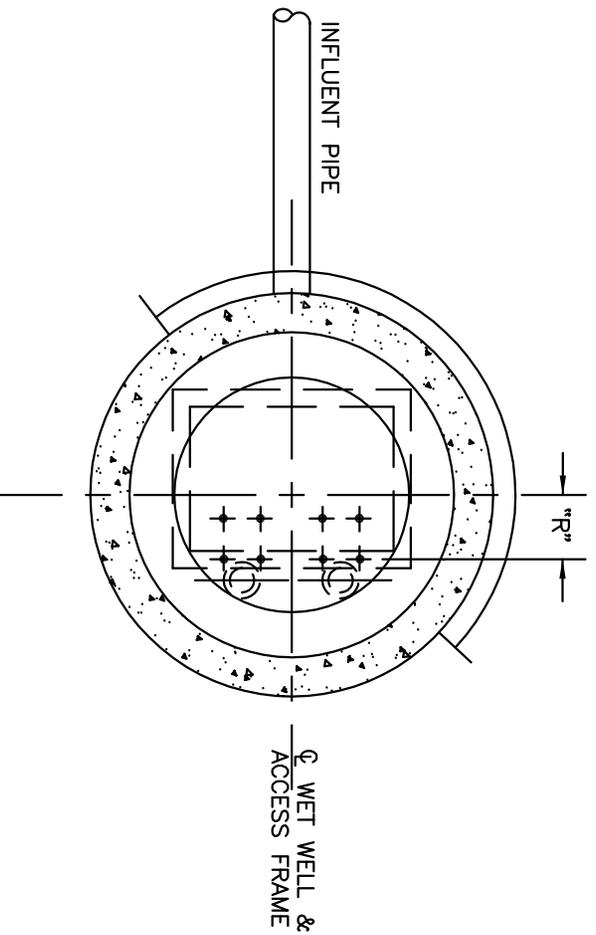


NOTE: INFORMATION RELATING TO ITEMS "A" THROUGH "P" SHALL BE SUBMITTED ON PLSUSD FORM NO. 29 BY THE ENGINEER-OF-RECORD TO THE PLSUSD WITH THE CONSTRUCTION PLANS.

**LIFT STATION WET WELL**



PLAN VIEW GRADE ELEVATION



PLAN VIEW BASE ELEVATION

NOTE: THE DIMENSIONS SHOWN SHALL BE SUBMITTED BY THE ENGINEER-OF-RECORD TO THE PLSUSD WITH THE SHOP DRAWINGS.

**PUMP STATION WET WELL**

1 **5. DESIGN CRITERIA FOR FORCE MAINS**

2  
3 Force mains shall be designed in accordance with Chapter 62-604, Florida Administrative Code  
4 and the criteria specified herein.

5  
6 **a. Sizing:** The EOR shall clearly state the basis for design, which shall include-

7  
8 (1) The PSLUSD Master Plan.

9  
10 (2) The Master Plan for the development.

11  
12 (3) Force mains shall generally not be less than 4” ID and with an ultimate design flow velocity  
13 of no less than 2.0 fps nor greater than 5.0 fps. Force mains less than 4” in diameter or velocity  
14 less than 2.0 fps may be approved by the PSLUSD on a case-by-case basis, if proper justification  
15 is submitted by the EOR in writing.

16  
17 **b. Layout:**

18  
19 (1) In order to facilitate wastewater service for all properties within the service area, force mains  
20 shall generally be extended along the full length of all fronting boundaries of a property by the  
21 developer/owner.

22  
23 (2) Force mains shall not be placed in ditches, landscape buffers, wetlands, and storm water  
24 management areas.

25  
26 (3) Separation from other mains and utilities shall be as in Section D of this Chapter.

27  
28 **c. Cover:**

29  
30 The minimum cover shall be 36” and a maximum of 72”.

31  
32 **d. Valves:**

33  
34 (1) Valves shall be designed to facilitate the isolation of each section of pipeline between  
35 intersections of the grid system. The number and location of valves shall provide for flexibility  
36 of operation and maintenance, while minimizing the number of customers out of service. In all  
37 instances, effectiveness of placement shall be primary criteria in determining valve location.

38  
39 (2) Valves shall not be placed in curbs, gutters, parking spaces, and handicap ramps.

40  
41 (3) Generally, the number of valves at an intersection shall be one less than the number of pipes  
42 forming the intersection.

43  
44 (4) Valves shall be installed for mains near each side of a canal crossing and/or major road  
45 crossing.

46

1 (5) On force mains less than or equal to 16” in diameter resilient seat gate valves shall be  
2 installed at a maximum of 1000’ intervals and branches of intersecting force mains on tees and  
3 wyes and at force main stubs. On force mains greater than 16”, valves shall be located at a  
4 maximum of 2500’ intervals.

5  
6 (6) Air valves shall be placed at all canal crossings, high points and at other locations specified  
7 by the PSLUSD. The EOR shall consult with the PSLUSD regarding the type of valve to be used  
8 and its location. For below ground installation the valve shall be located inside a maintenance  
9 access structure as shown in the standard details. Valves shall be sized as per the manufacturer’s  
10 recommendation.

11  
12 **6. DESIGN CRITERIA FOR LOW PRESSURE SEWER SYSTEMS**

13  
14 a. LPSS shall be designed in accordance with the “Design and Specification Guidelines for Low  
15 Pressure Sewer Systems”, prepared by a Technical Advisory Committee for the State of Florida  
16 Department of Environmental Protection (FDEP), and the PSLUSD utility standards.

17  
18 b. Separation to other mains and utilities shall be as in Section D of this Chapter.

19  
20 c. The minimum cover shall be 36” and a maximum of 72”.

21  
22 **7. DESIGN CRITERIA FOR RECLAIMED WATER MAINS**

23  
24 a. Reclaimed water mains shall be designed in accordance with Chapter 62-610, Florida  
25 Administrative Code and this manual.

26  
27 b. In order to facilitate service for all properties within the service area, reclaimed water mains  
28 shall generally be extended along the full length of all fronting boundaries of a property by the  
29 developer/owner.

30  
31 c. Separation to other mains and utilities shall be as in Section D of this Chapter.

32  
33 d. The pipes shall be PVC and meet the specification outlined in Section J.4 of this Chapter.

34  
35 e. The minimum cover shall be 36” and a maximum of 72”.

36  
37 **8. DESIGN CRITERIA FOR RECLAIMED WATER METERING STATIONS**

38  
39 a. An engineering report and construction plans prepared by the EOR shall be submitted to the  
40 PSLUSD for review and approval.

41  
42 b. Design shall incorporate the requirements included in section J.10.

1 **I. QUALIFIED PRODUCT LIST (QPL)**  
2

3 1. Products listed on the QPL have been approved by PSLUSD for use in the construction of  
4 water, wastewater and reclaimed water facilities. Prior to the pre-construction meeting, the  
5 contractor shall submit to PSLUSD a list of products and equipment to be installed circled on the  
6 QPL. Any materials not listed in the QPL shall require submittal of shop drawings approved by  
7 the EOR, and review by the PSLUSD prior to ordering the materials. Use of products on the  
8 QPL will expedite the review and approval process and is, therefore, encouraged. If the applicant  
9 prefers to use other products it is strongly suggested that a request be submitted to include such  
10 products on the QPL.

11  
12 2. The PSLUSD reviews new products through the Product Evaluation Committee (PEC). The  
13 PEC provides technical information to the Utility Director regarding the inclusion or exclusion  
14 of products on the Qualified Products List. The goals of the PEC are to:

15  
16 a. Review and evaluate new and existing technologies and products for potential application in  
17 the rehabilitation and expansion of the PSLUSD utility system.

18  
19 b. Encourage standardization and interchangeability of parts/products.

20  
21 c. Provide the Utility Director with technically sound information regarding new and existing  
22 products.

23  
24 3. The PEC consists of PSLUSD staff members and meets during the month of May and October  
25 each year.

26  
27 4. The New Product Review Application Package contains instructions on how to complete the  
28 application form and list the necessary documentation required supporting the application. A  
29 total of seven (7) copies of the completed application form, together with all the supporting  
30 documentation, shall be submitted to the PEC Chairperson by April 1<sup>st</sup> for the May meeting and  
31 September 1<sup>st</sup> for the October meeting. The New Product Review Application Package and  
32 application form can be downloaded from the city website at  
33 [www.cityofpsl.com/utility/commercial-development/utility-commercial-development.html](http://www.cityofpsl.com/utility/commercial-development/utility-commercial-development.html).

34  
35 5. The product representative will be notified, in writing, that the New Product Review  
36 Application has been received and whether it is administratively complete. If items are found to  
37 be incomplete, the application will not be reviewed by the PEC until all sections of the  
38 application are complete. Applications that are not properly completed and are not returned to  
39 the PEC within 60 days of the notice of an incomplete application shall be considered void, and  
40 the process must be started over.

41  
42 6. An administratively complete application will be reviewed at the next scheduled meeting of  
43 the PEC. The PEC shall present to the Utility Director all pertinent information related to the  
44 product including performance, costs for labor and materials, comparison with currently  
45 approved products, references from other users, spare parts availability, standardization, financial  
46 stability of the manufacturer, etc.

1 7. The PEC may also review a previously approved product that is on the QPL and provide the  
2 Utility Director with technically sound information for decision-making purposes. Prior to the  
3 PEC meeting, the product representative will be notified of the PSLUSD's concern with the  
4 product and will be offered an opportunity to meet with the PEC. The Utility Director may then  
5 approve or disapprove the inclusion/exclusion of a product on the QPL.  
6

7 8. The Utility Director may approve use of products for trial periods of up to five (5) years prior  
8 to inclusion in the QPL. Products acquired for such trial periods may be provided free of charge  
9 by the vendor or may be purchased sole source with the concurrence of the Utility Director. The  
10 Utility Director may require that in order for a product to be used on a trial basis, a performance  
11 bond be posted in the amount equal to all inclusive cost associated with the product's removal  
12 and replacement. The Director may also cancel the use of the product at any time during the trial  
13 period.  
14

## 15 **J. MINIMUM TECHNICAL SPECIFICATIONS AND CONSTRUCTION STANDARDS**

16

17 This section includes the specification of materials; construction standards and contractor  
18 responsibilities associated with the installation of water, wastewater and reclaimed water  
19 facilities. These specifications relate to construction and installation work associated with the  
20 following:  
21

- 22 1. EARTHWORK, EXCAVATION, BACKFILL AND COMPACTION
- 23
- 24 2. JACK AND BORE
- 25
- 26 3. DIRECTIONAL BORING
- 27
- 28 4. PIPE AND FITTINGS
- 29
- 30 5. VALVES AND APPURTENANCES
- 31
- 32 6. GRAVITY SEWER
- 33
- 34 7. INTERCEPTORS
- 35
- 36 8. WASTEWATER PUMP STATIONS
- 37
- 38 9. PIPELINE CLEANING – POLYPIG METHOD
- 39
- 40 10. RECLAIMED WATER METERING STATION
- 41
- 42 11. CONDUIT AND PULL BOXES FOR FIBER OPTIC CABLE
- 43
- 44
- 45
- 46



1 (3) Suitable material for fills to be placed in water shall be classified as A-1 or A-3 in accordance  
2 with AASHTO Designation M-145.

3  
4 (4) Unsuitable materials are classified as A-2-5, A-2-6, A-2-7, A-4, A-5, A-7 and A-8 in  
5 accordance with AASHTO Designation M 145 or soils, which cannot be compacted to specified  
6 percentage of maximum density.

7  
8 All fill shall be placed with moisture content within 2% of the optimum moisture content.  
9

#### 10 **d. CLEARING, GRUBBING AND STRIPPING**

11  
12 (1) All clearing work shall be done for the full width of the corridor area or right-of-way shown  
13 on the approved plans.

14  
15 (2) Existing vegetation including trees, roots and stumps shall be removed from the corridor  
16 areas. Damage to trees or other items outside of the corridor area shall be prevented. If damage  
17 occurs, the contractor shall be responsible for repairs or replacement. The contractor shall  
18 dispose of all vegetation material and trash removed from the site to a permitted disposal facility  
19

#### 20 **e. FILLING & GRADING**

21  
22 (1) Future roadway elevations are shown on the drawings when available from construction  
23 plans on file with the Owner or proposed by others. These elevations shall be used as guides for  
24 the filling and grading of the corridor.

25  
26 (2) All filling and grading work shall be done to provide corridor access and suitable conditions  
27 in preparation for utility pipeline construction.  
28

#### 29 **f. EXCAVATION**

30  
31 (1) Unsuitable material shall be removed from the corridor area only as necessary for access and  
32 pipeline construction  
33

34 (2) The maximum amount of open excavation/trench permitted in any one location shall be the  
35 length necessary to accommodate the amount of pipe installed in a single day. All excavation/  
36 trenches shall be fully backfilled at the end of each day. Barricades and warning lights meeting  
37 OSHA requirements shall be provided and maintained.  
38

39 (a) **Trench Dimensions:** The minimum width of the excavation/ trench shall be equal to the  
40 outside diameter of the pipe, plus the minimum necessary to obtain proper utility facility  
41 excavation backfill and compaction requirements; the maximum width of trench, measured at the  
42 top of the pipe, shall not exceed the outside pipe diameter plus two feet, unless otherwise shown  
43 on the drawing details or approved by the EOR.  
44

45 (b) **Trench Grade:** Standard trench grade shall be defined as the point of contact between the  
46 utility facility and the soil. Excavation/ trench grade for utilities in rock or other non-cushioning

1 material shall be defined as 6” below the outside of the bottom of the utility, which 6” shall be  
2 backfilled with extra utility bedding material. Excavation below trench grade shall be backfilled  
3 to trench grade with granular material placed in appropriate lift thicknesses, compacted, and  
4 meet density requirements stated herein.  
5

6 (c) **Utility Bedding:** The bottom of the trench shall be shaped to provide firm bedding for the  
7 utility facility/ pipe. The utility shall be firmly bedded in firm soil, or hand-shaped unyielding  
8 material. The bedding shall be shaped so that the pipe will be in continuous contact therewith for  
9 its full length and shall provide a minimum bottom segment support for the pipe equal to spring  
10 line of the pipe or one-half of the outside diameter of the barrel. Special bedding may be  
11 required, due to depth of cover, impact loadings, or other conditions.  
12

13 (d) **Unsuitable Material Below Trench Grade:** Soil unsuitable for a proper foundation  
14 encountered at or below trench grade, such as muck or other deleterious material, shall be  
15 removed for the full width of the trench and to the depth required to reach suitable foundation  
16 material, unless special design considerations receive prior approval from the PSLUSD and  
17 EOR. Backfilling below trench grade shall be in compliance with the applicable provisions of  
18 "Backfilling", with material as specified in Section g. - Backfill.  
19

20 (e) **Extra Utility-Bedding Material:** When rock or other non-cushioning material is  
21 encountered at trench grade, excavation shall be extended to six inches below the outside of the  
22 bottom of the utility, and a cushion of granular material shall be provided. Utility-bedding  
23 material shall be installed as specified in Section g. - Backfill.  
24

25 (f) **Sheeting and Bracing:** In order to prevent damage to property, injury to persons, erosion,  
26 cave-ins, or excessive trench widths, adequate sheeting and bracing shall be provided, as  
27 required within these specifications, in accordance with accepted standard practice. When the  
28 situation arises, sheeting and bracing shall be used as necessary to protect the integrity of the  
29 road shoulder. Sheeting shall be removed when the trench has been backfilled to at least one-half  
30 its depth, or when removal would not endanger the construction of adjacent structures. Upon  
31 written approval from the EOR and the City, to eliminate excessive trench width or other  
32 damage, sheeting, bracing, or shoring shall be left in place and the top cut off at an elevation of  
33 5.0 feet below finished grade or 1.0' above top pipe whichever is less, unless otherwise directed.  
34 All sheeting and bracing will be in accordance with OSHA and the Florida Trench Safety Act.  
35

36 (g) **Excavated Material:** Suitable material to be used for backfill shall be neatly and safely  
37 deposited at the sides of the excavations/ trenches where space is available. The contractor will  
38 make every effort to segregate any and all unsuitable material and isolate it from the clean fill  
39 intended for backfilling. Whenever possible, excavated material near a roadway should be  
40 deposited on the right-of-way side of the trench away from the travel-way. Where temporary  
41 stockpiling of excavated material is required, the Contractor shall be responsible for transporting  
42 the material to and from the stockpile site. No excavated material shall be placed within roadside  
43 swales for longer than that days work.  
44

1 (h) **Excess Fill Material:** Clean excess fill shall be the property of the City. The Contractor  
2 shall deliver and stockpile this material to areas designated by the City, within the City limits.  
3 Resale of excavated material on the project site will not be permitted.  
4

5 (i) **Material Disposal:** Unsuitable fill material or cleared and grubbed material resulting from  
6 the utility installation shall be removed from the work site and disposed of at location(s) secured  
7 by the Contractor, and in accordance with the agency having jurisdiction.  
8

9 (j) **Borrow:** Should there be insufficient satisfactory material from the excavations to meet the  
10 requirements for fill material, borrow shall be obtained from pits secured by the Contractor. All  
11 borrow shall meet the provisions of these specifications.  
12

13 (k) **Dewatering:**  
14

15 (i) Utilities shall be laid "in the dry", unless otherwise approved in writing by the  
16 PSLUSD and EOR. The contractor, at no direct cost to the PSLUSD, shall perform all  
17 dewatering activity required for facilities to meet PSLUSD Standards. Dewatering  
18 systems shall be utilized in accordance with good standard practice and must be efficient  
19 enough to lower the water level in advance of the excavation and maintain it continuously  
20 to keep the trench bottom and sides firm and dry.  
21

22 (ii) Trench excavations shall be dewatered by using the well point system, sumps with  
23 pumps or other method(s), as approved by the EOR. If the material encountered at trench  
24 grade is suitable for the passage of water without destroying the sides or utility  
25 foundation of the trench, sumps with pumps may be provided.  
26

27 (iii) Discharge from dewatering shall be disposed of in such a manner that it will not  
28 interfere with normal drainage of the area in which the work is being performed, create a  
29 public nuisance, or cause flooding. All discharge shall be in accordance with SFWMD  
30 issued permits. The operations shall not cause damage to any portion of the work  
31 completed, or in progress, or to the surface of streets, or to private property. Prior to  
32 construction the EOR and applicable regulatory agencies, shall approve the proposed  
33 dewatering method(s) and schedule. Additionally, where private property will be  
34 involved, the contractor shall obtain advance permission from the property owner.  
35

36 (l) **Obstructions:** It shall be the contractor's responsibility to become acquainted with existing  
37 conditions and to locate structures and utilities along the proposed utility alignment in order to  
38 avoid conflicts. Where actual conflicts are unavoidable, work shall be coordinated with the  
39 facility owner and performed so as to minimize any adverse impact on the use of affected  
40 property. All affected utilities shall be notified prior to excavation in their vicinity.  
41  
42  
43  
44  
45  
46

1 **g. BACKFILL**

2  
3 (1) **General:**

4  
5 (a) Backfill of all excavations shall be conducted as promptly as the work permits, but not until  
6 completion of the following:

7  
8 (i) Completion of construction below finish grade.

9  
10 (ii) Inspection, testing, approval and recording locations of underground utilities.

11  
12 (iii) Removal of shoring, and bracing, and backfilling of voids with satisfactory materials.

13  
14 (iv) Removal of trash and debris.

15  
16 (v) Permanent or temporary horizontal bracing which is in place on horizontally  
17 supported walls.

18  
19 (b) Backfilling shall be divided into two specified areas:

20  
21 (i) Trench grade to a point 12" above the top of the utility, shall be referred to as initial  
22 backfill

23  
24 (ii) From the top of the pipe to the bottom of the sub-grade if under pavement, or profile  
25 grade if the pipe is not under pavement shall be referred to as final backfill

26  
27  
28 (c) Where encasements or other below grade concrete work have been installed, backfilling  
29 shall not proceed until the concrete has obtained sufficient strength to support the backfill load.

30  
31 (d) All restraints and conflicts shall not be backfilled until approved by the PSLUSD.

32  
33 (2) **Initial Pipe Backfill:** Backfill material shall be carefully placed and tamped around the lower  
34 half (spring line) of the utility. Backfilling shall be carefully continued until the fill is 12" above  
35 the top of the utility in layers not exceeding 12" (un-compacted thickness), using the best  
36 available material from the excavation, if approved. The material shall be lowered to within two  
37 feet above the top of the previously compacted lift before it is allowed to fall. Initial backfill  
38 shall exclude organic matter and or deleterious material, stones, or rock fragments larger than  
39 one inch for PVC pipe. Compaction of each lift shall be equal to 98 % of maximum density as  
40 determined by AASHTO T-180.

41  
42 (3) **Final Pipe Backfill:** The remainder of the trench, above initial backfill shall be backfilled  
43 and compacted in layers not exceeding 12" (un-compacted thickness), except that the last two  
44 lifts shall not exceed six inches (un-compacted thickness) per lift. Compaction of each lift shall  
45 be equal to 98 % of maximum density as determined by AASHTO T- 180.

1 (4) **Structure Backfill:** Backfill material shall be carefully placed and tamped around the  
2 structure with the first lift of material starting at the bottom of the structure. Backfilling shall be  
3 continued in layers not exceeding 12” (un-compacted thickness). Backfilling shall be continued  
4 until the fill is at plan grade. The material shall be lowered to within two feet above the top of the  
5 previously compacted lift before it is allowed to fall. Backfill shall exclude organic matter and or  
6 deleterious material, stones, or rock fragments larger than one inch. Compaction of each lift shall  
7 be equal to 98% of maximum density as determined by AASHTO T-180.  
8

9 (5) **Shoulder Restoration:** All shoulder restoration shall be in accordance with the applicable  
10 permit requirements of the agency having jurisdiction. In excavated locations outside a  
11 2(horizontal) to 1(vertical) slope downward from the shoulder line or the back of the curb,  
12 backfill (initial and final) shall be compacted to a density equal to 98% of maximum density, as  
13 determined by AASHTO T-180.  
14

15 (6) **Non-Structural Backfill:** When approved in writing by the EOR and PSLUSD, non-  
16 structural backfill can be used and compacted to a density of 95% of maximum density as  
17 determined by AASHTO T-180.  
18

## 19 **h. COMPACTION**

20

21 (1) **Compaction Methods:** Specified compaction shall be accomplished using accepted standard  
22 methods (powered tampers, vibrators, etc.), with the exception that the initial backfill below 12”  
23 over top of pipe shall be compacted by hand-operated tamping devices. Flooding with water to  
24 consolidate backfill is not acceptable.  
25

### 26 (2) **Density Tests:**

27

28 (a) Density tests for determination of the above-specified compaction shall be made by a  
29 testing laboratory selected by the PSLUSD and the EOR. If any test results are unsatisfactory to  
30 the City or the EOR, the contractor shall re-excavate, re-compact the backfill, and retest, at his  
31 expense until the desired compaction is obtained. Additional compaction tests shall be made to  
32 each side of an unsatisfactory test, as directed, to determine the extent of re-excavation and re-  
33 compaction necessary. All costs associated with additional testing required to verify that all  
34 specifications have been met shall be borne by the contractor.  
35

36 (b) Acceptance Testing for Pipe: (density testing): The first lift of testing shall start with the  
37 bedding material under the utility pipe for all gravity sewer main. The PSLUSD or the EOR may  
38 require density under the pipe for all pressure pipe. All bedding material shall have passing  
39 density tests prior to installation of utilities. All density testing shall be completed with a  
40 Nuclear Density Gauge or Drive Cylinder Method per ASTM D-2397. The second lift of  
41 testing shall be along the sides of the pipe, after the first lift of backfill is placed. A lift of backfill  
42 shall be considered passing when the criteria of the lift being firm, unyielding, and passing a  
43 density test using the appropriate proctor is met as determined by the Geotechnical Engineering  
44 Firm. No backfill for the subsequent lift shall be placed until such time as the underlying lift has  
45 met acceptance criteria. “Stepping, Sloping, or digging down” to take density tests on an  
46 underlying lift of backfill is prohibited. Each lift of backfill is to be placed and meet acceptance

1 criteria prior to any portion of the subsequent lift of backfill material being placed in the  
2 excavation/trench.

3  
4 (c) Acceptance Testing for Structures: (density testing): The first lift of testing shall start  
5 below the bottom center of the structure, prior to placement. All density testing shall be  
6 completed with a Nuclear Density Gauge or Drive Cylinder Method per ASTM D-2397. The  
7 Drive Cylinder Method (ASTM D-2937) may be used if approved in writing by the EOR and  
8 PSLUSD in certain cases. A lift of backfill shall be considered passing when the criteria of the  
9 lift being firm, unyielding, and passing a density test using the appropriate proctor is met. No  
10 backfill for the subsequent lift shall be placed until such time as the underlying lift has met  
11 acceptance criteria. "Stepping, Sloping, or digging down" to take density tests on an underlying  
12 lift of backfill is prohibited. Each lift of backfill is to be placed and meet acceptance criteria prior  
13 to any portion of the subsequent lift of backfill material being placed in the excavation/trench.

14  
15 NOTE: If the question of accuracy of moisture levels arises due to any given lift being yielding  
16 or "pumping". A Calcium Carbonate Moisture Test (Speedy) shall be performed to determine if  
17 actual moisture levels are within the acceptable limits established by the proctor test. Any soils  
18 that appear soft, pumping or otherwise yielding as determined by the EOR, PSLUSD or testing  
19 laboratory personnel will not be considered to have met the compaction specifications stated  
20 herein.

21  
22 (d) For City of Port St. Lucie roadway or large residential development projects, (as  
23 determined by PSLUSD) a density logbook, with all densities graphed, equal to that accepted by  
24 FDOT, shall be submitted to the PSLUSD with the as-built plans seven days prior to final  
25 inspection. The logbook shall be to scale. The density logbook shall be made available for  
26 review by the PSLUSD on a monthly basis. The EOR shall schedule these reviews and be  
27 present for the review.

28  
29 (e) For projects installing a grinder with no gravity sewer system, copies of the density test  
30 reports, and a copy of the density technician's field notes shall be submitted to the PSLUSD with  
31 the final inspection package. A logbook will not be required. A copy of the density test reports  
32 shall be submitted to the PSLUSD within 10 days of the test. An electronic copy is acceptable.

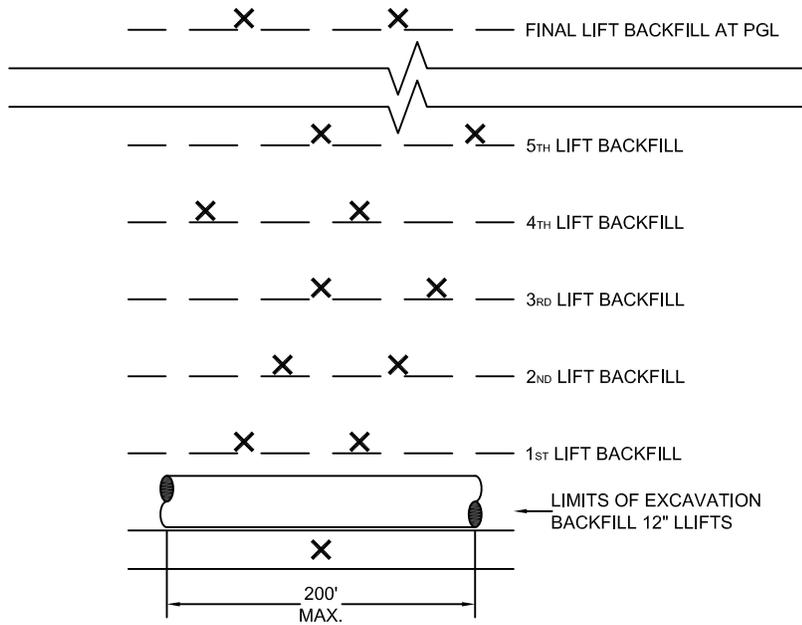
33  
34 (f) No more than two tests over 100% will be accepted on any given section of testing. If results  
35 over 100% continue, a new proctor shall be taken.

36  
37 (3) **Location of Density Tests for Pipe:** Density tests for determination of the specified densities  
38 shall be made on each individual section of trench backfilled and compacted during each work  
39 day's production or every 200', whichever is less. At least three density tests shall be taken  
40 under each roadway cut, per lift of backfill. Test locations shall be staggered and random as  
41 determined by the testing lab. Additional test locations may be requested by the EOR or  
42 PSLUSD. If the run of pipe is less than 200', two densities shall be taken per lift.

43  
44 (4) **Location of Density Tests for Structures:** Density tests for determination of the specified  
45 densities shall be made on each individual lift of backfill with, two tests per lift, randomly  
46 chosen around the structure. One test shall be within two feet of structure walls, and one test

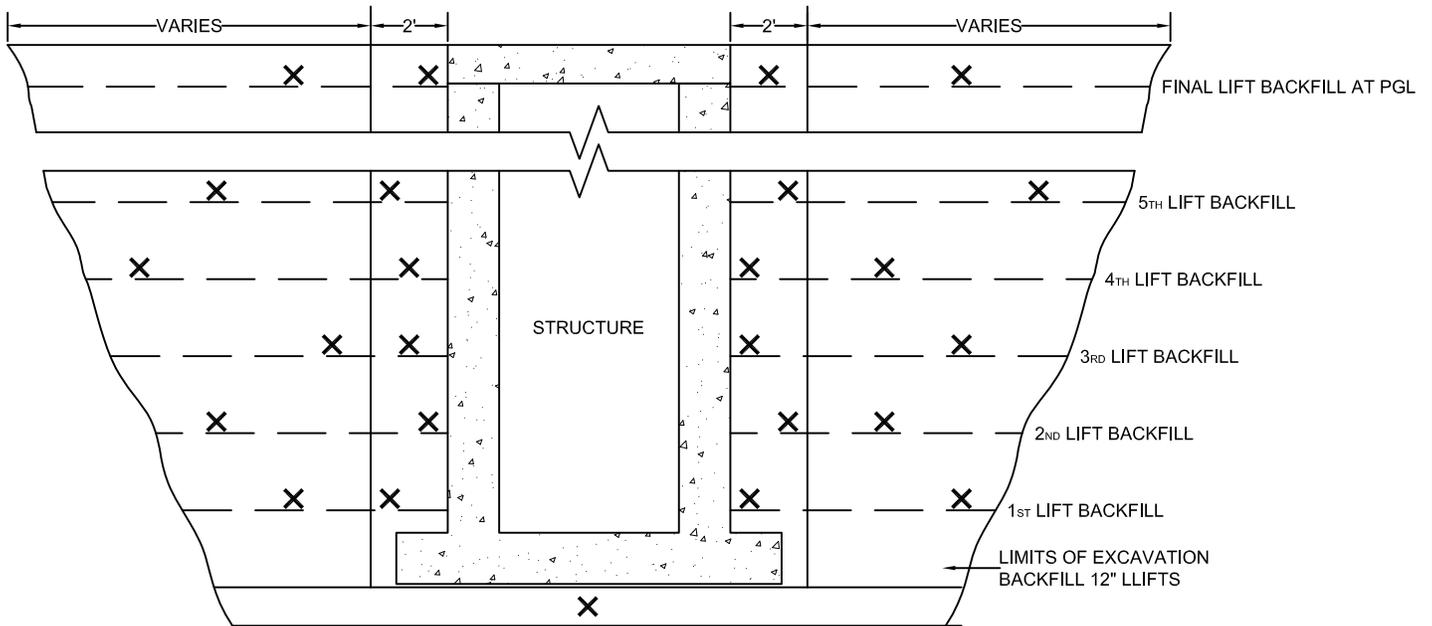
1 shall cover the remaining excavation backfill for the structure. A lift of backfill shall be  
2 considered passing when the criteria of the lift being firm, unyielding, and passing a density test  
3 using the appropriate proctor is met. No backfill for the subsequent lift shall be placed until such  
4 time as the underlying lift has met acceptance criteria.

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X = DENSITY TEST LOCATION

1 DAY PRODUCTION OR MAXIMUM OF 200'  
(WHICHEVER IS LESS)  
NUMBER OF LIFTS DETERMINED BY DEPTH OF EXCAVATION



X = DENSITY TEST LOCATION

NUMBER OF LIFTS DETERMINED BY DEPTH OF EXCAVATION

**SAMPLE DENSITY TESTING LOCATIONS  
NOT TO SCALE**

1 **2. JACK AND BORE**

2 **a. GENERAL**

3  
4 (1) The contractor shall be responsible for furnishing of all labor, materials, equipment and  
5 incidentals required to complete the jack and bore installations as shown on the approved plans  
6 and as specified herein.

7  
8 (2) The provision of this section shall be the minimum standards for the installation of casing  
9 pipe by the jack and bore method. Other types of trenchless methods may be acceptable and  
10 encouraged if the specific method is at least equal to the performance of typical jack and bores.

11  
12 **b. CASING PIPE MATERIALS**

13  
14 (1) Casings shall be steel pipe conforming to the requirements of ASTM Designation A-139. The  
15 minimum casing pipe size and wall thickness shall be as shown on the approved plans. For sizes  
16 not included therein, or for special design considerations, approval shall be obtained from the  
17 Engineer of Record (EOR) and PSLUSD.

18  
19 (2) For crossing of state roads, casing materials and installation shall conform to FDOT  
20 Standards, latest edition.

21  
22 **c. CARRIER PIPES**

23  
24 (1) Water, wastewater and reclaimed water carrier pipes to be installed within the specified  
25 casings shall be equipped with restrained joint connections.

26  
27 (2) Pipe and fittings shall comply with the applicable provisions of these standards.

28  
29 **d. CASING INSULATORS**

30  
31 (1) Non-corrosive casing insulators shall be used.

32  
33 (2) The casing runner height shall be large enough so that it does not interfere with the pipe-  
34 restrained joints.

35  
36 (3) Stainless steel nuts and bolts shall be used.

37  
38 (4) Installation and spacing of casing insulators shall be as required by the manufacturer.

39  
40 **e. INSTALLATION**

41  
42 (1) Casing pipes crossing under roadways/railroads shall be located at suitable approved  
43 alignments in order to eliminate possible conflict with existing or future utilities and structures,  
44 with a minimum 36” depth of cover between the top of the casing pipe and the surface of the  
45 roadway. For casing pipe crossings under roadways/railroads, the contractor shall comply with  
46 the regulations of jurisdictional authority in regard to design, specifications, and construction.

1 Casing installations shall be as specified in the Florida Department of Transportation, "Utility  
2 Accommodation Guide", and for railroads the American Railway Engineering Association.

3  
4 (2) The jack and bore operations shall be conducted simultaneously with continuous installation,  
5 until the casing pipe is in final position. Correct line and grade shall be carefully maintained.  
6 Add-on sections of casing pipe shall be full-ring welded to the preceding length, developing  
7 watertight total pipe strength joints. The casing installation shall produce no upheaval,  
8 settlement, cracking, movement, or distortion of the existing roadbed or other facilities.  
9 Following placement of the carrier pipe within the steel casing, end link seals are to be installed  
10 at each open end. Said end link seals shall be suitable for restraining the external earth load,  
11 while allowing internal drainage.

12  
13 (3) Casing pipe holes shall be mechanically bored through the soil by a cutting head on a  
14 continuous auger mounted inside the pipe. The distance between the leading end of the first  
15 auger section and the leading end of the casing shall be as necessary to maintain a solid plug of  
16 spoil material inside the forward portion of the casing.

17  
18 (4) The casing pipe shall be adequately protected to prevent crushing or other damage under  
19 jacking pressures. Backstops shall be provided for adequately distributing the jack thrust without  
20 causing deformation of the soil or other damage. Should the casing pipe be damaged, such  
21 damaged portion not in the hole shall be replaced; however, if installed, the encasement pipe  
22 shall be abandoned in place, grouted full, and suitably plugged, and an alternate installation  
23 made. An alternate installation will also be required if the casing alignment or elevation  
24 substantially deviates from the plan locations, and results in the installation being unusable, as  
25 determined by the PSLUSD and EOR.

26  
27 (5) Required jack and bore pits or shafts shall be excavated and maintained to the minimum  
28 dimensions necessary to perform the operation. Said excavations shall be adequately barricaded,  
29 sheeted, braced and dewatered, as required, in accordance with the applicable portions of Section  
30 J.1 of this Chapter -"Earthwork, Excavation, Backfill and Compaction" and applicable  
31 regulations/specifications. The pits will normally be no closer than 5' from the edge of  
32 pavement, with the permitting agency having final determination of the required setback  
33 distance.

### 34 35 **3. DIRECTIONAL BORING**

#### 36 37 **a. GENERAL**

38  
39 (1) Portions of pressure mains shall be installed by the directional boring method within the  
40 limits indicated on the approved plans and as specified herein. Generally, as a minimum, the  
41 pressure main is to be located within the road right-of-way or easement and shall be installed by  
42 directional boring. Piping not designated for installation by a specific method may be installed  
43 by open trench or directional boring, as approved by the Engineer of Record (EOR) and the  
44 PSLUSD.

1 (2) The contractor shall be responsible for furnishing of all labor, materials, equipment and  
2 incidentals required to perform trenchless installation of pressure mains, as shown on the  
3 approved plans and as specified herein.  
4

5 (3) The contractor is required to bring to the attention of the EOR any known design  
6 discrepancies with actual tunneling methods that the contractor will be performing, no later than  
7 the pre-construction meeting.  
8

#### 9 **b. CONTRACTOR'S EXPERIENCE**

10  
11 (1) The contractor must demonstrate expertise in trenchless methods by providing a list of ten  
12 utility references for which similar work has been performed in the last two years. The name and  
13 telephone number of the references shall be included so contact can be made to verify the  
14 contractor's capability. Also, the contractor must provide documentation showing successful  
15 completion of the projects used for reference. Conventional trenching experience is not sufficient  
16 to demonstrate expertise in trenchless methods.  
17

18 (2) All supervisory personnel must be adequately trained and will have at least four years  
19 experience in directional boring. The contractor will have to submit the names and resumes of all  
20 supervisory field personnel prior to construction. In order to save time the contractor may wish to  
21 provide multiple experienced directional boring crews.  
22

#### 23 **c. SUBMITTALS**

24  
25 (1) Technical data must be submitted for equipment including clay slurry material, method of  
26 installation with working drawings, and proposed sequence of construction for approval by the  
27 EOR and PSLUSD.  
28

29 (2) Prior to approval for directional boring, the contractor must submit the names of supervisory  
30 field personnel and historical information of directional boring experience. In addition, the  
31 contractor must submit for approval nameplate data for the drilling equipment, mobile spoils  
32 removal unit, and Material Safety Data Sheets (MSDS) information for the drilling slurry  
33 compounds.  
34

#### 35 **d. INSTALLATION**

36  
37 (1) Installation shall be in accordance with APWA publication "Trenchless Technology  
38 Applications in Public Works" and in a trenchless manner producing continuous bores.  
39

40 (2) The tunneling system shall be remotely steerable and permit electronic monitoring of tunnel  
41 depth and location. Accurate placement of pipe within a  $\pm 2$ " window is required both  
42 horizontally and vertically. Turning capability of 90° is required. Continuous monitoring of the  
43 boring head is required, including across open water if necessary.  
44

45 (3) The directional boring contractor will be required to submit certification, by a Professional  
46 Engineer and a Professional Land Surveyor licensed in the State of Florida, that the directional

1 boring has been performed in accordance with the approved plans, and provide signed and sealed  
2 as-built drawings of the installation.

3  
4 (4) Tunneling must be performed by a fluid-cutting process (high pressure-low volume) utilizing  
5 a liquid clay, i.e. bentonite. Liquid clay type colloidal drilling fluid shall consist of at least 10%  
6 high-grade, carefully processed bentonite to consolidate cuttings of the soil, to seal the walls of  
7 the hole, and to furnish lubrication for subsequent removal of cuttings. In addition, the clay fluid  
8 must be totally inert and contain no environmental risk.

9  
10 (5) The contractor must have a mobile vacuum spoils recovery vehicle on-site to remove the  
11 drilling spoils from the access pits. The spoils must then be transported from the job site for  
12 proper disposal. Under no circumstances will the drilling spoils be permitted to be disposed of  
13 into sanitary or storm sewers, public or private drainage systems, and surface waters.

14  
15 (6) Mechanical, pneumatic, or water-jetting methods will be considered unacceptable. After an  
16 initial bore has been completed, a reamer will be installed at the termination pit and the pipe will  
17 be pulled back to the starting pit. The reamer must also be capable of discharging liquid clay to  
18 facilitate the installation of the pipe into a stabilized and lubricated tunnel. Upon completion of  
19 boring and pipe installation, the contractor will remove all spoils from the starting and  
20 termination pits. All pits will be restored to their original condition.

21  
22 **e. RESTORATION OF PAVED, IMPROVED & UNIMPROVED AREAS**

23  
24 The shoulders, ditches, banks and slopes of roads and railroads crossed and paralleled shall be  
25 restored to their former condition and properly sodded to prevent erosion. Restoration shall be as  
26 required by the jurisdictional authority and as specified within the contract documents. Road and  
27 railroad crossings and parallel installations are to be continuously maintained until completion of  
28 the work.

29  
30 **4. PIPE AND FITTINGS**

31  
32 **a. GENERAL**

33  
34 (1) The contractor shall be responsible for furnishing of all labor, materials, equipment and  
35 incidentals required to install and complete, all pipeline and fittings as shown on the approved  
36 plans and in accordance with the design, specifications and construction standards incorporated  
37 in this manual.

38  
39 (2) All pipe and fittings shall be clearly marked with the name or trademark of the manufacturer,  
40 the batch number, the location of the plant, strength designation, and standards as applicable.

41  
42 (3) All pipe, fittings, valves appurtenances and linings for potable water facilities shall be in  
43 conformance with ANSI/NSF Standard 61-Drinking Water System Components – Health  
44 Effects.

1 **b. RELATED SECTIONS**

- 2  
3 (1) Earthwork, Excavation, Backfill and Compaction (Section J.1, Chapter II)  
4 (2) Jack and Bore (Section J.2, Chapter II)  
5 (3) Directional Boring (Section J.3, Chapter II)  
6 (4) Valves and Appurtenances (Section J.5, Chapter II)  
7

8 **c. PIPE AND FITTINGS**

9  
10 **(1) Ductile Iron**

11  
12 Use of Ductile Iron Pipe (DIP) is not permitted excepting in limited special circumstances where  
13 PVC and HDPE do not meet the design requirements. The EOR shall submit justification for the  
14 use of DIP to PSLUSD, for review and approval.  
15

16 **(a) Pipe:**

- 17  
18 (i) DIP shall conform to ANSI/AWWA C151/A21.51.  
19  
20 (ii) All above ground pipe shall be flanged and shall conform to ANSI/AWWA  
21 C115/A21.15. Flanges shall be threaded unless otherwise noted. Flanges shall be flat  
22 faced unless they are mating up to existing raised flanges.  
23  
24 (iii) The EOR shall specify the pressure class rating and special thickness class rating of  
25 the pipe for the prevalent conditions.  
26  
27

28 **(b) Fittings:**

- 29  
30 (i) DIP fittings for buried pipe shall conform to ANSI/AWWA C153/A21.53.  
31  
32 (ii) All above ground fittings for flanged pipe must conform to ANSI/AWWA  
33 C110/A21.10 or C153/A21.53, with a minimum pressure rating of 150. Gaskets shall be  
34 full face, 1/8" thick, cloth-inserted rubber and furnished in Buna-N rubber suitable for  
35 sewage and water service, rated for pressure class 150. Bolts and nuts for flanges shall be  
36 Type 316 stainless steel conforming to ASTM A-193, Grade B&M for bolts, and ASTM  
37 A-194, Grade M for nuts. Washers shall be provided for each nut and shall be of same  
38 material as the nuts.  
39

40 **(c) Joints:**

- 41  
42 (i) All buried joints at fittings must be restrained with mechanical joints.  
43  
44 (ii) "Push On" and mechanical joints shall be in accordance with ANSI/AWWA  
45 C111/A21.11.  
46

1 (iii) Restrained joint assemblies with mechanical joint pipe shall be approved restraining  
2 devices (QPL).  
3

4 **(d) Coatings and Linings:**  
5

6 (i) Buried ductile iron pipe and fittings for water facilities shall receive an exterior  
7 asphaltic coating as specified in ANSI/AWWA C151/A21.51. The pipe shall be cement  
8 mortar lined and sealed with a coat of asphaltic material, in accordance ANSI/ AWWA  
9 C104/A21.4.  
10

11 (ii) For wastewater and reclaimed water facilities, ductile iron pipe and fittings shall be  
12 cement mortar and epoxy lined and a bituminous coating applied on the exterior, in  
13 accordance with the manufacturer's recommendations.  
14

15 (iii) Machined surfaces shall be cleaned and coated with a suitable rust-preventive  
16 coating at the shop immediately after being machined.  
17

18 (iv) Ductile iron pipe exposed to the atmosphere and all above ground applications shall  
19 be cleaned and given a new inhibitive primer coat at the place of manufacturer. The  
20 prime coat shall be compatible with the finish coat of alkyd enamel. Minimum primer  
21 dry-film thickness shall be 3 mils. A field prime coat shall be applied in areas where the  
22 initial prime coat is damaged in the field. After installation, all above ground ductile iron  
23 piping shall receive two or more coats of a high grade, gloss or semi gloss alkyd enamel  
24 coating. Each coat shall have a minimum dry thickness of 3 mils. All related piping shall  
25 be the same color.  
26

27 **(e) Special Exterior Protection for Corrosion:**  
28

29 (i) When specifically required, extra protection shall be provided for underground cast or  
30 ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be  
31 accomplished by the installation of polyethylene encasement as per AWWA C105,  
32 through the area of concern. Soil-test evaluation to determine the necessity for extra  
33 protection in suspect areas shall be as set forth in ANSI Standard A21.5.  
34

35 (ii) If a ductile iron pipe crosses another pipe with cathode protection, it shall be  
36 protected for a distance of 20' on each side of the crossing; also, protection shall be  
37 provided when the ductile iron pipe is laid parallel to and within 10'.  
38

39 **(2) Polyvinyl Chloride (PVC): Water, Wastewater and Reclaimed Water Pressure Mains**  
40

41 **(a) Pipe:**  
42

43 (i) PVC pipe must meet requirements as set forth in AWWA C900 and C905 and potable  
44 water pipe must bear the National Sanitation Foundation seal. Provisions must be made  
45 for contraction and expansion at each joint with a rubber ring and integral thickened bell  
46 as part of each joint. Pipe and fitting must be assembled with nontoxic lubricant.

1  
2 (ii) Water mains shall be blue, wastewater mains shall be green and reclaimed water  
3 mains shall be purple.  
4

5 (iii) The Dimension Ratio (DR) and Pressure Rating shall be C900, DR-18 (Pressure  
6 class 235) for 4" to 12" pipe and C 905, DR-18 (Pressure rating 235) for 14" to 24" pipe.  
7

8 **(b) Joints:** Connections for pipe 2" or greater in diameter shall be rubber compression ring-  
9 type. Pipe shall be extruded with integral thickened wall bells without increase in dimension  
10 ration (DR). Rubber ring gaskets shall consist of synthetic compounds meeting the requirements  
11 of ASTM Designation D869 and suitable for the designated service.  
12

13 **(c) Fittings:** Ductile iron fittings shall be used on all PVC C900 & C905 mains. Fittings shall  
14 conform to AWWA/ANSI C153/A21.53.06 with a minimum pressure rating of 350 psi. Fittings  
15 shall be coated as specified under c.(1) (d) Coating & Linings for DIP.  
16

### 17 **(3) PVC: Gravity Sewer**

18  
19 PVC pipe and fittings for gravity sewer as well as service lines shall, as a minimum, conform to  
20 ASTM D-3034, SDR 26 and meet requirements of ASTM D-3212 on joints for sewer pipe using  
21 flexible elastomeric seals. For depths greater than 15', the pipe, joints and fittings shall meet the  
22 specifications.  
23

### 24 **(4) PVC: Low Pressure Mains**

25  
26 **(a) Pipe:** PVC pipe for low-pressure mains, as a minimum, must meet requirements set forth in  
27 ASTM D2241 with an SDR-21 and pressure rating of 200 psi. Fittings shall be of the same type  
28 of material used for the pipeline.  
29

30 **(b) Fittings:** Fittings shall be manufactured in one piece of injection molded PVC meeting  
31 ASTM D-1784, class 200.  
32

33 **(c) Joints:** Pipe shall have push-on type joints with integral wall bell. Bell shall be a gasket  
34 joint conforming to ASTM D-3139 with gaskets conforming to ASTM F477. Push joint or  
35 mechanical joint ductile iron fittings meeting AWWA C153 may be allowed as an alternative  
36 when PVC sizes are not available, as approved by the PLSUD.  
37

### 38 **(5) Polyethylene Tubing (up to 3" diameter)**

#### 39 **(a) Pipe:**

40  
41  
42 Polyethylene tubing shall conform to AWWA C901, Standard Code Designation PE 3608;  
43 Pressure Class 200 Dimension Ratio (DR) 9 for water use and Pressure Class 160, Dimension  
44 Ratio (DR) 11 for sanitary use.  
45

1 (b) **Joints:** Joints for polyethylene tubing shall be of the compression type utilizing a totally  
2 confined grip seal and coupling nut. Stainless steel tube stiffener inserts shall also be used for  
3 tubing services.  
4

5 (c) **Fittings:** All fittings and stops to be high quality water works brass. No PVC fittings or  
6 adapters will be permitted. Fittings shall be brass or bronze, equipped with compression-type  
7 connectors.  
8

## 9 (6) **High Density Polyethylene Pressure Pipe over 3” Diameter OD**

### 10 (a) **Pipe and Fittings**

11 Pipe supplied under this specification shall have a nominal Ductile Iron Pipe Size OD (Outside  
12 Diameter) unless otherwise specified. The pipe and fittings shall conform to AWWA C906,  
13 Standard Code Designation PE 3408. The SDR (Standard Dimension Ratio) and the pressure  
14 rating of the pipe and fittings materials shall be as specified by the EOR. As a minimum, the  
15 materials shall be Pressure Class 200 Dimension Ratio (DR) 9 for water use and Pressure Class  
16 160, Dimension Ratio (DR) 11 for sanitary use.  
17  
18

### 19 (b) **Joining:**

20 (i) Sections of polyethylene pipe should be joined into continuous lengths on the job site  
21 above ground. The joining method shall be the butt fusion method and shall be performed  
22 in strict accordance with the pipe manufacturer's recommendations. The butt fusion  
23 equipment used in the joining procedures should be capable of meeting all conditions  
24 recommended by the pipe manufacturer, including but not limited to temperature  
25 requirements of 500° F, alignment, and 150 psi interfacial fusion pressure.  
26

27 (ii) Butt fusion joining shall be 100% efficient offering a joint weld strength equal to or  
28 greater than the tensile strength of the pipe. Socket fusion shall not be used. Extrusion  
29 welding or hot gas welding of HDPE shall not be used for pressure pipe applications or in  
30 fabrications where shear or structural strength is important. Flanges, unions, grooved-  
31 couplers, transition fittings and some mechanical couplers may be used to mechanically  
32 connect HDPE pipe without butt fusion.  
33  
34

## 35 **d. INSTALLATION (Pressure Pipe)**

36 The installation standards detailed below apply only to pressure pipe - water mains, force mains,  
37 low-pressure sewer mains and reclaimed water mains. **The installation of gravity sewers is**  
38 **covered in Section J.6 of this Chapter.**  
39

### 40 (1) **Existing PSLUSD Facilities and Other Utilities**

41 (a) Contractor is required to verify location of existing PSLUSD facilities, service lines and  
42 other utilities (telephone, gas, electric, cable, etc.) prior to beginning of construction, whether  
43 shown in the construction drawings or not. Any discrepancies between the construction drawings  
44 and field conditions shall be brought to the attention of the EOR prior to construction.  
45  
46

1 Construction shall not be initiated if the discrepancy may result in non-compliance with utility  
2 standards; the EOR shall obtain prior written approval from PSLUSD.

3  
4 (b) Any damage to existing utilities or services shall be repaired immediately in coordination  
5 with the utility, with all repair costs being incurred by the contractor.

6  
7 (2) Piping and fittings shall be installed in accordance with these standards and in general with  
8 the manufacturer's recommendations for the applicable service.

9  
10 (3) Piping shall be installed along straight line and grade between fittings, or other defined  
11 points, unless other definite lines of alignment deflection or grade change have been established.  
12 Modification to approved alignment or grade during construction shall not be made without prior  
13 approval from the EOR and PSLUSD.

14  
15 (4) The standard minimum cover for utility mains shall be 36" and a maximum of 72".

16  
17 (5) Utility crossing signs may be required along the pipe alignment at each side of the canal,  
18 waterway, storm water retention area, etc. and shall be approved by PSLUSD and agency having  
19 jurisdiction over the water body.

20  
21 (6) All piping shall be laid in a clean dry trench on line and grade. All valves and vertical  
22 appurtenances shall be plumb.

23  
24 (7) Materials shall be cleaned and maintained clean, with all coatings protected from damage.  
25 The interior of the pipe shall be free of dirt and debris, and when work is not in progress all open  
26 ends shall be plugged with an approved device.

27 (8) Pipe and fittings, and other items shall be inspected prior to installation and any items  
28 showing a fracture or any other defect shall be rejected. Additionally, any pipe or fitting which  
29 has received a severe blow that may have caused an incipient fracture may be salvaged by  
30 cutting off the impacted section 12" past the damage, providing the remaining pipe is sound.  
31 Discoloration of PVC due to exposure to the sun may result in pipe rejection.

32  
33 (9) Underground piping shall not be driven to grade by striking it. After the pipe has been  
34 properly bedded, enough compacted backfill shall be placed to hold the utility in correct  
35 alignment. Precautions shall be taken to prevent flotation when necessary.

36  
37 (10) Joining shall be by the manufacturer's approved method and shall not require undue force to  
38 accomplish full satisfactory seating and assembly. Connections at structures shall be cut  
39 accurately and worked into place without forcing and shall align with the connecting point.  
40 Flanged joints shall be made tight, but with care taken to prevent undue strain upon equipment or  
41 other items. Suitable flange filler rings shall be installed where required to provide suitable  
42 joints. The installation shall be permanently watertight with no visible leakage at joints,  
43 connections and other locations, under operational or testing conditions. Material that in jointing  
44 does not remain completely seated and/or watertight shall be rejected.

45  
46 (11) Pipe Restraints:

1 Underground pressure piping systems shall be securely anchored by acceptable means at all tees,  
2 plugs, caps, bends and valves, and at all other locations where unbalanced forces exist or as  
3 directed by PSLUSD, EOR and as specified herein.  
4

5 (a) All pressure pipes at fittings shall be restrained by appropriate restraint devices meeting  
6 requirements of UNI-B-13 for PVC pipe and Ductile Iron Pipe Research Association for ductile  
7 iron pipe, and be UL listed. The criteria for establishing required pipe restraint lengths are  
8 specified in the standard details.  
9

10 (b) Approved pipe restraint devices that are on the QPL shall be used. Shop drawings shall  
11 specify the particular system to be utilized and no substitutions will be allowed after approval  
12 without re-submittal of shop drawings to the PSLUSD for written approval.  
13

14 (c) All bends, tees, crosses, reducers, valves and dead ends shall be restrained through an  
15 approved means of mechanical joint restraint. Any line terminated as a construction phase that is  
16 a known future extension, shall have a plugged valve placed at the end, and restrained with  
17 approved mechanical joint restraint.  
18

19 (d) Restrained joints shall be installed in accordance with manufacturer's recommendations and  
20 PSLUSD Standards. Every pipe joint that is required to be restrained shall be inspected by the  
21 PSLUSD and EOR prior to the contractor backfilling the restrained joint.  
22

23 (12) Exposed systems shall be supported as necessary to hold the piping and appurtenances in a  
24 firm, substantial manner to the required alignment and grade, with no undue piping stresses  
25 transmitted to equipment or other items. Aboveground pipe outside of buildings shall be  
26 supported on concrete supports or pre-manufactured adjustable pipe supports.  
27

28 (13) In case of conflict between various installation requirements the more stringent one shall  
29 apply.  
30

31 (14) Installation of pipe and testing shall be performed in the presence of the PSLUSD and EOR.  
32

33 (15) Pipeline joint deflections shall not exceed what is recommended in the Uni-Bell Handbook  
34 of PVC Pipe or 75% of the manufacturer's maximum allowable deflection, whichever is more  
35 stringent.  
36

37 **(16) Ductile Iron Pipe:** Installation shall be performed in accordance with the applicable  
38 provisions of AWWA Standard C600 and the manufacturer's recommendations.  
39

40 **(17) Polyvinyl Chloride Pipe:**  
41

42 (a) **Water, Sewer, and Reclaimed Water Mains (C900& 905)** - Installation shall be  
43 performed in accordance with the applicable provisions of AWWA 605, ASTM D-2774,  
44 AWWA Manual M23 and the manufacturer's recommendations. Lubrication used for pipe and  
45 fitting joints shall be nontoxic.  
46

1 (b) **Low Pressure Mains (SDR-21)** - Installation shall be performed in accordance with the  
2 applicable provisions of ASTM D-2774, Uni-Bell B-3 for PVC pressure sewer pipe and with the  
3 manufacturer's recommendations. If there are conflicts in installation methods, the more  
4 stringent installation criteria shall apply.

5  
6 (18) **HDPE:** Construction and installation shall be performed in compliance with the  
7 manufacturer's guidelines and the standards included in this document.

8  
9 **(19) Service Connections:**

10  
11 (a) **Residential Water Service Connections (Water Main):** Connections to water mains shall  
12 be made by installing service saddles or tees. A corporation stop shall be placed at the saddle or  
13 fitting, with the service line extended to the R.O.W./easement/property line perpendicular to said  
14 line, and terminating with a curb stop pending meter installation.

15  
16 (b) **Non-Residential Water Service Connections (Water Main):** Connections to water mains  
17 shall be made by installing service saddles. A gate valve shall be placed at the saddle or fitting,  
18 with the service line extended to the R.O.W./easement/property line perpendicular to said line,  
19 and terminating with a riser and an angle valve, above ground in grass areas, pending meter  
20 installation.

21  
22 (c) **Residential Wastewater Service Connections (Low-Pressure Main):** Connection to low  
23 pressure mains will be made by use of a tapping sleeve, valve, and check valve with the service  
24 line extended to the R.O.W./easement/property line perpendicular to said line, terminating with a  
25 cap. Schedule 80 PVC is the only pipe acceptable to tap for threads.

26  
27 (d) **Non-Residential Wastewater Service Connections (Low-Pressure Main):** Connection to  
28 low-pressure mains will be made by use of a tapping sleeve, valve, gate valve, and check valve,  
29 with the service line extended to the R.O.W./easement/property line, perpendicular to said line,  
30 and terminating with a cap. Schedule 80 PVC is the only pipe acceptable to tap for threads.

31  
32 (e) **Services Crossing under Roadways** shall be pushed, moled or installed by the jack and  
33 bore method. Jetting shall not be used. No open cutting of roads for service lines will be allowed.  
34 The service line shall have a minimum cover of 30" with slight grade sloping away from the  
35 water main or low-pressure main. The service shall be enclosed within a casing pipe. Casing pipe  
36 shall be at least schedule 40 PVC.

37  
38 **(20) Locating Devices:**

39  
40 (a) **Locator Wire** - The locator wire is required to be installed on all PSLUSD facilities except  
41 gravity sewers. All pressure mains and water service lines shall be marked by use of an approved  
42 solid copper locator wire per the QPL. The wire shall be installed on the top of the pipe and  
43 attached or looped at each pipe bell. The wire shall be inserted into a curb stop box at each valve  
44 and blow off pad. The wire shall be looped into the valve box where the pump out is located on  
45 all grinders. The loops shall be a minimum of 10" long.

1 (b) **Marking Tape** – A marking tape shall be placed in the trench above all PSLUSD facilities  
2 12”-18” below grade.

3  
4 (i) Marking tape shall be minimum 6” wide.

5  
6 (ii) Marking tape shall be per the QPL, as specified, with "CAUTION PSLUSD MAIN CALL  
7 BEFORE DIGGING (772) 873-6400" printed every 3’ in black letters.

8  
9 (iii) The tape shall be a dielectric, polyolefin film tape that is tear resistant, and corrosion  
10 resistant. The tape shall be constructed using material and ink colors, which will not change  
11 when exposed to acids and other destructive substances commonly found in the soil.

12  
13 (c) **Marker Balls** - Service Connections for water mains, gravity sewer and low pressure mains  
14 shall be provided with an electronic marker ball, placed directly above the end of the pipe at the  
15 R.O.W./easement/property line. Marker balls with tie down straps shall be placed on fittings at  
16 service termination points, service connection points on all pressure mains, stub outs for future  
17 construction, buried abandon valves, and all vertical and horizontal deflections. The marker balls  
18 shall be installed in accordance with the manufacturers requirements and be capable of operating  
19 at a depth of 6’ below the ground surface. The marker balls shall have separate and unique  
20 frequencies for water, wastewater and reclaimed water service connections.

## 21 22 23 24 **5. VALVES AND APPURTENANCES**

### 25 26 27 28 **a. GENERAL**

29  
30 (1) The contractor shall be responsible for the proper location and installation of valves and  
31 appurtenances for utility pipeline construction, as shown on the approved plans and as specified  
32 herein.

33  
34 (2) Materials shall include, but not be limited to, the following:

- 35 (a) Gate Valves
- 36 (b) Butterfly Valves
- 37 (c) Ball Valves
- 38 (d) Plug Valves
- 39 (e) Valve Boxes
- 40 (f) Extension Stem for Valve Operator
- 41 (g) Check Valves
- 42 (h) Air Release Valves
- 43 (i) Corporation Stops and Curb Stops
- 44 (j) Service Saddles
- 45 (k) Water Meters
- 46

- 1 (l) Water Meter Boxes
- 2 (m) Tapping Valves and Sleeves
- 3 (n) Backflow Prevention Assemblies
- 4 (o) Fire Hydrant Assembly

5  
6 (3) All equipment and appurtenances shall be of the size shown on the approved plans and all  
7 equipment of the same type shall be from one manufacturer.

8  
9 (4) All equipment and appurtenances shall have the name of the manufacturer, the size and the  
10 design working pressure either cast in raised letters or on a stainless steel plate.

11  
12 (5) Coating conforming to ANSI/AWWA C550 shall be applied to the interior surfaces of valves  
13 and appurtenances that will be in contact with water.

14  
15 (6) One 5' (min) valve key (wrench) shall be provided per project.

16  
17 **b. INSTALLATION**

18  
19 Valves and appurtenances shall be installed in accordance with the manufacturer's  
20 recommendations for the applicable service. Approved restraint devices shall be used as detailed  
21 in Section J.4d (11) – Pipe Restraints of this Chapter.

22  
23 **c. REFLECTIVE PAVEMENT MARKERS**

24  
25 (1) Reflective Pavement Markers (RPM) marking locations of valves, blow offs, etc. shall be  
26 placed 6" from edge of pavement in the event the plans do not call for roadway striping, and 8"  
27 from edge of pavement in the event the plans call for roadway striping to be placed.

28  
29 (2) All fire hydrants shall be marked with a blue RPM placed in the center of the travel lane  
30 closest to the hydrant, outside of the crosswalk.

31  
32 (3) RPMs shall NOT be placed in crosswalks. If RPM placement falls within the crosswalk, it  
33 shall be placed outside of crosswalk as close to valve or hydrant location as possible.

34  
35 **d. INLINE VALVES**

36  
37 **(1) General**

38  
39 (a) Valves shall be carefully inspected, opened wide, and then tightly closed; all the various  
40 nuts and bolts thereon shall be tested for tightness. Special care shall be taken to prevent joint  
41 materials, stones or other substances from becoming lodged in the valve seat. Valves, unless  
42 otherwise required, shall be set with their stems vertically above the centerline of the pipe. Any  
43 valve that does not operate correctly shall be adjusted to operate properly or removed and  
44 replaced.

1 (b) Buried valves shall be installed vertically where depth of cover permits. Where depth of  
2 cover does not permit vertical installation, side operators shall be used if approved in writing by  
3 PSLUSD. The operating nut shall be between 24"- 30" below final grade. Extension stems shall  
4 be provided on all buried valves when the operating nut is deeper than 30" below the final grade.  
5

6 (c) Valves shall open left (counterclockwise).  
7

## 8 (2) Gate Valves (GV) 9

10 (a) Valves 2" and larger shall be gray or ductile iron body, conforming to AWWA C509 or  
11 C515, with mechanical joints or flanged ends, and shall be equipped with a 2" square gray or  
12 ductile iron wrench nut.  
13

14 (b) The stem shall be non-rising type for underground and outside screw-and-yoke rising type  
15 for above ground installation.  
16

17 (c) Gate valves shall be resilient wedge type and meet the following provisions:  
18

19 (i) The wedge shall be of ductile or gray iron, fully encapsulated with EPDM rubber,  
20 including the glide path.  
21

22 (ii) The gland flange shall be ductile iron for maximum strength.

23 (iii) Two upper stem seal O-rings, one above the thrust collar and one below, and a lower  
24 stem seal o-ring shall be provided to assure the upper stem seals can be replaced with the  
25 valve under full working pressure.  
26

27 (iv) The stem material shall be stainless steel with yield strength of 40,000 psi.  
28

29 (v) Valve body, bonnet and gland flange shall have an electrostatic applied, fusion-  
30 bonded epoxy coating internally and externally, a minimum of 8 mils thick. The coating  
31 shall meet or exceed the requirements of the AWWA C550. Coating shall be applied at  
32 the valve manufacturer's facilities.  
33

34 (vi) All bolts, nuts and washers shall be stainless steel to limit exterior corrosion and  
35 maintain fastener strength. Manufacturer shall use a lubricant listed on the QPL during  
36 assembly of bolt and nut sets to prevent galling of similar metals.  
37

38 (vii) Valves shall be rated for 250-psi working pressure. All valves shall have pressure  
39 tests performed to the requirements of AWWA C509 or C515 specifications, as  
40 applicable, prior to shipment from the manufacturer.  
41

42 (viii) Valves shall be covered by a Manufacturer's 10 year Limited Warranty from date of  
43 purchase by the end user and delivered within 30 days from receipt of purchase order.  
44 The supplier will also provide laminated maintenance manuals in an appropriate level.  
45  
46

1 **(3) Butterfly Valves (BFV)**  
2

3 (a) Butterfly valves shall be used at the discretion of the PSLUSD. Valves shall be cast or  
4 ductile iron body; alloy cast iron or ductile iron disc; one-piece stainless steel shaft; short or long  
5 body-type; with the valve class, shaft size, and other special requirements selected in accordance  
6 with the specific design; and shall comply with the provisions of AWWA C504, "Rubber-Seated  
7 Butterfly Valves".  
8

9 (b) The valve disc shall be gray iron or ductile iron. The valve disc or valve body shall be fitted  
10 with a resilient seat of synthetic rubber.  
11

12 (c) Valves shall open counter clockwise. Actuators shall comply with AWWA C504 with 2"  
13 square operating nut. Actuators shall be capable of developing torques listed in AWWA C504  
14 for Class 150B valves. Valve actuators shall be traveling nut or worm gear type, fully field  
15 adjustable stops so the actuator does not have to be disassembled for valve seat adjustment.  
16

17 **(4) Ball Valves (BV)**  
18

19 (a) Ball valves shall be limited to ¾" through 2" in size and shall have cast bronze or stainless  
20 steel body, bronze tee head, stem with check, full round way opening and provisions for locking  
21 in a closed position.  
22

23 (b) Ball valves shall be used on all water and low pressure service lines ¾"-2" in size.

24 (c) Ball valves shall be designed to be fully open by a 90° turn of the operating handle and shall  
25 be full port design with bi-directional sealing rated for 150 psi minimum working pressure.  
26

27 (d) Valve ends may be threaded if Schedule 80 PVC is used and push-on restrained or solvent  
28 welded ends may be used for other PVC.  
29

30 **(5) Plug Valves (PV)**  
31

32 (a) Plug valves may be used if approved in advance by PSLUSD in writing.  
33

34 (b) All valves shall be cast or ductile iron or steel body, non-lubricated, eccentric-type, with  
35 resilient faced plugs, and capable of drip-tight shutoff at the rated pressure when applied at either  
36 port. Valve surfaces in contact with the plug face shall be 90% pure nickel. Operation of all  
37 valves 10" and larger, and smaller sizes in exposed locations which require hand wheels or chain  
38 wheels, shall be by approved gear actuators, equipped with position indicator and stop, and shall  
39 be furnished by the valve manufacturer. Gear actuators for buried or submerged installations  
40 shall be furnished with sealed enclosures. Valves shall be equipped with 2" actuating nuts, cast  
41 iron hand wheels, or chain operators, with galvanized steel chains, as appropriate for the  
42 installation and type of operator.  
43

44 (c) Port areas of valves sized 3" through 24" shall be at least 80%, and 30" and larger at least  
45 75% of full pipe area.  
46

1 (d) Valves shall be non-lubricated and rated for 150 psi pressure differential acting in either  
2 direction. At this differential the valve shall provide drip tight shutoff.

3  
4 (e) The valves shall have a balanced plug to assure low torque and drip tight shutoff. Valves  
5 shall be equipped with resilient plug facings to provide drip tight shutoff without use of sealing  
6 lubrications. Even if small solids are trapped between the plug and seat, the resilient facing shall  
7 provide tight shutoff and prevent seat damage.

8  
9 (f) Plug valves shall have heavy-duty upper and lower guide bearings capable of resisting  
10 corrosion and preventing binding. Bearings shall be stainless steel or bronze bushing.

## 11 12 **e. MISCELLANEOUS VALVES AND APPURTENANCES**

### 13 14 **(1) Valve Boxes**

15  
16 (a) Units shall be adjustable, cast iron, two-piece screw-type with minimum interior diameter  
17 of 5", with covers cast with the applicable inscription in legible lettering on the top - "SEWER",  
18 "RE-CLAIM" or "WATER". Boxes shall be of heavy-duty construction for traffic loading.  
19 Extension pieces, if required, shall be the manufacturer's standard screw-type for use with the  
20 valve box. Bolt down covers shall be provided for traffic and pedestrian (pavement) areas.

21  
22 (b) The top side of valve box covers and the inside of the top section of the valve box shall be  
23 painted blue for water mains, green for sewer mains and purple for reclaimed water mains. The  
24 paint used shall be on the QPL.

25  
26 (c) Valve boxes shall be provided with concrete base and valve nameplate with suitable  
27 anchors for casting flush into concrete. Nameplate shall be 3" diameter bronze disk with 1/8"  
28 high lettering. Information on disk shall be of specific valve type, size, direction and number of  
29 turns, schematic of facilities. The brass disc shall be set into wet concrete to be flush with the  
30 pad. Disc's that have been drilled in and set with epoxy will not be accepted. All water valve  
31 locations to be marked by a blue RPM and wastewater valves by a green RPM.

32  
33 (d) A valve box alignment device shall be used to eliminate the shifting of the valve box  
34 against the operating nut.

35  
36 (e) The tops of valve boxes shall be set to the required grade. Any valve box that becomes out  
37 of alignment or is not to grade shall be dug out and adjusted.

38  
39 (f) The valve box shall not transmit surface loads directly to either the pipe or valve. Care shall  
40 be taken to prevent earth and other material from entering the valve boxes.

### 41 42 **(2) Extension Stem for Valve Operators**

43  
44 Where the depth of the operating nut is more than 30", operating extensions shall be provided to  
45 bring the operating nut to a point 24"-30" below finished grade. The extension shall be high  
46 strength steel construction and permanently attached to the operating nut or handle on the valve.

1 Where extension stems are required within valve boxes, approved insert stem guides shall be  
2 provided; also, a steel centering plate welded to the extension shall be provided.  
3

### 4 **(3) Check Valves (CV)**

5  
6 (a) Valves less than 2" (water) - Valves shall be bronze body and disc, swing check-type, with  
7 removable inspection covers, and rated for 150 psi minimum working pressure.  
8

9 (b) Valves (Low-Pressure Mains) - Valves shall be a brass or stainless steel check valve rated  
10 for 150 psi. The check valve will provide a full-ported passageway when open. A non-metallic  
11 hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom  
12 to assure seating, even at a very low back pressure.  
13

14 (c) Check valves 2" and larger shall conform to ANSI/AWWA C508, Standard for Swing  
15 Check Valves and shall meet the following additional provisions:  
16

17 (i) Valves shall be of the flanged type and shall be supplied with or without external lever  
18 and weight or lever and stainless steel spring. A priming actuator may be supplied for  
19 installations that require manual backflow to prime pumps, drain the line, and/or back  
20 flush.  
21

22 (ii) Valve bodies and bonnets shall be of ductile or gray iron meeting the requirements of  
23 ASTM A536. The check valve shall be a clear waterway design as defined by AWWA  
24 C508. The minimum working pressure rating shall be 250 psi.  
25

26 (iii) Flanges shall be in compliance with ANSI/ASME B16.1 Class 125. Laying lengths  
27 shall comply with ANSI/ASME B16.10.  
28

29 (iv) All internal uncoated ferrous components and bolting shall be stainless steel. The  
30 hinge and hinge pin shall be constructed of AISI 316 stainless steel. O-rings shall be used  
31 to seal the hinge pin. Exterior bushing material shall be bronze.  
32

33 (v) All exterior bolting shall be stainless steel.  
34

35 (vi) All valves shall be covered by a manufacturer's 10 year Limited Warranty from date  
36 of purchase by the end user, which shall include repair parts and reasonable labor costs.  
37

### 38 **(4) Air Valves**

39  
40 (a) Air valves for water facilities shall conform to AWWA C512 and be of single body  
41 configuration. Valves shall be of gray cast iron or ductile iron body and cover, with stainless  
42 steel float and trim, and rated for a minimum 150 psi working pressure. Combination valves shall  
43 be used unless a different type of air valve is approved by PSLUSD based on recommendation of  
44 the EOR. Air valves shall be equipped with an inflow prevention device when required by  
45 PSLUSD.  
46

1 (b) Air valves for wastewater facilities shall be of single body configuration and shall be  
2 constructed with gray or ductile iron body and cover with stainless steel trim and float for a  
3 minimum working pressure of 150 psi. Combination valves shall be used unless a different type  
4 of air valve is required by PSLUSD based on recommendation of the EOR.

5  
6 **(5) Corporation Stops and Curb Stops**  
7

8 (a) Corporation and curb stops shall be required on all water services. The units shall be  
9 manufactured from cast bronze or brass with machined fitting surfaces and, for sizes ¾”-2”, in  
10 accordance with AWWA C800.

11  
12 (b) Units shall be equipped with connections compatible with the connecting service pipe-  
13 type; must have pack joint type connections for polyethylene tubing with locking collars and  
14 stainless steel inserts.

15  
16 **(6) Service Saddles**  
17

18 Service saddles for PVC or ductile iron pipe shall conform to AWWA C800. Saddles shall be  
19 double strap, stainless steel full circle type with a bronze body and epoxy lined. Sealing gaskets  
20 shall be suitable for the applicable service.

21  
22 **(7) Water Meters**  
23

24 Water meters up to 2” in size shall be purchased from and installed by PSLUSD. The property  
25 owner shall be responsible for furnishing and installing the meter above 2” and shall obtain a  
26 written approval from PSLUSD prior to installation. Shop drawings shall be submitted for the  
27 proposed meter along with a certification of calibration. The meter shall meet the following  
28 specifications:

29  
30 (a) Turbine - The meter to be furnished shall be Class II, horizontal shaft, and shall meet the  
31 requirements of AWWA C701, with particular reference to flow capacity, pressure loss,  
32 accuracy, physical dimension and material construction.

33  
34 (b) Compound – The meter shall comply with the requirements of AWWA C702 with  
35 particular reference to flow capacity, pressure loss, accuracy, physical dimension and material  
36 construction.

37  
38 (c) The main case shall be of high-grade bronze containing not less than 75% copper and with  
39 operating pressure test of 200 psi without leakage at gasket. The name of the manufacturer shall  
40 be marked permanently on the lid of the register box. The serial number of the meter shall be  
41 imprinted on the lid and on meter main case.

42  
43 (d) The meter must be able to use a strainer without the additional piping up stream and down  
44 stream to control accuracy of the meter; strainer will come with meter only upon request.  
45

1 (e) The register shall be permanently hermetically sealed, magnetic drive, low torque  
2 registration, straight reading, large numerals and no fogging type lens.

3  
4 (f) The connection shall be flanged and shall come with companion flanges, gaskets, bolts and  
5 nuts.

6  
7 (g) Meters shall have an Encoder-Receiver-Transmitter device for automatic meter reading,  
8 compatible with existing city system.

9  
10 (h) Meters shall be NSF approved for potable water use.

11  
12 **(8) Meter Boxes**

13  
14 (a) Meter boxes shall be high-density polyethylene body with a solid cover.

15  
16 (b) Meter boxes shall be the same type throughout the project.

17  
18 **(9) Tapping Valves and Sleeves**

19  
20 (a) Tapping valves shall have a ductile iron body that accommodates a full size shell cutter.

21  
22 (b) Valves shall conform to the specifications set forth previously for the applicable service  
23 conditions. Additionally, units shall be comparative with the connecting sleeve or saddle and  
24 specially designed for wet tapping installation operations.

25  
26 (c) When specified, tapping valves 4” through 12” shall have a ring cast with the body on its  
27 flanged end to ensure proper alignment with suitable tapping sleeves. All other end  
28 configurations shall be specified as mechanical joint (MJ).

29  
30 (d) Tapping sleeves shall be split-type stainless steel or MJDI with flanged outlet for  
31 connection to tapping valve. Carbon steel flanges are not allowed without written approval by  
32 the EOR and PSLUSD.

33  
34 **(10) Backflow Prevention Assemblies**

35  
36 (a) Backflow prevention assemblies shall be manufactured and installed in full conformance  
37 with the following standards:

38  
39 (i) AWWA C510 – Standard for Double Check Valve Backflow Prevention  
40 Assembly;

41  
42 (ii) AWWA C511 – Standard for Reduced Pressure Principle Backflow Prevention

43  
44 (iii) AWWA M14 – Recommended Practice for Backflow Prevention and Cross  
45 Connection Control

1 (iv) Laboratory and field performance specifications of the Foundations for Cross  
2 Connection Control and Hydraulic Research, University of Southern California.  
3

4 (b) Final approval shall be based on a “Certificate of Approval” issued by an approved testing  
5 laboratory certifying full compliance with above standards. Backflow prevention assemblies,  
6 which have been fully tested and have been granted a certificate of approval by an approved  
7 testing laboratory, may be used if listed on the QPL.  
8

## 9 **(11) Fire Hydrant Assembly**

### 10 **(a) General**

11  
12  
13 (i) Fire hydrant assemblies shall include fire hydrant, spool pieces, gate valve, hydrant  
14 extensions, valve extensions, valve box, concrete collars around valve box and hydrant,  
15 tee at the main, necessary bends and fittings, restraining devices, and bedding material.  
16

17 (ii) All hydrants shall be of the size and type specified and all hydrants shall be from one  
18 manufacturer.  
19

20 (iii) Hydrant extensions shall not be used unless specifically approved in writing by the  
21 PSLUSD.  
22

23 (iv) Fire hydrant adjustments and re-locations include all materials and labor that may be  
24 required to complete adjustment and/or re-location to the PSLUSD specifications.  
25

26 (v) Fire hydrants shall be connected to the main with a minimum 6” branch controlled by  
27 an independent 6” gate valve. All pipe, valve and joints from the hydrant to the main  
28 shall be restrained. Hydrants shall stand plumb and true and shall have nozzles parallel  
29 with or at right angles to the curb or edge of pavement, with the pumper nozzle facing the  
30 curb or edge of pavement. Hydrants shall be set to the established grade, with nozzles at  
31 least 18” above the ground.  
32

33 (vi) Fire hydrants shall be free of corrosion and all working parts shall be properly  
34 lubricated. Hydrants shall be painted with an approved paint on the QPL. Hydrants  
35 owned and maintained by PSLUSD shall be painted red. Private fire hydrants shall be  
36 painted yellow.  
37

38 (vii) Fire hydrants shall have a minimum of 10-year warranty from the manufacturer,  
39 covering 100% of all parts and labor for repairs/replacement. The warranty shall become  
40 effective on date of acceptance by PSLUSD.  
41

42 (viii) One operating wrench for every ten fire hydrants shall be provided to PSLUSD.  
43

### 44 **(b) Specifications**

45 Hydrants shall be Dry Barrel type and shall meet the following provisions:  
46  
47

1 (i) Shall conform to ANSI/AWWA C502.

2  
3 (ii) Shall be listed by Underwriters Laboratory and approved by Factory Mutual for fire  
4 line service. UL and FM trademarks shall be cast on the hydrant nozzle section.

5  
6 (iii) A weather shield shall be provided to prevent dirt and corrosion from affecting the  
7 operating mechanism. It will be marked with an arrow indicating the direction of opening  
8 (counter-clockwise). Weather shields and nozzle cap nuts shall be 1½” pentagon shape.

9  
10 (iv) Operating nut shall be 1½” pentagon shape and made of bronze. It shall utilize two  
11 anti-friction washers, one above and one below the thrust collar. A bronze thrust nut shall  
12 be used and secured without reverse threading and locked in place with a stainless  
13 setscrew and plate.

14  
15 (v) Hydrant bonnet, nozzle, standpipe, shoe sections and flanges shall be made of ductile  
16 or gray iron. All caps and weather shields may be manufactured of cast or ductile iron.  
17 Caps shall be provided with gaskets and cap threads shall be lubricated before delivery  
18 with an anti-seize lubricant listed in the QPL.

19  
20 (vi) Hydrant sections shall have an electrostatic applied, fusion bonded, epoxy coating  
21 internally and externally. The coating shall meet or exceed the requirements of AWWA  
22 C550. Coating shall be applied only at the valve manufacturer’s facilities. New hydrants  
23 shall be painted at the manufacturer’s facility; field painting will not be accepted.

24  
25 (vii) The standpipe shall be Bitumen coated internally and externally with a bury line  
26 present below the break flange to indicate proper installation depth. Bury depth will be  
27 clearly stenciled or cast on the standpipe section.

28  
29 (viii) Rated working pressure shall be 250 psi; test pressure shall be 500 psi in both the  
30 open and closed position. Independent testing shall certify fire hydrants have a maximum  
31 head loss of 2.5 psi, when flowing at 1000 gpm through the 4½” nozzles. Tests will be  
32 preformed as described in AWWA C502.

33  
34 (ix) The hydrant main valve shall be 5¼” and true compression type, opening against and  
35 closing with the pressure. It shall use EPDM seating material only. All working parts  
36 shall be removable without excavation.

37  
38 (x) The hydrant’s upper and lower stem, as well as its break coupling, internal pins and  
39 clips, shall be manufactured of stainless steel or epoxy coated steel. External bolting shall  
40 be manufactured of stainless steel. Manufacturer shall use a lubricant during assembly of  
41 bolt and nut sets to prevent galling of similar metals.

42  
43 (xi) All hydrants shall be of the traffic breakaway type and allow a 360° rotation to  
44 position the pumper nozzle in the desired direction after installation. Undercut or  
45 breakaway bolts will not be permitted.

1 (xii) Hydrants will consist of one 4½” NST pumper nozzle and two 2½” NST hose  
2 nozzles. Each nozzle will be bronze and secured with a stainless steel set screw, for easy  
3 maintenance and replacement should damage occur. Nozzles threaded into the nozzle  
4 section shall be lubricated with a lubricant before delivery.  
5

6 (xiii) Lubrication reservoir shall be cast as part of the bonnet, creating a watertight cavity  
7 without the use of gaskets. A lubrication port shall be provided for lubrication, without  
8 disassembly of the bonnet section. The reservoir shall be filled with NSF/FDA approved  
9 food grade grease or oil, certified to contain no acetates, at the manufacturer’s facility.  
10 The combination of two o-ring sets in the reservoir shall seal the cavity from contact with  
11 water - one set on the interior and exterior of the thrust nut and the second set at the  
12 bottom of the reservoir as a stem seal.  
13

14 (xiv) Hydrants shall have two positive stops to prevent over travel of the operating rod -  
15 one on the upper stem (stop nut) and/or one on the main valve (bottom stop). The main  
16 valve shall not bottom out onto the shoe section.  
17

18 (xv) The seat ring shall be bronze and threaded into a bronze drain ring. The drain ring  
19 assembly shall be replaceable without removing the MJ shoe connection, thrust blocks or  
20 restraints. The draining system shall be a sliding drain seal type. The drain mechanism  
21 shall be completely closed after no more than four turns in the opening direction. The  
22 drain channel shall be 360° with drain port outlets, bronze bushed on the exterior of the  
23 hydrant, with a bronze plug.  
24

## 25 **6. GRAVITY SEWER**

### 26 **a. GENERAL**

27 (1) The contractor shall be responsible for furnishing of all labor, materials, equipment, and  
28 incidentals required for construction of gravity sewers and appurtenances as shown on the  
29 approved plans and as specified herein.  
30  
31

32 (2) The contractor shall be responsible to ensure that all safety requirements are met.  
33  
34

35 (3) Materials shall include, but not limited to, the following:  
36

- 37 (i) Gravity Wastewater Main
  - 38 (ii) Wastewater Manholes
  - 39 (iii) Services laterals and cleanouts
- 40  
41

### 42 **b. SEWER**

43 (1) **Materials**  
44  
45

1 The pipe material, joints and fittings shall be as specified in Section J.4 of this Chapter and on  
2 the QPL.

3  
4 **(2) Installation**

5  
6 (a) All sewer pipes shall be true to line and grade with bells facing upstream. The sections of  
7 the pipe shall be so laid and fitted together that when complete, the sewer shall have a smooth  
8 and uniform invert. All pipes shall be free from defects. Trenches shall be kept dry while the  
9 pipe is being laid. Visible leakage, deflections, horizontal misalignment, non-constant slopes  
10 between manholes, and sagging joints shall each be grounds for rejection of lines.

11  
12 (b) Where navigable waterways are crossed, approved utility crossing signs shall be placed on  
13 the pipe alignment at each side of the waterway.

14  
15 (c) Special care shall be exercised in design and installation to provide adequate bedding for  
16 the type of pipe used, taking into consideration trench width and depth, superimposed loadings  
17 above grade, and the material below trench grade. Pipe loading capabilities shall be computed in  
18 accordance with established design criteria and special supporting bedding or facilities shall be  
19 provided as required by the Engineer of Record (EOR). Trenches and excavations shall be kept  
20 dry while work is in progress. The pipe barrel shall be uniformly supported along its entire  
21 length on undisturbed soil or bedding material.

22  
23 (d) A collector service connection shall not be directed into a manhole.

24  
25 (e) No service connection shall be made within 5' of any manhole. The allowable length of  
26 PSLUSD owned service laterals shall be no more than 150'.

27  
28 (f) Cleanouts shall be spaced a maximum of 75' apart. Cleanouts shall be shown on the plans at  
29 the property/ROW line or other required locations to limit the PSLUSD maintenance and  
30 ownership responsibility. Cleanouts ending the PSLUSD maintenance responsibility shall be  
31 installed at a minimum of 3' from back of curb, edge of driveway/pavement. For cleanout  
32 installations within a non-exclusive utility easement paralleling a road ROW, the cleanout shall  
33 be located a maximum of 1½' from the right-of-way line.

34  
35 (g) The service pipe lateral and required fittings shall extend to the property line, perpendicular  
36 to said line, terminating with stoppered ends or fittings, as indicated. The exact location for each  
37 installed service shall be marked by marker balls.

38  
39 **c. MANHOLES**

40  
41 **(1) Materials**

42  
43 (a) Manhole interior shall be lined as detailed and specified by the manufacturer. The  
44 minimum inside diameter of manholes shall be 48". Non-penetrating lift pin inserts shall be  
45 installed by pre-cast Fabricator. Pre-cast reinforced manholes shall be in accordance with ASTM  
46 C478, Class II, made with Type II acid resistant cement, shall attain a minimum compressive  
47 strength of 4000 psi in 28 days. The liner system shall be cast integrally into the manhole, pre-

1 cast concrete surrounding it, with alignment/grade of channels/openings for connecting pipes  
2 matching drawing requirements. Liner integrally formed bell gaskets shall comply with ASTM F  
3 477 Standard Specification for Elastomeric Seal (Gaskets) for Joining Plastic Pipe. Installation of  
4 pre-cast manholes shall comply with the details shown in the Construction Standards and in  
5 accordance with the manufacturer's recommendations.  
6

7 (b) Manhole frames and covers shall be ductile iron or gray cast iron traffic rated heavy duty  
8 conforming to ASTM Designation A48, Class 30 and on the Qualified Product List. Covers shall  
9 be marked with the word "SANITARY SEWER" in 2" raised letters. Frames and covers shall be  
10 set to the correct finish grade elevation.  
11

12 (c) The base slab and first ring of the pre-cast manhole shall be cast monolithically.  
13

14 (d) Lift holes shall be grouted once the manhole is in place.  
15

## 16 (2) Marking and Identification

17

18 Each manhole shall be marked on the inside and outside with the following information:  
19

20 (a) Manufacturer's name or trademark

21 (b) Manufacturer's factory location

22 (c) Manufacturer's serial number

23 (d) Total manhole depth  
24

## 25 (3) Installation

26

27 (a) Manholes shall be installed at the end of each sewer; at every change in grade, size, or  
28 alignment; at all sewer intersections; and at distances not greater than 400' apart.  
29

30 (b) Manholes shall be placed in accessible locations, preferably in pavement flush to the  
31 surface. In unpaved areas, a concrete collar shall be poured around the top of the manhole, flush  
32 with the cover and 2" above finished grade.

33 (c) Manholes shall be set according to approved construction plans and shall be pre-cast in  
34 accordance with approved shop drawings, specifications, and construction standards.

35 (d) Manholes shall not be placed in low-lying areas where storm water inflow may occur. The  
36 manhole cover and frame shall be water tight to prevent inflow of storm water and shall be on  
37 the Qualified Product List.  
38

39 (e) Certification from manufacturer stating that manufacturer has provided factory training to  
40 the pre-cast fabricator, and that the pre-cast fabricator is approved by the liner manufacturer for  
41 incorporation of manufacturer's liner into fabricator's pre-cast manhole product, shall be  
42 required.  
43

1 (f) Fabricator shall provide on site guidance during manhole pipe connection and joint sealant  
2 installation of first manhole. Upon completion of construction, contractor shall provide  
3 certification from the fabricator stating that such field guidance was provided to the contractor.  
4

5 (g) Concrete manhole exterior shall receive three (3) applications 3-5 mils each of a 100%  
6 solids water base epoxy. The first coat is a primer followed by two (2) finish coats. Application  
7 shall be by an approved applicator.  
8

9 (h) All manholes shall require backfill compaction as specified in compaction specifications.  
10

11 (i) Backfill shall be of a suitable material. Debris or other unstable materials shall not be used.  
12

#### 13 **(4) Tools**

14  
15 One manhole lid removal hook/bar shall be provided per project.  
16

### 17 **7. GREASE, OIL AND SAND INTERCEPTORS**

#### 18 19 20 **a. GENERAL**

21  
22 (1) The contractor shall be responsible for furnishing all labor, materials, equipment, and  
23 incidentals required for installation of a grease, oil or sand interceptor as shown on the approved  
24 plans. The installation shall comply with the standard detail and as specified herein.  
25

26 (2) Installation of the interceptor and its components shall be performed by a licensed plumber or  
27 septic tank contractor registered with the Florida Department of Health.  
28

29 (3) Materials shall include the tank, baffle, lid, manhole covers, valve boxes, pipe, tees, elbows  
30 and miscellaneous fittings and hardware.  
31

#### 32 **b. TANK**

33  
34 (1) The tank shall be built of pre-cast concrete with a minimum of 4" thick walls and pre-cast  
35 holes for the inlet/outlet pipes. The lid shall be at least 8" thick. Traffic lids shall meet the  
36 specifications of ASTM C890-91, latest revision.  
37

38 (2) The inlet and outlet holes shall have a prefabricated pipe boot with stainless steel clamp or  
39 gasket.  
40

41 (3) The inlet invert level shall be a minimum of 2½" above the water level.  
42

43 (4) The liquid depth shall be at least 42".  
44

45 (5) A baffle shall be installed such that the first chamber shall have a minimum effective capacity  
46 of ½ (one-half) to 2/3 (two-thirds) the total required effective capacity. The flow between the

1 two compartments shall be through an 8” diameter hole in the baffle; the hole shall be located  
2 12” from the tank bottom for a grease interceptor and 16” to 20” for a sand/oil interceptor. A  
3 baffle is not required if multiple interceptors are installed in series,  
4

5 (6) A manhole shall be provided over each compartment for access to the inlet and outlet tees.  
6  
7

### 8 **c. INSTALLATION** 9

10 (1) All piping shall be a minimum of 4” PVC.  
11

12 (2) The inlet and outlet tees shall be located no more than 4” from the end of the tank and shall  
13 be in accordance with ASTM C923-98, latest revision, Standard Specification for Resilient  
14 Connectors between Reinforced Concrete Manhole Structures, Pipes and Laterals. The inlet tee  
15 shall extend no more than 24” below the water level for a grease interceptor. An inlet tee is not  
16 required for sand/oil interceptors, however, if used it shall not extend more than 12” below the  
17 water level. The outlet tee shall extend to within 8” of the bottom of the tank.  
18

19 (3) The inlet and outlet tee shall be attached to the tank wall as per detail submitted by the EOR  
20 and approved by PSLUSD.  
21

22 (4) Inspection ports (two-way clean-outs) shall be installed on each end of the interceptor, which  
23 are easily accessible for inspection/sampling.  
24

25 (5) When the required effective capacity of the interceptor is greater than 1250 gallons, the  
26 PSLUSD may require installation of multiple tanks in series. When multiple tanks are used there  
27 shall be a minimum 4’ separation between tanks with the required inspection port installed in the  
28 center.  
29

30 (6) The manholes shall be brought to grade and fitted with covers.  
31

32 (7) All joints, including mid-seams, risers and lids shall be sealed using a bonding compound  
33 that meets ASTM C-990-96, latest revision.  
34

35 (8) An approved external joint sealing system on the QPL shall be applied to on the outside of all  
36 joints.  
37

## 38 **8. WASTEWATER PUMP STATIONS** 39

### 40 **a. GENERAL** 41

42 (1) These specifications are the minimum requirements for pump stations, including factory  
43 testing of all materials, equipment and appurtenances, delivery and installation. The  
44 manufacturer’s recommendations, approved plans and standard details may contain additional  
45 requirements pertinent to the installation including accessory and auxiliary equipment and  
46 material types, which may not be specified herein.

1  
2 (2) The specifications for “Grinder Pump Station” and “Lift Station” shall be used in conjunction  
3 with Section G.4 of this Chapter - Design Criteria for Wastewater Pump Station.  
4

5 (3) The pumps and appurtenances furnished shall be installed in accordance with the industry  
6 standards and methods, as specified herein. All pumps shall be manufactured in accordance with  
7 the Hydraulic Institute standards.  
8

9 (4) In the event that it is impossible to conform to certain details of the specifications due to  
10 different manufacturing techniques, a written justification shall be submitted for all non-  
11 conforming aspects.  
12

13 (5) Only components on the QPL shall be utilized.  
14

15 (6) All equipment and materials furnished shall be new and the standard product of the  
16 manufacturer.  
17

18 (7) The use of stainless steel nuts and bolts, minimum grade 316, is required on all parts.  
19

20 (8) When pump stations are located in areas where fire or explosion hazards may exist, the  
21 electrical components (e.g. motors, lights, cables, conduits, switch boxes, control circuits,  
22 etc.) shall comply with the National Electrical Code requirements for Class I, Division I,  
23 Group D locations. The pumps and electrical components shall be certified as explosion  
24 proof by Factory Mutual Approvals.  
25

## 26 **b. SHOP TESTING**

27

28 Each pump shall be tested in the manufacturer's shop to demonstrate the proper operation of all  
29 components. Testing shall also be conducted to determine overheating of bearings, motors or  
30 other components.  
31

## 32 **c. SUBMITTALS**

33

34 Contractor shall provide to the PSLUSD copies of shop drawings and factory test results. A  
35 minimum of three (3) sets of shop drawings shall be submitted to the PSLUSD for review and  
36 approval.  
37

38 **(1) Grinder Pump System** - The following information shall be provided as a minimum:  
39

40 (a) Dimensions and anchor bolt locations.

41 (b) Descriptive literature, bulletins, and/or catalogs of the equipment.  
42

43 (c) A list of the manufacturer's recommended spare parts to be supplied in addition to those  
44 specified herein under Section g. - Spare Parts; gaskets, packing, etc. shall be included and  
45 bearings shall be listed by the manufacturer's item numbers only.  
46

1 (d) Complete motor data.

2  
3 (e) Copies of all factory test results.

4  
5 (f) A certified Hydraulic Institute test curve from an identical pump including head, capacity,  
6 brake horsepower, and pump efficiency for each pump type supplied.

7  
8 **(2) Lift Station** – The submitted drawings and data shall be provided by the manufacturer,  
9 including but not limited to the following:

10  
11 (a) Information on wet well, pumps, discharge piping, valves, guide rail systems,  
12 pressure gauges, access covers, control panel, electrical schematics and any other requirements  
13 necessary to complete the lift station installation, including –

14  
15 (i) Assembly drawings, nomenclature, and materials list

16 (ii) Outline dimensions and weights

17 (iii) Drawings, method of anchoring equipment, and piping connection details

18 (iv) Electric motors

19 (v) Name of manufacturer

20 (vi) Type, model and frame size

21 (vii) Motor horsepower

22 (viii) Full load speed

23 (ix) Construction

24 (x) Temperature rise and class of insulation

25 (xi) Service factor.

26 (xii) Voltage, frequency, number of phases

27 (xiii) Full load current

28 (xiv) Locked rotor current

29 (xv) Motor efficiencies at 1/2, 3/4, and full load

30 (xvi) Controls and Wiring Diagram

31 (xvii) Pump curves at listed RPM ("Family" curves are not acceptable)

32  
33 (b) Drawings and descriptive information in sufficient detail to show the kind, size,  
34 arrangement, and operation of component materials and devices; the external connections,  
35 anchorages, and support required; and dimensions needed for installation and correlation with  
36 other materials and equipment. All part numbers and catalog data required for ordering spares  
37 and replacements shall be provided.

38  
39 (c) The acceptance of drawings returned marked "REVIEWED" or "REVIEWED AS NOTED"  
40 will not constitute a blanket approval of dimensions, quantities, and details of the materials,  
41 equipment, device or items shown and does not relieve the contractor of responsibility for errors  
42 or deviations from the requirements.

43  
44 **d. MANUFACTURER'S QUALIFICATIONS**

1 Equipment and materials shall be furnished by a manufacturer fully experienced, reputable and  
2 qualified in the manufacture of items to be installed.

3  
4 **e. PRODUCT HANDLING**

5  
6 (1) All equipment and parts shall be properly protected so that no damage or deterioration will  
7 occur during a prolonged delay from the time of shipment until installation is completed and  
8 ready for operation.

9  
10 (2) Factory assembled parts and components shall not be dismantled for shipment unless  
11 permission is received in writing from the EOR.

12  
13 (3) Finished surfaces of all exposed pump openings shall be protected by wooden planks,  
14 strongly built and securely bolted thereto. Finished iron or steel surfaces not painted shall be  
15 properly protected to prevent rust and corrosion.

16  
17 (4) After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and  
18 proper care shall be taken to protect parts from entry of water during shipment, storage and  
19 handling.

20  
21 (5) Each box or package shall be properly marked to show its net weight in addition to its  
22 contents.

23  
24 **f. WARRANTY**

25  
26 Pumps shall have a minimum of 5-year warranty from the manufacturer, covering 100% of all  
27 parts and labor for repair/replacement. The warranty period shall commence at the time of pump  
28 station acceptance by the PSLUSD.

29  
30 **g. SPARE PARTS**

31  
32 Spare parts to be furnished to the PSLUSD shall include:

33  
34 (1) 1 full set of fuses for entire panel,

35  
36 (2) 1 full set of fuses for disconnect (if fused), and

37  
38 (3) 1 set of motor starters for a grinder pump station or 1 set of starter contacts for the lift station,  
39 as applicable.

40  
41 These items shall be turned over to the PSLUSD at the start-up inspection.

42  
43 **h. FIELD QUALITY CONTROL**

44  
45 The services of a qualified factory-trained manufacturer's representative shall be provided to  
46 assist the contractor in installation and start-up of the equipment specified under this section.

1 The manufacturer's representative shall provide technical direction and assistance to the  
2 contractor in general assembly of the equipment, connections, adjustments and testing. The  
3 following work shall be performed by the contractor, as a minimum, under the technical  
4 direction of the manufacturer's service representative:

5  
6 (1) Inspections and final adjustments.

7  
8 (2) Operational and functional checks of controllers/starters and spare parts.  
9

## 10 **i. PUMP STATION SPECIFICATIONS & INSTALLATION**

### 11 **(1) Grinder Pump Station**

12  
13  
14 A single manufacturer shall be responsible for supplying the entire grinder pump station  
15 including but not limited to pumps, motors, wet well, valve vault, rail assembly, electrical  
16 controls and appurtenances. The PSLUSD will make available to developer/contractor for  
17 purchase the major components of the single-phase grinder system; all appurtenances and labor  
18 required to complete the installation will be the responsibility of the developer/contractor.  
19

#### 20 **(a) Pumps**

21  
22 (i) The pumps shall be totally submersible grinder type, designed to pump raw sewage.  
23 The pumps shall be standard dimensions such that parts will be interchangeable between  
24 like units. The same manufacturer shall supply all units.

25  
26 (ii) The pumps shall be equipped with a rail and discharge connection assembly, which  
27 will allow the removal of the pumps without the need for personnel to enter the wet well.  
28

#### 29 **(b) Valves & Piping**

30  
31 (i) Pipes, fitting, valves and appurtenances shall meet the specifications included in  
32 Sections J.4 and J.5 of this Chapter and must be approved by PSLUSD (QPL).  
33

34 (ii) A heavy duty brass or stainless steel check valve, rated for 150 psi, shall be installed  
35 in the discharge line at the point of connection to the main, as shown on the approved  
36 plans and standard details.

37  
38 (iii) Discharge piping shall be schedule 80 PVC.

39  
40 (iv) For grinder pump stations with 3HP and 5HP pumps, a valve vault made of fiberglass  
41 shall be provided as required in the design criteria and shown on the standard details. The  
42 valve vault shall include a check and plug valve for the discharge line for each pump and  
43 an emergency pump out connection with a 3" camlock. The lid and cover shall be made of  
44 aluminum, capable of bearing a live load of 300 pounds per square foot.  
45

#### 46 **(c) Wet Well & Access Cover**

1 (i) The wet well shall be sized as specified in the approved plans and made of molded  
2 reinforced polyester resin and fiberglass construction. The wet well shall have a  
3 minimum wall thickness of ¼". A 6" diameter inlet hub of the O-ring seal type shall be  
4 provided for field installation of the lateral. Other wall penetrations for electrical conduits  
5 and venting shall be provided.  
6

7 (ii) The wet well manufacturer shall furnish wet well access covers and frames as shown  
8 on the approved plans and PSLUSD standard details for the wet well. The cover shall be  
9 made of aluminum, gasket sealed, with 316 stainless steel bolts used to secure the cover  
10 to the wet well, and shall be capable of bearing 300 pounds per square foot live load.  
11

12 (iii) An approved (QPL) safety net or grate shall be provided for fall prevention.  
13

#### 14 **(d) Pump Control System**

15  
16 (i) A pump controller shall be provided for each grinder pump unit. The controller shall  
17 automatically start and stop the pump and switch the lead and lag pump on each start-up.  
18

19 (ii) The pump controller shall be the standard system of the manufacturer, as modified for  
20 the proposed application.  
21

22 (iii) The control panel shall consist of a lightning arrester, a disconnect switch, a circuit  
23 breaker and NEMA rated magnetic starter for each pump motor. A high level alarm and  
24 pump shut-off shall be activated by a float type, low voltage liquid level control system.  
25 Control switches shall provide means to operate each pump manually or automatically.  
26

27 (iv) The electrical control equipment shall be mounted within a NEMA control panel  
28 with all stainless steel hardware. The enclosure shall be U.L. listed as an assembly and  
29 shall incorporate a removable back panel on which control components shall be mounted.  
30 Back panel shall be secured to enclosure with collar studs. A high level and seal failure  
31 alarm light shall be mounted on top of the control cabinet. The light shall be enclosed in a  
32 red polycarbonate enclosure. The high level alarm float installed in the wet well shall  
33 activate an exterior light and audible alarm. Seal failure alarm circuitry shall only be  
34 provided if required to obtain manufacturers warranty.  
35

36 (v) The enclosure shall be installed with stainless steel anchors imbedded a minimum of  
37 2" into concrete.  
38

#### 39 **(e) Installation**

40 Installation shall be strictly in accordance with the manufacturer's instructions, PSLUSD  
41 standard details and in the location shown on the approved plans. If the equipment requires an  
42 arrangement or dimensions different from those shown on the approved plans or the standard  
43 details, the EOR shall submit shop drawings, showing all necessary changes, to the PSLUSD for  
44 review and approval,  
45

#### 46 **(2) Lift Station**

47

1       **(a) Wet Well**  
2

3           (i) The base slab and the first ring of the pre-cast wet well shall be cast monolithically.  
4

5           (ii) The holes for influent pipe and discharge pipes shall be pre-cast and have pre-  
6           fabricated boots installed by the manufacturer of the wet well.  
7

8           (iii) A liner shall be provided as a corrosion barrier by an approved manufacturer on the  
9           QPL.  
10

11          (iv) Installation of the lift station risers shall be in accordance with the manufacturer's  
12          specifications.  
13

14          (v) The exterior of the wet well and all piping surface shall receive three (3) applications  
15          3-5 mils each of a 100% solid water based epoxy on the QPL. The first coat is a primer  
16          followed by two (2) finish coats. The coatings shall be applied at the manufacturer's  
17          facility; field application is not acceptable excepting for repairs and shall be conducted by  
18          a factory representative.  
19

20          (vi) Holes to accommodate pipe shall be pre-cast into the section at the manufacturer's  
21          plant.  
22

23          (vii) Any visible reinforcing wire, steel or honeycombs on pre-cast structures shall be  
24          cause for rejection.  
25

26          (viii) Interior of wet well shall be fitted with stainless steel (316) upper guide bar  
27          brackets, cable holder, guide rails and grip eyelift cable.  
28

29          (ix) The wet well shall have a concrete top and a pad lockable aluminum hatch cover and  
30          frame with stainless steel hardware. The cover shall be sized and located to allow for  
31          unobstructed vertical removal of all pumps and mixed flush valves and shall be capable  
32          of supporting a 300 pounds per square foot static load. The cover shall have a pull-up  
33          handle to open and have a locking safety handle to retain the covers in an open position.  
34

35          (x) All access openings shall be fitted with a permanently installed fall through  
36          prevention system that is easily retractable for access to the opening below. The fall  
37          through prevention system shall consist of the following components:  
38

- 39           1. A safety grate
- 40           2. All stainless steel 316 hardware
- 41           3. A permanently attached metal tag with the following information:
- 42           4. Name of the grate manufacturer
- 43           5. Identification of the grate material
- 44           6. Date of manufacture
- 45           7. Date of prototype test
- 46           8. Name of testing agency
- 47           9. Serial number

1 Installation shall be in accordance with the manufacturer's instructions.

2  
3 **(b) Discharge Piping**  
4

5 (i) Discharge piping from the pumps shall be installed in accordance with PSLUSD  
6 standard details. Piping up to the plug valve shall be flanged, 316 stainless steel or ductile  
7 iron pipe. Ductile iron pipe shall be Class 53 with interior epoxy lining, minimum 35  
8 mils.  
9

10 (ii) Each base elbow shall be secured to the concrete floor with stainless steel expansion  
11 bolts and a stainless steel plate per PSLUSD standard details.  
12

13 (iii) The pipes, valves, and fittings shall be coated as specified for exterior of wet well.  
14

15 (iv) Check valves shall include external spring and lever.  
16

17 (v) Shutoff valves shall be resilient plug valves.  
18

19 (vi) An emergency pump connection device shall be provided and shall be a male  
20 aluminum or bronze "Cam-loc" fitting with dust cap and an isolation plug valve. A  
21 stainless steel ball valve shall be provided on the dust cap.  
22

23 (vii) All fittings to have flange ends.  
24

25 (viii) All hardware shall be grade 316, stainless steel.  
26

27 (ix) An air release valve shall be provided with a vent into the wet well.  
28

29 (x) An oil filled pressure gauge and a pressure transducer shall be provided in the  
30 discharge pipe after the check valves. The gauge shall read in pounds per square inch,  
31 with a range suitable for the required service. Gauge shall be equipped with diaphragms  
32 (neoprene or stainless steel), or other suitable separating device, to preclude wastewater  
33 from entering the mechanism.  
34

35 **(c) Pumps**  
36

37 (i) Pumps shall be non-clog, and mechanical seal submersible pumps.  
38

39 (ii) The pump electrical conductor shall be continuous multi-conductor, copper cable (no  
40 splices), in compliance with industry standard for load and resistance against sewage. The  
41 conductor shall enter the pump through a heavy-duty entry assembly that shall be  
42 provided with an internal grommet assembly to protect against leakage once secured and  
43 must have a strain relief assembly as part of standard construction. The pump conductor  
44 shall be the length required to properly connect the pump and panel, but in no case shall  
45 be less than 40'.  
46

1 (iii) Each pump shall be provided with a guide rail assembly designed so that each pump  
2 automatically connects to the discharge piping when the pump is lowered into place. The  
3 pump to guide rail assembly connection shall be non-sparking. The pumps shall be easily  
4 removable for inspection and/or service.

5  
6 (iv) Pumps shall have a tandem mechanical shaft seal system. Mechanical seals shall be  
7 made of tungsten carbide or silicon carbide with a stainless steel case. Wearing rings  
8 shall be abrasion resistant and shall be installed at the inlet side of the pump to provide  
9 protection against wear to the impeller.

10  
11 (v) The lifting handle shall be stainless steel and be large enough to hook the pump with a  
12 standard assembly from a height of 20' and be equipped with a grip eye lifting cable and  
13 tool.

14  
15 (vi) The pumps with a size of 15 HP or greater shall be equipped with a moisture sensor  
16 to detect seal failures. A visual signal with a manual override shall be used at the control  
17 panel.

18  
19 (vii) One pump shall be equipped with a utility approved mix flush system per the pump  
20 manufacturer.

21  
22 (viii) Pump motor shall be housed in an air-filled watertight casing and shall have Class F  
23 insulated windings which shall be moisture resistant. The motor shall be Nema Design B  
24 rated 155° C maximum and have a minimum 1.15 service-factor. Pump motors shall have  
25 cooling characteristics suitable to permit continuous operation in a totally, partially, or  
26 non-submerged condition. The pump shall be capable of running dry continuously in a  
27 totally dry condition. Cable junction box and motor shall be separated by a stator-lead  
28 sealing gland or terminal board which shall isolate motor from any water or solids  
29 gaining access through pump cable

30  
31 **(d) Motor Starter/Controller**

32  
33 To extend the useful life of the pump station components including the pump and motors and  
34 comply with the rules and regulations for electrical service and maximum allowable voltage  
35 fluctuations, one of the following starter/controllers is required for each pump/motor based upon  
36 the motor horsepower. The warranty shall include materials or workmanship, which do not  
37 conform to these specifications.

38  
39 (i) **Type “one” (MCC I):** 10 HP 230 VAC started across the line shall be protected at  
40 300% of nameplate Full Load Amperage (FLA), using NEMA motor starters.

41  
42 (ii) **Type “two” (MCC II):** 11 HP – 30 HP 480 VAC requires soft start device with  
43 internal bypass protected at 200% of nameplate FLA.  
44

1 (iii) Type “three” (MCC III): 31 HP and above 480 VAC requires a soft start device  
2 with internal bypass or a variable frequency drive protected at 200% of motor nameplate  
3 FLA.  
4

5 (iv) NEMA Motor Starters (MCC – I Only): NEMA Magnetic Motor Starter with solid  
6 state overload relay with life time coil warranty. Overload relay includes phase loss and  
7 phase unbalance. Device must be manufactured to ensure full voltage is applied to coil  
8 even at 85% of nominal eliminating contact chatter and premature contact failure. When  
9 lower than acceptable voltages are applied the motor starter will not start or will break the  
10 circuit to prevent contact chatter.  
11

12 (v) Soft Start Motor Starters (MCC – II Only):  
13

14 Reduced Voltage Solid State Motor Starters shall be severe duty rated with overload  
15 protection, adjustable ramp times, and adjustable torque control and shall be ordered with  
16 edge control option of automatic reset if desired. The starter shall offer adjustable kick  
17 start control, soft stop control feature, which reduces water hammer through soft stop  
18 control. The starter shall shut down at 110° C and have jam and stall detection and  
19 protection features. Kick Start feature shall provide 0 to 550% full load current for a  
20 duration of 0-2 seconds. Ramp up start, current limit start features are also required.  
21 Device shall incorporate an internal by pass, shunting Silicon Controlled Rectifier (SCR)  
22 after reaching full load.  
23

24 (vi) Solid-State Reduced Voltage Motor Control:  
25

26 1. The solid-state reduced voltage starter (soft starts) shall be UL and CSA listed  
27 and bear the CE mark for compliance with applicable IEC and Eruo Norm  
28 standards for solid state reduced voltage starters. The solid-state reduced voltage  
29 starter shall be an integrated unit with power SCR’s heat sink, logic board,  
30 paralleling bypass contactor, and electronic overload relay enclosed in a shingle  
31 molded housing. The SCR based power section shall consist of six (6) back-to-  
32 back SCRs and shall be rated for a minimum peak inverse voltage (PIV) rating of  
33 1600 volts. The starter shall be three-phase, 60 Hz, and rated for the HP, current,  
34 and voltage as shown on the QPL. The following control function adjustments on  
35 the device keypad are required:  
36

- 37 a. Selectable Torque Ramp Start on Current Limit Start
- 38 b. Adjustable Kick Start Time, 0-2 seconds
- 39 c. Adjustable Kick Start torque, 0-85%
- 40 d. Adjustable Ramp Start Time, 0.5-180 seconds
- 41 e. Adjustable Initial Starting Ramp Torque, 0-85%
- 42 f. Adjustable Smooth Stop Ramp Time, 0-6 seconds  
43

44 2. Enclosed units shall include a thermal magnetic circuit breaker or Motor  
45 Circuit Protector (HMCP) for short circuit protection and quick disconnect means.  
46 Starters with breakers/HMCPs are to be rated per UL508D with a withstand rating

1 of 65 kAIC rms. Control power shall be 24V DC as standard for safety and  
2 reliability. Separate control terminals shall be provided for 24V DC power, logic  
3 levels signals for permissive, start, jog forward, ramp start overload override and  
4 electric reset. Control terminals shall be pull-apart for easy access and wiring.  
5 Optional external interface circuitry shall include 120-volt relay logic interface  
6 capability. A removable Customer Interface Module (CIM) shall be provided that  
7 allows for full adjustment of control and protection functions through the use of  
8 potentiometers and DIP (Dual in-line package) switches. Enclosure shall not be  
9 less than 16 gauge steel. Type 12 enclosures shall be of welded construction with  
10 gasketed heat sink and doors.

11  
12 **(vii) Variable Frequency Drive (VFD) Controllers (MCC III Only):**

13  
14 1. The Variable Frequency Drive shall be rated for input voltage. The variable  
15 frequency drive shall be microprocessor-based control for three phase induction  
16 motors. The VFDs shall be Pulse Width Modulated (PWM) design. Adjustable  
17 current source VFDs are not acceptable. Insulated Gate Bipolar Transistor shall  
18 be used in inverter section. Bipolar Junction Transistor, Gate Turn-Offs (GTO) or  
19 Silicon Controlled Rectifiers (SCR) are not acceptable. The VFDs shall have  
20 efficiency at full load speed that exceeds 97% for motors over 40 HP.

21  
22 2. The system containing the VFDs shall comply with the 5% level of total  
23 harmonic distortion of line voltage and the line current limits as defined in IEEE  
24 519-1992. If the system cannot meet the harmonic levels with the VFD provided  
25 with standard input line reactor or optional input isolation transformer, the VFD  
26 manufacturer shall supply a multiple bridge rectifier AC to DC conversion section  
27 with phase shifting transformer for all drives above 100 HP. Harmonic filters are  
28 not acceptable above 100 HP. The device shall be capable of communicating  
29 with PSLUSD approved programmable logic controller with optional Modbus  
30 communication capability.

31  
32 **(e) Controls**

33  
34 **(i) Control Panel Builder**

35  
36 1. The panel builder shall be experienced in the construction of lift station control  
37 panels, shall have a UL approved shop, and shall be able to provide both a UL  
38 508 label for the panel, and a UL label for service rated.

39  
40 2. The panel builder shall warrant the panel for one (1) full year minimum from  
41 the date of start-up.

42  
43 3. The panel builder or qualified technical representative shall checkout and test  
44 the panel as part of the lift station start-up with the PSLUSD and EOR.

45  
46 **(ii) Panel Components**

1 The panel and panel components are specified in the PSLUSD standard details. Omission  
2 of any component on the standard details does not relieve the contractor from furnishing  
3 such components that would normally be required for wastewater pumping stations.  
4

5 **(iii) Enclosure**  
6

- 7 1. The EOR shall ensure the panel sizing is in accordance with the pump size of  
8 the lift station.  
9
- 10 2. The panel shall be of a NEMA, 12M construction (QPL) with a drip lip and  
11 have the following features:  
12
- 13 a. Constructed of grade 304, stainless steel, 14 gauge with a # 3 polish on the  
14 exterior.  
15
- 16 b. All external hardware shall be stainless steel with piano hinge, three-point latch  
17 with roller fitting top and bottom and single handle with padlock fitting and  
18 stainless steel external parts.  
19
- 20 c. Drip shield to deflect water from the door, closed cell neoprene gasket on the  
21 door.  
22
- 23 d. Blank outer door with dead front inner door of 1/8" thick aluminum hinged on  
24 the left with the operators controls mounted on or projecting through it.  
25
- 26 e. Painted steel back mounting plate for heavy components.  
27
- 28 f. Aluminum enclosure 1/8" thick around the surge arrestor and surge capacitor  
29 with a 1/8" minimum, lexan cover for the ends of the arrestor and capacitor and  
30 the incoming line terminals to isolate the lightning arrestor and surge capacitor in  
31 case of failure and to provide protection for the operator from the live terminals if  
32 the breaker is open.  
33
- 34 g. The outer door is to have 9" x 11" painted steel or aluminum pocket for the  
35 log book, tack weld to the inside of door.  
36
- 37 h. Arms and latches shall hold both outer door and inner door in an open position;  
38 these must be sufficiently rigid and secure to hold doors open under windy  
39 weather conditions.  
40
- 41 i. Sliding locking bar to allow only main or emergency breaker to be closed. Bar  
42 shall be aluminum with stainless steel hardware.  
43
- 44 j. All hardware shall be grade 316, stainless steel.  
45

46 **(f) Telemetry**

1 The contractor shall furnish and install the new radio telemetry equipment and programming as  
2 specified in the approved plans and in accordance with the PSLUSD standard details. Extension  
3 of fiber optic cable may be required when deemed necessary by the Utility Director. A single  
4 subcontractor shall be responsible for all hardware, software, system integration, programming,  
5 testing and startup.  
6

### 7 (i) Components

8  
9 The specifications for the components are as follows:

#### 10 11 **1. Remote Telemetry System**

12  
13 a. The Remote Telemetry shall be a microprocessor based Intelligent Electronic  
14 Device (IED) and shall serve as an interface to accumulate, process, transmit, and  
15 receive discrete and analog status and control messages between the RTU base  
16 station and the remote RTU sites located.

17  
18 b. The IED shall be designed to operate in an industrial environment. The IED  
19 shall be capable of operation in an ambient temperature range of 0-60° C. and a  
20 relative humidity of 5%-95%, non-condensing. The IED shall operate on supply  
21 voltages of 24 volts DC.

22  
23 c. LED-type indicating lights shall be shall be provided as follows:

24  
25 (1) READY; RUN; BATTERY LOW; MODBUS.

26  
27 (2) Controller and accessory equipment shall be on the QPL.

28  
29 (3) All IEDs shall be powered with 24 vdc through a power supply capable of  
30 float charging sealed Gel-Cell batteries and shall include AC Power  
31 monitor with alarm output to the RTU loss of AC power. Batteries shall be  
32 sized to provide 60 minutes of full load back up in the event of AC power  
33 loss.

34  
35 (4) Input/Output modules shall be wired to terminal strips.  
36

#### 37 **2. RTU Communication Interface**

38  
39 a. The IED serial interface port shall serve as the RTU communications interface.  
40 The data transmission shall be selectable between 300 and 4800 Baud  
41 (asynchronous).  
42

43 b. The Radio Transceiver shall be complete with RS-232 asynchronous serial  
44 interface and cable and time out to inhibit communication lockup. The Radio  
45 transceiver shall include automatic frequency, control, loop back, and SMART

1 diagnostics. Radio enclosure shall include RF shield. Radio transceiver shall be 5  
2 watts at a frequency of 452.100 MHz.

3  
4 c. The complete communications subsystem including interconnecting cables  
5 shall contain lighting, surge, and transient protection.

6  
7 d. Control panels shall be sized to accommodate the IED, radio transceiver, power  
8 supply, backup battery, and other ancillary equipment related to the remote  
9 telemetry system.

10  
11 **3. Antenna and Tower Assembly:**

12  
13 a. Antenna and tower assembly shall be installed in accordance with standard  
14 details.

15  
16 b. Antenna cable shall be ½” Heliax with LMR connectors, and protected in panel  
17 with a Polyphaser surge protector.

18  
19 **4. Surge Protection**

20  
21 Surge Protection shall protect the 120 volts AC system, the ½” helix cable and  
22 antenna subsystem.

23  
24 **5. Electrical Transient Protection:**

25  
26 All electrical and electronic elements shall be protected against damage due to  
27 electrical transient induced in interconnecting lines from lightning discharges and  
28 nearby electrical systems.

29  
30  
31  
32 **6. Manufacturer’s Qualifications**

33  
34 The company shall have at least five years experience in the design, development,  
35 and manufacture of surge suppressors.

36  
37 **7. Surge Suppressor**

38  
39 a. Surge suppressors shall be located at:

40  
41 (1) Any connections between AC power and electrical and electronic  
42 equipment, including panels, assemblies, and field mounted analog  
43 transmitters.

44  
45 (2) The field, panel, or assembly connections of all analog signal circuits that  
46 have any portion of the circuit extending outside of a protecting building.  
47

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- b. Surge suppressor assemblies for 120 volt AC power supply connectors shall be:
  - (1) Provided with two 3-terminal barrier terminal strips capable of accepting a No.12 - AWWC solid or stranded copper wire. One terminal strip shall be located on each end of the suppressor unit.
  - (2) Epoxy encapsulated within a nonflammable phenolic enclosure with provision for mounting to interior or equipment racks, cabinets, or to the exterior of freestanding equipment. Epoxy encapsulation shall be flame retardant.
  - (3) Constructed as multistage devices. The first stage shall be a high-energy metal oxide variator element. The second stage shall consist of fast-acting high power bipolar silicon avalanche devices. First and second stages shall be interconnected through a series air core inductor of sufficient current-carrying capacity to permit a continuous operating current of 15 amperes. Inductors having ferrous or other high permeability core materials are not acceptable. Suppressor assemblies shall be the automatic recovery type.
- c. Surge suppressors shall meet or exceed the following performance criteria based on a test surge wave shape with an 8-microsecond rise time and a 20-microsecond exponential delay time:
  - (1) Minimum Operating Voltage: 120 volts AC
  - (2) Maximum Breakdown Voltage: 150 volts AC
  - (3) Maximum Operating Current: 15 amps
  - (4) Peak First Stage Surge Current: 20,000 amps
  - (5) Maximum Second Stage Clamping Voltage: 350 volts
  - (6) Minimum Second Stage Clamping Voltage: 210 volts
  - (7) Ambient Temperature Range: -20° C to +85° C
- d. Surge suppressors for analog signal connections shall:
  - (1) Have four lead devices with a threaded mounting/grounding stud.
  - (2) Have a circuit consisting of a 3 electrode gas tube and silicone avalanche devices to clamp each line to the ground. High-energy gas tube and silicone avalanche devices shall be separated by series impedance.
  - (3) Be epoxy encapsulated with a nonflammable phenolic enclosure. Epoxy encapsulation shall be flame retardant.
  - (4) Limit line-to-ground and line-to-line voltage to 30 volts on 24 volts DC circuits.
  - (5) Meet or exceed the following performance criteria based on a test surge

1 wave with 8-microsecond rise time and 20-microsecond exponential decay  
2 time:

- 3 (a) Recovery - Automatic
- 4 (b) Peak Source Current - 10,000 amps
- 5 (c) Pulse Lift Before Failure - 100 occurrences
- 6 (d) Minimum Voltage Clamp Rating - 30 volts
- 7 (e) Series Impedance - 24 ohms total
- 8 (f) Temperature Range - -20° C to +85° C
- 9 (g) Operating Voltage - Less than 30 volts DC
- 10 (h) Operating Current - 4 to 20 mA DC
- 11 (i) Resistance Line-to-Ground - Greater than 1 megohm

## 12 **8. Corrosion Protection**

13  
14  
15 All indoor and outdoor panels shall be fitted with vapor phase corrosion inhibitor  
16 capsules. Capsules shall be labeled with the date of activation.

## 17 **9. Workstation Displays/Database**

18  
19  
20 The graphics screens shall match existing plant standard screens. The database  
21 shall be configured for complete functionality including I/O driver, tag names,  
22 alarm points, and printouts.

## 23 **10. Installation**

24  
25  
26 The system supplier shall be responsible for coordinating all interfacing wiring  
27 between the Pump Control Panel and the RTU to make the system functional.

## 28 **11. Fabrication**

29  
30  
31 a. Cabinets and panel shall provide mounting for power supplies, control  
32 equipment, input-output subsystems, panel mounted equipment and  
33 appurtenances. Ample space shall be provided between equipment to facilitate  
34 servicing and cooling.

35  
36 b. The rack framework shall be stainless steel construction, 15/8" x 15/8", using  
37 Powerstrut, Unistrut, or equal and/or angle to provide a rigid assembly. Racks  
38 shall be of open, box-like framework with all frame supports welded and ground  
39 smooth. Stainless steel straps shall be used for locating terminal blocks. The  
40 terminal blocks shall be factory assembled on a miniature mounting channel and  
41 the channel bolted to the stainless steel strap. Terminals shall be miniature screw  
42 type unless otherwise required and shall be rated at least 300 volts, 20 amps, per  
43 the QPL.

44  
45 c. The terminals shall be marked vertically with a permanent, continuous marking  
46 strip from top to bottom. One side of each terminal strip shall be reserved

1 exclusively for field incoming conductors. Common connections and jumpers  
2 required for internal wiring shall not be made on the field side of the terminal  
3 subject to the approval of the PSLUSD. A vendor's pre-engineered and  
4 prefabricated wiring termination system will be acceptable.  
5

6 d. Wiring shall comply with accepted standard instrumentation and electrical  
7 practices and codes. For each pair of parallel terminal blocks, the field wiring  
8 shall be between the blocks. Solder-less horseshoe (spade) connectors, with  
9 insulating sleeves shall be used for connecting wires to terminal blocks.  
10

11 e. All wiring shall be bundled and run open or enclosed in vented plastic wire  
12 way, as required. All conductors run open shall be bundled and bound at regular  
13 intervals, not exceeding 12", with nylon cable ties. Care shall be taken to separate  
14 electronic signal, discrete signal, and power wiring. A copper ground bus shall be  
15 installed the full length of each panel, interior panel wiring and field wiring shall  
16 be tagged at all terminations with machine printed plastic sleeves. The wire  
17 number shall be the ID number listed in the input/output schedules.  
18

19 f. Wires shall be color coded as follows:  
20

- Neutral - White
- Ground - Green
- Power - Red
- Signal - Black and White
- Control - Violet
- Special - Blue

21 g. Panels shall be provided with a main circuit breaker and a circuit breaker on  
22 each individual branch circuit distributed from the panel. Main breaker and  
23 branch breaker sizes shall be coordinated such that a fault in a branch circuit will  
24 trip only the branch breaker, but not the main breaker.  
25

26 h. Panels shall be provided with 120 volt duplex receptacles for service  
27 equipment.  
28

29 i. Provide separate 120 volt feeder circuit complete with circuit breaker and on/off  
30 switch.  
31

32 j. Panels shall be furnished with red laminated plastic warning signs in each  
33 section. The sign shall be inscribed "WARNING - This Device is Connected to  
34 Multiple Sources of Power". Letters shall be 1" high, white.  
35

36 k. Panels shall have equipment racks mounted on a removable back plate (sub  
37 panel) to permit withdrawal of the equipment for maintenance or adjustment.  
38 Panels shall be designed to permit front access for all service and removal of  
39 equipment. Front access panels shall be hinged, removable with common keyed  
40 locking hardware. The interconnection between equipment and panel shall be by  
41

1 means of flexible cables provided to permit withdrawal of the equipment from the  
2 cabinet without disconnecting the plugs.

3  
4 **12. Supplier's Qualifications:**

5  
6 The system supplier shall be ISO 9000 certified, and regularly engaged in design,  
7 construction, installation, and startup of SCADA RTU systems.

8  
9 **(g) Wiring**

10  
11 (i) All wiring shall be copper, AWG 14 minimum. Wires shall be color coded as follows:  
12

<u>Controls</u>		<u>Color</u>
Ground	-	Green
Grounded Neutral	-	White
120 Volt Power	-	Black
Control	-	Red
24 Volt Control	-	Blue

13

<u>Power</u>	<u>240Y/120</u>	<u>480Y/277</u>
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

14  
15 (ii) Different control wiring colors are acceptable if clearly identified. Power wiring shall  
16 be kept separate from control wiring, and shall be identified by phase. The high leg shall  
17 be the center terminal on the main breaker.

18  
19 (iii) All wires shall be numbered with machine made plastic wrap around labels at both  
20 ends.

21  
22 (iv) All external connection and internal connections, where shown on the drawings, shall  
23 be brought to the numbered terminals.

24  
25 (v) Wiring shall be enclosed in panduct or equivalent wire ways and wiring between the  
26 doors and the panel shall be enclosed in a spiral wrap or approved equal with sufficient  
27 slack to allow full opening of the door.

28  
29 (vi) Wiring shall be secured with screw-on tabs. Tabs with adhesives shall not be used.

30  
31 (vii) All wiring shall be front accessible.

32  
33 (viii) All conduits to be ultra-violet resistant PVC, Schedule 80 or stainless steel for  
34 electrical use, as indicated in PSLSUD standard details for control panels, and shall be of  
35 2" minimum size.  
36

1 **(h) Component Mounting**

2  
3 (i) All components shall be securely mounted with stainless steel hardware. Self-tapping  
4 screws are not acceptable.

5  
6 (ii) All relay bases shall be front-mounted with screw terminals. No soldered connections  
7 shall be used. All base terminals shall be numbered to correspond to relay numbers.  
8 Where plug-in components are not firmly secured in bases, hold down clamps shall be  
9 provided.

10  
11 **(i) Identification**

12  
13 (i) All components shall be identified in accordance with the schematic diagram, using  
14 permanent nametags on the panel of laminated micarta or approved equal. The permanent  
15 nametags shall be securely attached and in a position where they are clearly visible.

16  
17 (ii) All operators' controls shall be provided with laminated micarta nametags attached  
18 with stainless steel screws, with minimum lettering height of 1/8".

19  
20 (iii) A laminated schematic drawing shall be attached to the inside of the outer door,  
21 minimum size 11" x 17".

22  
23 (iv) Attach a separate laminated label showing the following details:

	<u>PUMP</u>	<u>MOTOR</u>
1.	Brand	Horsepower
2.	Catalog number	Speed
3.	Impeller number and size	Voltage
4.	Design head	Full load amps
5.	G.P.M.	Catalog number
6.	Serial numbers	Serial numbers

24  
25  
26 **(j) Component Features**

27  
28 **(i) Main and Emergency Breaker:** The panel shall include circuit breaker sized as  
29 required for main power and emergency power disconnect. Breakers shall be mounted on  
30 the sub panel with handles through inner door and shall include a mechanical interlock on  
31 the handles to insure that only one breaker can be in the "ON" position at any one time.  
32 Circuit breaker Ampacity Voltage and Interrupting Capacity shall be listed on the  
33 construction drawings. Panel shall also include an externally mounted generator power  
34 receptacle pre-wired to the emergency breaker.

35  
36 **(ii) High Level Alarm System:** The panel shall include a vapor-proof red light mounted  
37 on the top of the enclosure for high-level alarm visual indication and a weatherproof horn  
38 mounted on the underside of the panel box. The alarm light and horn shall be pre-wired  
39 to terminals to operate on a high-level control signal. An alarm silence push button  
40 labeled "Alarm Silence" shall be mounted on the outside of the enclosure and pre-wired  
41 to a relay which will silence the horn under all conditions, and automatically reset when

1 high level condition is corrected. The high level light shall have a flasher to pulse the red  
2 external visual indicator light during a high level condition. The alarm light is to be  
3 designed and positioned to provide an unobstructed access for changing light bulb.  
4

5 **(iii) Elapsed Time Meters:** The panel shall include a non-resettable type elapsed time  
6 meter for each starter mounted on the inner door to record the accumulated running time  
7 of each pump. A totalizer to record running time of all pumps shall also be provided.  
8

9 **(iv) Convenience Receptacle:** The panel shall have a Ground Fault Interrupter (GFI)  
10 type convenience receptacle mounted on the inner door to provide plug-in 120 volt power  
11 with ground fault protection.  
12

13 **(v) Phase and Voltage Monitor Relay:**

14  
15 1. The panel shall have a line voltage rated phase sequence and loss monitor relay.  
16 The monitor relay shall be the adjustable type to be field set for nominal available  
17 incoming voltage. The monitor relay will be pre-wired to take the control circuit  
18 out of service if a phase is reversed, one or more phases are lost, or drops below  
19 nominal voltage or if all three phases drop below nominal voltage.  
20

21 2. The unit will automatically restore when normal conditions are restored.  
22

23 3. Relay shall be the socket-mounted type.  
24

25 **(vi) Seal Failure Indicator:** The panel shall have a seal failure (leak detector) indicator  
26 pilot light for each pump, if applicable. These pilot lights shall be operated by moisture  
27 sensing monitors that are signaled by probes supplied in each pump.  
28

29 **(vii) Lightning Arrester/Surge Suppressor:** The panel shall have three-phase transient  
30 voltage lightning arrester/surge suppressor protection. The suppressors shall be pre-wired  
31 to the point of incoming line service.  
32

33 **(viii) Liquid Level Control System:**

34  
35 1. The panel shall have a conductance actuated control system utilizing the  
36 electrical conductivity of the liquid to carry a small current which, when sensed,  
37 activates the appropriate controls. The one-piece multi-sensored probe shall have  
38 the capability to control several pumps and alarms, as well as indicate levels,  
39 using discrete set points. The system shall be composed of a multi-sensored or  
40 single-sensored liquid detection probe used in conjunction with various  
41 monitoring, indicating, and logic control devices.  
42

43 2. Each motor shall have a separate circuit breaker.  
44

45 3. Each control cable from the wet well into the control panel shall be protected  
46 by a suppressor.

1  
2 4. Each alarm shall have a spare contact. The contacts shall be terminated on a  
3 terminal strip for future use.  
4

5 **(ix) Telemetry System:** The components shall include, but not be limited to, terminal  
6 strip, relays, float switches, power supply (24 volt and 120 volt) and pilot lights.  
7

8 **(x) Main Power Disconnect:** A service rated fused type circuit breaker shall be included,  
9 sized as required for disconnecting main power to panel box and shall be housed in  
10 separate stainless steel enclosure mounted behind main panel box as indicated on the  
11 PSLUSD standard detail. Where required by the power company, an additional  
12 disconnect will be provided prior to the meter.  
13

14 **(k) Installation**

15  
16 (i) Installation of piping and valves shall be in accordance with specifications in Sections  
17 J.4 and J.5 of this Chapter.  
18

19 (ii) All installations shall be performed in such a manner so that components are plumb  
20 and true and aligned in such a manner that the station is fully operable and functional and  
21 no additional maintenance or restorative action is required. All electrical installations  
22 shall be performed by a licensed electrical contractor in accordance with prevailing codes  
23 and licensing requirements and shall result in a fully functioning station meeting the full  
24 intent of these specifications and the drawings.  
25

26 (iii) The contractor shall install the required fence in a true and straight manner, construct  
27 the required water service with a reduced pressure principle backflow prevention  
28 assembly, construct the concrete driveway access, construct all necessary conduit and  
29 electrical connections and all other appurtenances shown on the approved plans or  
30 reflected within these specifications and PSLUSD standard details, to provide for a fully  
31 functional installation.  
32

33 (iv) The contractor should give particular attention to the following items during  
34 installation of the lift station:  
35

36 1. All guide rails shall be attached to access lid frame with approved bracket  
37 assemblies. Intermediate guide rail supports shall be provided per manufacturer's  
38 recommendations and at least every 10'. Guide rails shall be 316 stainless steel  
39 piping.  
40

41 2. Lifting rings for the wet well or valve vault shall be removed below the surface  
42 and grouted flush to avoid tripping hazards. Exterior lifting holes shall be grouted  
43 flush.  
44

45 3. Concrete work is to be of a professional quality with nonskid finish.  
46

1 4. All discharge elbows shall be level and plumb to ensure all guide rails will  
2 work properly and that pumps can be removed easily and seat properly.  
3

4 5. All adapter flanges shall be installed according to drawings to allow easy  
5 removal of valves. All bolts shall be torqued according to the manufacturer's  
6 recommendations.  
7

8 6. The pedestal, control panel, and related components shall not be painted.  
9

10 7. The lift station site, within the fenced area, shall be covered with # 57 stone, a  
11 minimum of 6" and a maximum of 8" deep, over 2 ply 4 mil visqueen. The site  
12 shall be graded for proper drainage to prevent inflow of storm water into the wet  
13 well.  
14

15 8. Modifications to an existing pumping station shall be completed in accordance  
16 with these specifications and the details shown on the approved plans. This  
17 includes all work, materials, and cleaning to provide a fully operational station in  
18 a "Like-new" condition.  
19

20 **(I) Generator**  
21

22 (i) Where portable emergency power equipment is utilized, the generator shall be diesel  
23 fuel powered, trailer mounted, and with sufficient capacity to run the pumps and all  
24 electrical equipment at the pump station during a power failure.  
25

26 (ii) The developer shall pay for the cost of the generator and related equipment, as  
27 required in the Utility Service Agreement.  
28

29 **9. PIPELINE CLEANING (Poly Pig Method)**  
30

31 **a. GENERAL**  
32

33 (1) The contractor shall provide supervision, labor, tools, material and equipment necessary to  
34 clean all newly constructed mains, using an approved poly pig procedure. The contractor shall  
35 provide and install all items required, including poly pigs, launching and retrieval devices and  
36 test equipment, in accordance with the specifications incorporated herein and PSLUSD standard  
37 details.  
38

39 (2) The materials specified shall be constructed and installed in accordance with the best  
40 practice and methods.  
41

42 **b. CONTRACTOR QUALIFICATIONS**  
43

44 (1) The materials and work specified herein shall be furnished and performed by firms fully  
45 experienced, reputable, and qualified in pipeline cleaning with the poly pig method.  
46

1 (2) Equipment shall be installed in accordance with manufacturer's recommendations by  
2 personnel thoroughly trained, knowledgeable and experienced in the technology and procedures  
3 required for the proper and safe "pigging" of the system.

4  
5 **c. CONTRACTOR RESPONSIBILITIES**

6  
7 **(1) Supervision**

8  
9 There shall be on-site at all times during the work, one supervisor with experience in the  
10 cleaning of utility mains utilizing the procedure outlined herein.

11  
12 **(2) Proposed Method**

13  
14 The method of cleaning shall be by use of bare swab type poly pigs with light-density open-cell  
15 urethane foam body, base coated with urethane elastomer. The pigs shall have the  
16 characteristics detailed below in section d.-Poly Pigs. A minimum of two pigs of a size 2" larger  
17 than the diameter of the pipe shall be used for each main that is cleaned.

18  
19 **(3) Cleaning & Testing:**

20  
21 (a) Cleaning shall remove soil, debris, suspended or floating matter and other foreign material  
22 from the pipe, without over abrading or over cleaning the interior walls of the pipe. PSLUSD  
23 shall consider a pipe to be clean when a sample of approximately two gallons of water is swirled  
24 and allowed to settle in a clean white five gallon bucket and there is no visible soil, debris,  
25 suspended or floating matter or any other foreign material. This test shall be performed when the  
26 water leaving the pipe appears to be clean for a minimum of two minutes.

27  
28 (b) The pigging procedure will be repeated until the above mentioned test shows that the  
29 cleaning is satisfactory.

30  
31 **d. POLY PIGS**

32  
33 (1) Poly pigs shall be constructed of blown elastomer polyurethane with an open cell  
34 construction and a density equal to or suitable for use in the piping system being cleaned. Poly  
35 pig configuration shall consist of a parabolic nose and a concave base. The pig shall be coated  
36 with a resilient surface material that will maintain a peripheral seal and effectively clean the pipe  
37 without over abrading or causing any damage to the interior wall.

38  
39 (2) Poly pig characteristics shall include the ability to navigate through 90° and one hundred and  
40 180° turns, bi-directional fittings, full port valves and comparable in-line appurtenances, reduce  
41 its cross sectional area and restore itself to its original design configuration, be propelled by  
42 applications of hydraulic and pneumatic pressure while maintaining its primary function as an  
43 internal cleaning device of conduits. When in use, the pig must be able to undergo a reduction to  
44 a minimum of 65% of the original cross sectional area and return to shape while maintaining the  
45 sliding seal and ability to clean. Pigs shall be bi-directional and have the ability to negotiate  
46 fittings, valves and other appurtenances.

1 **e. PERFORMANCE**

2  
3 (1) Contractor will prepare, with assistance from the EOR, the design of the cleaning procedure  
4 including the provision of:

5  
6 (a) Selection of starting and ending points for the cleaning process.

7  
8 (b) Evaluation of total volume of fluids to be used and the disposal and the source(s) of fluids.

9  
10 (c) Mechanical or piping adaptation to the existing piping configuration.

11  
12 (d) Coordination and scheduling of the cleaning process to include selection of the distances  
13 and sizes of the piping to be cleaned as one procedure.

14  
15 (e) Immediately available alternative procedures to be applied if the cleaning of the system  
16 requires such remedial action.

17  
18 (2) PSLUSD will not accept any utility mains that do not pass the cleanliness test required in  
19 Section c.(3)(a) above.

20  
21 **10. RECLAIMED WATER METERING STATIONS**

22  
23 **a. GENERAL**

24  
25 (1) The contractor shall be responsible for furnishing of all labor, materials, equipment and  
26 incidentals required to install a complete and operational reclaimed water metering station as  
27 shown on the approved plans, the PSLUSD standard details and as specified herein.

28  
29 (2) These specifications are the minimum requirements regarding the equipment application;  
30 furnishings, installation, delivery, shop and field-testing of all materials, equipment and  
31 appurtenances for reclaimed water metering stations. The manufacturer's recommendations and  
32 approved plans may contain additional requirements pertinent to the installation of equipment,  
33 including accessory and auxiliary equipment and material types, which may not be specified  
34 herein.

35  
36 (3) Installation shall be completed in a manner that all components are plumb, true, properly  
37 aligned, fully operable and functional, and no additional maintenance or restorative action is  
38 required. Electrical work shall be performed by a licensed Electrical Contractor in accordance  
39 with prevailing codes and licensing requirements. The fence, driveway and other features shall  
40 be constructed in accordance with the approved plans and the PSLUSD standard details

41  
42 (4) The specifications shall not be construed as requiring the contractor to utilize personnel  
43 supplied by his assigned instrument manufacturer's organization, or any division thereof, to  
44 accomplish the physical installation of any elements, instruments, accessories or assemblies  
45 specified herein. However, the contractor shall employ installers who are skilled and experienced  
46 in the installation and connection of all elements, instruments, accessories and assemblies.

1  
2 (5) PSLUSD shall be provided with an exclusive easement around the metering station,  
3 consistent with PSLUSD detail RW-01. Dedicated easements for ingress and egress shall also be  
4 provided where necessary.

5  
6 (6) Developer/Contractor shall pay for all costs associated with having electrical power designed  
7 and installed to the metering facility. This shall include any and all fees or charges which may be  
8 required and payable to Florida Power and Light Company (FPL).

9  
10 (7) The operation of the metering station shall allow PSLUSD to control flow to a customer  
11 based upon the following options of operational control:

- 12  
13 (a) flow  
14 (b) upstream pressure  
15 (c) downstream pressure,  
16 (d) daily volume and storage levels

17  
18 The Engineer of Record (EOR) shall obtain written approval from the PSLUSD as to the specific  
19 type of operational controls required.

20  
21 **b. RELATED SECTIONS**

- 22  
23 (1) Design Criteria for Reclaimed Water Mains (Section H.7, Chapter II)  
24 (2) Pipe and Fittings (Section J.4, Chapter II)  
25 (3) Valves and Appurtenances (Section J.5, Chapter II)

26  
27 **c. CONTRACTOR'S QUALIFICATIONS**

- 28  
29 (1) A contractor who is experienced, reputable and qualified in the installation of underground  
30 and above ground utility lines and related appurtenances, as determined by the PSLUSD.  
31  
32 (2) A manufacturer who is experienced, reputable and qualified in the manufacture of items to be  
33 installed /constructed shall furnish all equipment and materials, as determined by the PSLUSD.  
34  
35 (3) All materials, fittings and appurtenances intended for use in pressure pipe systems shall be  
36 designed and constructed for a minimum working pressure of 150 psi unless otherwise specified.

37  
38 **d. SUBMITTALS**

- 39  
40 (1) The EOR must submit signed and sealed flow meter sizing calculations for review and  
41 approval by PSLUSD.  
42  
43 (2) When selecting the electronic/hydraulic control valve, the EOR shall provide PSLUSD with a  
44 copy of the cavitation analysis performed by the manufacturer, and any anti-cavitation device  
45 recommendations, if necessary. PSLUSD retains the authority to request additional cavitation  
46 analysis for varying scenarios. Additionally, should the use of an orifice plate be required by the

1 manufacturer, or if PSLUSD opts to use one instead of other anti-cavitation options  
2 recommended by the manufacturer, the EOR must submit signed and sealed calculations to  
3 PSLUSD for review to verify proper sizing and adjustment of hydraulic grade.  
4

5 (3) A minimum of three (3) sets of shop drawings shall be submitted to PSLUSD and EOR for  
6 review and/or approval. Each set of shop drawings shall be submitted as a complete bound  
7 package (preferably 3-ring bound). Original stamps and signatures on each of the individual  
8 components for each bound set shall be required from both the contractor as well as the EOR. No  
9 copies of signatures/stamps shall be accepted. Each shop drawing submittal, whether it is the first  
10 submittal to PSLUSD or subsequent revised submittal, must be accompanied with the "Shop  
11 Drawing Review Form", which is available on PSLUSD website at

12 <http://www.cityofpsl.com/utility/commercial-development/utility-commercial-development.html>.  
13

14 (4) Shop drawings shall include information on all above ground piping, piping  
15 primer/intermediate/finished coats, above ground fittings, above ground valves, flow meter, all  
16 telemetry hardware, interface between instruments, control panel, level detection components,  
17 electronic/hydraulic control valves, pipe supports, pressure gauges, electrical schematics and any  
18 other requirements necessary to complete the reclaimed water metering installation.

19 (5) Data shall include drawings and descriptive information in sufficient detail to show the kind,  
20 size, arrangement, and operation of component materials and devices; the external connections,  
21 anchorages, and support required; and dimensions needed for installation and correlation with  
22 other materials and equipment. All part numbers and catalog data required for ordering spares  
23 and replacements shall be provided.  
24

25 (6) Data sheets for each component must be submitted together with a technical product brochure  
26 or bulletin (this includes electronic indicator, manual set-point station, ultrasonic level controller,  
27 RTU, panel enclosure and all other devices or equipment which will be used).  
28

29 (7) The Instrumentation Systems Integrator (ISI) shall be per the Qualified Products List (QPL),  
30 and shall submit to PSLUSD (through the EOR) detailed procedures to physically test each  
31 Input/Output (I/O) that provides control and/or warnings such as alarms, level controls and  
32 pressure & flow set-points. PSLUSD reserves the right to modify the testing procedures provided  
33 by the ISI. Any modifications to the procedures by PSLUSD will be provided in writing to the  
34 EOR.  
35

36 (8) Drawings showing definite diagrams are required for every instrumentation loop system.  
37 Drawings shall include electrical schematics, layout, wiring diagrams and a parts list for all  
38 control circuits and within the control panel.  
39

40 (9) The acceptance of drawings returned marked "REVIEWED" or "REVIEWED AS NOTED"  
41 will not constitute a blanket approval of dimensions, quantities, and details of the materials,  
42 equipment, device or items shown and does not relieve the contractor of any responsibility for  
43 errors or deviations from the requirements.  
44

1 (10) The EOR must submit to PSLUSD start-up documentation, initialized by the contractor, ISI  
2 and the valve manufacturer, indicating that the hydraulic control valve and all associated  
3 equipment have been installed correctly and operating per the manufacturer's specifications.  
4

5 (11) The ISI shall submit to PSLUSD (through the EOR) any independent instrumentation  
6 programs outside the PLC in hard copy format (i.e., storage level sensor, etc.).  
7

#### 8 **e. METERS** 9

10 (1) The flow meter shall be per the QPL and have a sealed indicator having a range determined  
11 by the EOR and approved by the PSLUSD, or approved equal.  
12

13 (2) The flow meter shall also be equipped with a transmitter per the QPL. The transmitter signal  
14 output shall be in direct proportion to the flow through the meter and shall be converted to a two-  
15 wire 4 to 20 mADC current output transmitted to a local display and the PLC.  
16

17 (3) Meter shall be a velocity propeller type, magnetic drive, sealed housing, flanged tube meter  
18 for 150 psi working pressure. It shall comply with the applicable provisions of AWWA, except  
19 for the higher standard required in this specification. In the event of conflict, the specification  
20 herein shall prevail. Meter shall be equipped with a six digit totalizer reading in units of gallons  
21 and shall be accurate within  $\pm 2\%$  of true flow within the manufacturer's specifications for flow  
22 range, or an approved equal.  
23

24 (4) Meter tube shall be fabricated steel pipe and use 150 lb AWWA Class "D" flat face steel  
25 flanges. The internal and external of the meter tube and meter head shall be blasted to near white  
26 metal and coated with 12-15 mils of fusion epoxy coating, applied by the fluidized bed method.  
27 Meter tubes shall have a constant nominal inside diameter to offer minimum obstruction to the  
28 flow and shall be furnished with four straightening vanes.  
29

30 (5) Meter head shall be connected to the tube by means of a flanged, o-ring sealed connection  
31 with stainless steel bolts. The meter head shall be designed for easy removal of water wetted  
32 parts from the tube for inspection or repair without having to remove the complete tube. Water  
33 wetted meter components that are permanently attached to the tube will not be accepted.  
34

35 (6) Gear box shall be bronze, sealed and filled with a high-grade lubricant. The drive mechanism  
36 shall be magnetically driven from the propeller, through a magnetic coupling and be isolated  
37 from the water flow by means of an o-ring sealed housing. A rigid stainless steel vertical shaft is  
38 required from the miter gear frame to the totalizer drive magnet; flexible cables will not be  
39 accepted.  
40

41 (7) Propeller shall utilize a water lubricated ceramic sleeve and spindle bearing system. The  
42 stainless steel/ceramic spindle on which the propeller is mounted shall be parallel to the direction  
43 of the water flow in the pipe. Dual ceramic thrust bearings shall be standard on the meter. Ball  
44 bearings or other types of sleeve bearings will not be accepted. The propeller shall be a conical  
45 shaped, three bladed, injection molded of thermoplastic material, resistant to normal water

1 corrosion and deformity due to high flow velocities. Propellers, which have been trimmed,  
2 shaved or require varying change gears for the same size meters, will not be accepted.

3  
4 (8) Transmitter shall be encased in a sealed housing conforming to NEMA standards for  
5 weatherproof enclosures. It shall provide a solid state, optically coupled pulse output and a loop  
6 powered current output to drive the associated instrument(s). The unit shall be per the QPL. The  
7 standard 4-20 mADC sourcing type current output gives 4 mA output at zero flow and 20 mA  
8 output at the maximum scale range selected by the EOR and approved by PSLUSD. The pulse  
9 output (open collector transistor output) will be a minimum of 150 pulses per minute at the  
10 maximum flow range of the instrument that the transmitter is controlling. The transmitter  
11 enclosure shall be made from injection molded 20% glass filled engineered grade thermoplastic.  
12 Transmitter shall attach directly to the propeller meter head with screws having holes for seal  
13 wires and be protected with an o-ring seal.

14  
15 (9) Transmitter output shall be in direct proportion to the flow through the meter at the above  
16 pulse rate and current output. The unit shall be powered by an external 12-30 volts DC power  
17 supply wired in a loop with the current output. The 4-20 mA DC output shall not change or  
18 require any field adjustments with the varying voltage of the power supply.

19  
20 (10) Indicator-Totalizer shall have a full 4" diameter indicator dial and shall be equipped with a  
21 six digit, straight reading type totalizer with black numbers on white wheels. The totalizer shall  
22 read in units of gallons and shall have a test hand to check the accuracy of the indicator. The  
23 indicator drive mechanism shall be temperature compensated, so the indicator hand shall be  
24 accurate and linear within +/- 1% at all points on the dial when the unit is operated within the  
25 temperature range of 32° to 140° F. The unit shall be equipped with change gears to facilitate  
26 easy change of registration without removing pressure from the line or removing the meter head  
27 from the meter tube. The indicator-totalizer shall be protected by an o-ring sealed bonnet made  
28 from injection molded 20% glass filled engineering grade thermoplastic. The bonnet shall be  
29 attached to the meter head by screws located under the hinged lid, which has a padlock hasp.

30  
31 (11) Volumetric testing of all meters must be performed and approved prior to shipment. The  
32 complete meter head assembly must be accuracy tested in the same pipe size and same type tube  
33 that the meter will be mounted in. The test shall be at near minimum, intermediate, and  
34 maximum manufacturers specified flow ranges of the meter. The amount of water used to  
35 conduct the test must be left on the totalizer. Prior to shipping, a tag shall be attached to the  
36 meter showing the totalizer reading after the test. The test facility must be certified annually to  
37 an accuracy of ±0.2% and be traceable to the National Institute of Standards and Technology. If  
38 desired, the test shall be witnessed by the customer or their selected agent and a copy of the  
39 certified accuracy test record must be furnished at no charge to the customer, if requested.

#### 40 41 42 **f. ELECTRONIC/HYDRAULIC CONTROL VALVES**

43  
44 (1) The electronic/hydraulic control valve shall be a dual solenoid control which shall close valve  
45 upon power loss or PLC failure. The valve shall also have the ability to be operated manually,  
46 via the pilot system, upon power or PLC loss and/or during normal operation. The valve shall be  
47 per the QPL. The valve to be manufactured as followed; ductile iron body, globe, 150 pound

1 class flanged, 304 stainless steel trim (disc guide, seat & cover bearing), 304 stainless steel cover  
2 hardware, brass ASTM B283 solenoid body and pilot tubing, 304 stainless steel disc retainer &  
3 diaphragm washer, Buna-N rubber, isolation valves, and flow clean strainers. Valve should be  
4 sized in accordance with manufacturer's recommendation. The valve may require an anti-  
5 cavitation option or an orifice plate, as determined by the manufacturer and with approval by  
6 PSLUSD, based upon the cavitation analysis submitted to PSLUSD. The valve shall have the  
7 ability to modulate flow, via a set-point signal from a remote computer, based upon varying  
8 feedback signals such as flow rate, upstream and/or downstream pressures, daily volumes  
9 delivered and storage levels.

10  
11 (2) A valve positioning transmitter shall also be provided. The valve positioning transmitter shall  
12 be per the QPL. The transmitter shall be installed and interfaced with applicable electronic  
13 components to provide remote monitoring of valve position. The signal from the position sensing  
14 mechanism shall be converted to a two-wire 4 to 20 mA current output transmitted to a local  
15 display and the PLC. The output signal shall range from 4 mA to represent valve fully closed to  
16 20 mA for valve fully open.

17  
18 (3) The brass solenoid body, brass pilot tubing, name plate data and all instrumentation  
19 connections to the valve shall not be painted.

## 20 21 **g. STORAGE REQUIREMENTS**

22  
23 Storage shall be provided by the developer/customer for the purposes of retention during wet  
24 weather conditions, maintenance of irrigation equipment, or other conditions which preclude the  
25 use of reclaimed water. Type of storage may include a pond, reservoir, tank, or an above/below  
26 ground structure and shall be addressed in the design engineering report required in section H.8  
27 of Chapter II. As a minimum, storage capacity shall be three times the average daily volume of  
28 reclaimed water used. Construction shall be in compliance with applicable state and local  
29 agencies.

## 30 31 **h. STORAGE LEVEL SENSOR**

32  
33 (1) The level monitoring system shall be ultrasonic type, continuous level measuring system  
34 consisting of, at the minimum, an ultrasonic level element/transducer, local display of storage  
35 elevation and cable for connection from level element to local display and PLC. Level element  
36 system shall have the ability to monitor storage levels both locally and through a remote  
37 telemetry system.

38  
39 (2) Level element shall be ultrasonic type transducer. Transducer shall be of water proof  
40 construction with minimum operating range of  $-20^{\circ}$  to  $+50^{\circ}$  C (larger range preferred) at one (1)  
41 atmosphere, unless otherwise noted. The instrument supplier will coordinate with the transducer  
42 manufacturer for proper mounting of the transducer within the storage stilling well, as shown in  
43 the standard detail.

44  
45 (3) The storage level monitoring system shall provide a 4 to 20 mA DC output signal to the PLC  
46 in linear proportion to the level being sensed. The level range/readouts shall be based upon the

1 maximum storage elevation allowed (high level), which is to be provided by the EOR and  
2 approved by PSLUSD. The local display component for the storage level shall be provided in the  
3 control panel, along with the any necessary functions for level calibration/controls, for use by the  
4 PSLUSD operator.

5  
6 (4) The system shall have an overall accuracy of plus or minus 0.25% of full scale and shall  
7 operate on 120 volts, 50/60-HZ power.

8  
9 (5) All necessary interconnecting cables shall be furnished with the equipment provided in  
10 sufficient length.

11  
12 (6) All equipment shall be provided transient surge protection for the incoming 120 volts AC and  
13 DC signals.

14  
15 (7) The sensors shall be accessible for calibration, maintenance and replacement.

16  
17 **i. CONTROL PANEL & TELEMETERY SYSTEM**

18  
19 (1) Fiber optic communication shall be used in lieu of telemetry in all instances where fiber optic  
20 is available.

21  
22 (2) The system supplier shall be per the ISI on the QPL and will be responsible for furnishing  
23 and installing the new Radio Telemetry equipment and programming as specified. ISI shall be  
24 responsible for all hardware, software system integration, programming, testing and startup.  
25 HMI graphical screen development and required database configuration of the existing data  
26 acquisition software shall be provided consistent with the monitoring facility (Glades or  
27 Westport WWTP).

28  
29 (3) Local control of the reclaimed water metering station shall be through a portable laptop  
30 computer.

31  
32 (4) The panel builder shall be experienced in the construction of lift station control panels, shall  
33 have a UL approved shop, and shall be able to provide both a UL 508 label for the panel, and a  
34 UL label for service rated.

35  
36 (5) The Remote Telemetry shall be microprocessor based, user programmable PLC, and shall  
37 serve as an interface to accumulate, process, transmit, and receive discrete and analog status and  
38 control messages between the RTU base station and the remote RTU sites located.

39  
40 (6) The panel builder shall warrant the panel for one (1) full year minimum from the date of  
41 start-up.

42  
43 (7) The panel builder or qualified technical representative shall checkout and test the panel as  
44 part of the station start-up with PSLUSD and the EOR.  
45

1 (8) The panel shall be 316 stainless steel modified NEMA-12 control panel with a drip shield  
2 along the complete top of panel. Padlocking handles shall be provided with accessories and  
3 doorstop kit. Provide two extra bolted clips on front edge of door panel with all stainless steel  
4 hardware. An aluminum inner hinged door shall contain all operators' controls and the dead front  
5 panel outside door shall be blank. Provide duct seal putty on all outgoing conduits. Provide  
6 corrosion inhibitor per the QPL.  
7

8 (9) Control panel shall be mounted to two (2) 3" diameter aluminum pipe supports (6061-T6-  
9 Sch40). Length of the pipe supports shall be sized so as to provide for 36" of burial (in 3000 psi  
10 concrete), and extend to 3" above the top of the supports. The panel shall be mounted to the pipe  
11 supports with one (1) 5/8" x 5/8" 12 gauge stainless steel unistrut at a height consistent with the  
12 FPL requirements for mounting their meter. Paint below ground portion of supports with asphalt  
13 based paint to 3" above grade. All hardware shall be stainless steel.  
14

15 (10) A back mounting panel for heavy components including RTU shall be provided.  
16

17 (11) Panel shall be surface wired with numbered terminals. Terminal strip shall be located at  
18 least 4" from the bottom of the enclosure for accessibility.  
19

20 (12) All wiring shall be copper THWN. Shielded cable shall be Belden 8760 or approved equal.  
21

22 (13) Panel shall be built by U.L. approved shop and adhere to U.L. label 508.  
23

24 (14) A circuit breaker disconnecting NEMA-4X stainless steel enclosure shall be provided  
25 outside the control panel. Disconnect shall be service entrance rated.  
26

27 (15) Panel components shall be as listed. No substitutions shall be made without prior approval  
28 in writing from the PSLUSD.  
29

30 (16) Telemetry hardware and conduit will conform as specified in control panel requirements.  
31 Telemetry systems shall be compatible with PSLUSD's central control receiving station.  
32

33 (17) RTU antenna requirement shall be as shown on the standard detail.  
34

35 (18) Local and remote readouts shall be provided per the standard detail for I/O Schematic and,  
36 at a minimum, as listed below in the units shown:  
37

- 38 (a) Upstream pressure (psi)
- 39 (b) Downstream pressure (psi)
- 40 (c) Flow (gpm/gpd) (two readouts/modes:
  - 41 (i) Instantaneous flow rate, and
  - 42 (ii) Daily volume delivered
- 43 (d) Storage Level (two readouts/modes:
  - 44 (i) Storage Elevation (NGVD), and
  - 45 (ii) Feet above or below storage high water elevation
- 46 (e) Valve position (% open)

1 (f) FPL power (light)

2  
3 (19) Breakers shall be per the QPL.

4  
5 (20) Pilot lights, selector switches and push buttons shall be per the QPL.

6  
7 (21) Surge Arrestor for power and lighting shall be per the QPL.

8  
9 (22) The PLC shall be per the QPL and shall have:

10  
11 (a) One (1) digital output card 8 channel

12 (b) One (1) digital input card 8 channel

13 (c) One (1) CPU

14 (d) One (1) Ethernet Module or Ethernet/Modbus converter

15 (e) One (1) fiber optic/Ethernet switch

16 (f) One (1) 8 channel analog input card

17 (g) One (1) 4 channel analog output card

18 (23) General I/O schedule is as follows, unless otherwise modified by the PSLUSD:

19  
20 (a) Upstream Pressure

Analog Input

21 (b) Downstream Pressure

Analog Input

22 (c) Instantaneous Flow rate

Analog Input

23 (d) Daily Volume Pumped

Totalizer Programmed into PLC

24 (e) Daily Volume Delivered

Totalizer Programmed into PLC

25 (f) Valve Position (Feed back)

Analog Input

26 (g) Valve Position (Flow rate Set Point)

Analog Output

27 (h) Storage Level

Analog Input

28 (i) FPL Power

Analog Input

29 (j) Storage Flow Rate

Analog Input

30 (k) Local/Remote Indication

Discrete Input

31  
32 **11. FIBER OPTIC CABLE**

33  
34 **a. General**

35  
36 The contractor shall provide complete installation of conduits (minimum of two; one spare  
37 conduit) and pull boxes including materials, equipment, labor and documentation, in accordance  
38 with these specifications and recognized industry standards.

39  
40  
41 **b. Related Sections**

42 Earthwork, Excavation, Backfill and Compaction - Section J.1, Chapter II

43  
44  
45 **c. Submittals**

1 (1) Shop drawings shall be submitted of all equipment and appurtenances required for a complete  
2 fiber optic infrastructure, which includes at least the following:

- 3
- 4 (a) Conduit
- 5 (b) Pull Boxes, Splice Boxes, Splice Vaults, Splice Cabinet.
- 6 (c) Cable
- 7 (d) Device Server
- 8 (e) Network Devices
- 9 (f) Locate Tracer Wire
- 10 (g) Marking Tape
- 11 (h) Pull Tape
- 12 (i) Cable Route Markers

13

14 (2) A schematic of entire system including proposed locations of pull boxes at locations shown  
15 on the approved plans with provisions for maximum pull box spacing.

16

17

18 **d. Workmanship**

19

20 (1) Conduit and pull box supplier or manufacturer shall guarantee material and all related  
21 appurtenances in writing for a period of two years from the date of delivery to the project. The  
22 manufacturer or supplier shall provide a copy of the signed guarantee with the bid.

23

24 (2) Inspections may be made by PSLUSD personnel of the manufacturer's or supplier's yard.

25

26 **e. Materials, Installation & Testing**

27

28 All products shall be new, unused and of current design and manufacturer.

29

30 **(1) Conduit**

31

32 **(a) Material specifications for underground installation**

33

34 (i) **HDPE** - HDPE conduit shall be used for directional bores.

35

36 **1. Outer Duct**

37

38 a. Conduit shall be manufactured from virgin high-density polyethylene with PE  
39 3408 resin. Conduit shall be extruded with uniform full-thickness orange only  
40 coloring. Printed or embossed striping is not permitted.

41

42 b. Conduit shall be labeled with durable identification giving the name of the  
43 manufacturer, conduit size (inner diameter trade size and wall thickness/rating),  
44 manufacture/date codes, and sequential foot marking.

1 c. Conduits shall be 2" in diameter (IPS) and shall conform to ASTM D-3305  
2 meeting the following minimum requirements:  
3

- 4 (1) Smoothwall DR 11
- 5 (2) Nominal outer diameter - 2.375"
- 6 (3) Average inner diameter - 1.926"
- 7 (4) Minimum Wall thickness - 0.216"
- 8 (5) Tensile Strength – 3,000 psi min (ASTM-D638).
- 9 (6) Elongation – 400% min.
- 10 (7) Melt Index – 0.4max (ASTM-D1238).
- 11 (8) Condition B – 20% failure max (ASTM-D1693).
- 12 (9) Cell classification -3340 or 34420 (ASTM-D3350).
- 13 (10) Impact – NEMA Standards Publication TC7 (ASTM-D2444).
- 14

15 d. Conduits shall be factory treated with an atomized silicone or manufactured in  
16 a manner to reduce friction during pulling fiber optic cable. The coefficient of  
17 friction shall be 0.09 or less.  
18

19 e. Conduit shall be resistant to calcium chloride, potassium chloride, sodium  
20 chloride, sodium nitrate, benzene, ethyl alcohol, fuel oil gasoline, lubricating oil,  
21 and transformer oil and is protected against degradation due to oxidation and  
22 general corrosion.  
23

24 f. Conduit shall be suitable for underground use in an ambient temperature range  
25 of -30 to 130 degrees F without degradation of material properties.  
26

27 g. All underground conduit installations shall be 2" Schedule 80 PVC or HDPE  
28 conduit with a minimum of 30" of cover as shown on the approved plans and  
29 standard detail. The contractor shall use the following methods for placement of  
30 the buried fiber optic cable conduit:

- 31 (1) Trenching
- 32 (2) Plowing
- 33 (3) Joint Trench Installation
- 34 (4) Directional Drilling where necessary, or
- 35 (5) Other methods approved by PSLUSD and EOR.  
36

37 h. The top of the conduit shall be not less than 30" below grade, and shall have a  
38 minimum slope of 3" in each 100' away from buildings and toward pull boxes and  
39 other necessary drainage points.  
40

41 i. If the required depth cannot be accomplished due to soil conditions or  
42 obstructions, additional mechanical protection shall be provided as indicated by  
43 the EOR and PSLUSD. For underground conduit requiring additional mechanical  
44 protection, i.e. boring under railroads, shall boring depth, proximity to other  
45 utilities, a black steel pipe shall be installed as an outer sleeve/casing or other  
46 material specified by the EOR and approved by the PSLUSD.

1  
2 j. The conduit shall be run in straight lines except where a change of direction is  
3 necessary. Should unsuitable soils be found, the contractor shall contact the EOR  
4 and PSLUSD for final determination. Where installation is conduit only (i.e., not a  
5 joint trench installation), unsuitable soils shall be removed up an additional 3” of  
6 depth and will be replaced with clean fine sands, tamped level and meet density  
7 requirements.

8  
9 k. For all new duct runs a continuous marking tape shall be direct buried at 12”-  
10 18” below grade.

11  
12 l. Every effort shall be made to minimize HDPE couplings. Couplings shall be  
13 airtight and watertight. All couplings shall be installed in accordance with the  
14 conduit and the coupling manufacturer’s recommendations. Only couplings of the  
15 type specified below and approved by the conduit manufacturer are permitted.  
16 Couplings shall be accomplished only by hydraulic press-on or electro-fusion  
17 coupling methods. Hydraulic press-on couplings of seamless tool-grade tubular  
18 aluminum with sealing barbs and center stop shall be used. Hydraulic compression  
19 duct coupling tools and manufacturer’s installation procedures shall be utilized to  
20 fully insert both conduit sections to the coupling center stop. Pre-fabricated  
21 electro-fusion couplings shall be used in accordance with the manufacturer’s  
22 recommended automatic self-monitoring fusing machine and installation  
23 procedures.

24  
25 **2. Inner-Duct**

26  
27 a. Provide factory lubricated, industry sized 1.25-inch inside diameter,  
28 low friction, coilable, conduit constructed of virgin high-density  
29 polyethylene outer duct. Said inner duct shall conform to ASTM D-2239  
30 and meet the following minimum requirements: Smooth wall SDR-11,  
31 nominal outer diameter of 1.592 inches, minimum inner diameter 1.360 inches  
32 and a minimum wall thickness of 0.106 inches.

33  
34 b. Provide conduit with a smooth outer wall and ribbed inner wall and  
35 ensure the conduit is capable of being coiled on reels in continuous lengths,  
36 transported, stored outdoors and subsequently uncoiled for installation without  
37 affecting its properties or performance. Inner duct shall be furnished in the  
38 following factory extruded colors: orange, red, and yellow.

39  
40 c. Furnish and install inner duct with an uninterrupted detectable Kevlar pull  
41 (mule) tape, with a minimum of 3-feet of excess tape extending out of each  
42 end of the outer duct; these pull tapes shall be utilized in future phases for the  
43 installation and detection of fiber optic cable.

44  
45 d. Provide mechanical duct plugs that provide a watertight barrier when  
46 installed in an unused inner duct conduit. Provide duct plugs sized in

1 accordance with the conduit furnished. Provide duct lugs that are removable.  
2 All conduits shall come with factory installed duct plugs to keep out dust, dirt,  
3 and water.  
4

5 e. Provide mechanical sealing devices that provide a watertight barrier  
6 between the conduit and communications cable. Provide mechanical  
7 sealing devices sized in accordance with the conduit furnished and with  
8 appropriately sized holes for the communications cable. Provide mechanical  
9 sealing devices that are removable.  
10

11 **(ii) PVC Conduit** - Use of PVC conduit materials is specifically required in joint trench  
12 applications and in other instances, if approved by PSLUSD.  
13

14 1. Conduit shall be 2" schedule 80 PVC manufactured to NEMA TC-2, Federal  
15 Specifications WC1094A and VC651.  
16

17 2. All bends shall consist of a minimum 48" radius sweep. Sweeps shall be  
18 fabricated by the manufacturer and shall have no indications of deformations of  
19 the pipe circumference or scorching of the conduit, otherwise the material will be  
20 rejected.  
21

22 3. No more than an equivalent 180° bend radius shall be allowed in any conduit  
23 run in-between hand-holes/pull-boxes. PVC conduit shall be manufactured and  
24 installed in 20' lengths with bell and spigot design and all joints solvent welded  
25 and fully seated.  
26

27 **(b) Material Specifications for above ground installation**  
28

29 (i) Conduit shall be 2" galvanized rigid steel (GRS), aluminum, or Schedule 80 PVC in  
30 accordance with ASTM D 1785. Rigid steel conduit material utilized shall be compliant  
31 with UL-6, ANSI C-80.1 and to Article 346 of the NEC. Aluminum conduits shall be of  
32 aluminum 6063 aluminum alloy, T-1 Temper, ANCI C80.5, and NEC 250.118(2). No  
33 reducing couplings or reduction in the inside diameter of conduit shall be permitted.

34 (ii) All required connectors, adapters, fittings, conduit straps or "U" guard clamps and  
35 incidentals required and necessary for above ground installations shall be galvanized  
36 and provided to construct a complete conduit/duct system.  
37

38 (iii) The conduit for above ground use (a riser assembly on a utility service pole for  
39 the purpose of bringing power from above ground to underground  
40 conduit/duct, or bridge mounted or other above ground structure) consisting of  
41 galvanized rigid steel (GRS), aluminum, or Schedule 80 PVC conduit in accordance  
42 with ASTM D 1785 and as approved by the City.  
43

44 (iv) Schedule 80 PVC conduit, aluminum or Rigid Metal Conduit (RMC) for  
45 bridge applicable. All rigid steel conduit material utilized shall be compliant with  
46 UL-6, ANSI C-80.1 and to Article 346 of the NEC. All aluminum conduits shall be

1 of aluminum 6063 aluminum alloy, T-1 Temper, ANCI C80.5, and NEC 250.118(2).  
2 All required connectors, adapters, fittings, conduit straps or “U” guard clamps and  
3 incidentals required and necessary for above ground installations shall be galvanized  
4 and provided to construct a complete conduit/duct system.  
5

6 (v) No reducing couplings or reduction in the inside diameter of conduit shall  
7 be permitted. No intermediate metallic conduit (IMC) or thin-wall type electrical  
8 conduit shall be permitted on this project for outdoor use.  
9

10 (vi) A galvanized metal conduit grounding bushing, or aluminum metal conduit  
11 grounding bushing on the terminating ends of all GRS/aluminum conduit runs.  
12 The bushings shall have an insert made of plastic or other suitable material to  
13 protect wiring installed in the conduit. The bushing shall have a compression-type  
14 grounding lug for bonding the conduit to the ground rod in the pull box. Do not field  
15 drill sealing bushings.  
16

### 17 **(c) Installation Requirements**

#### 18 **(i) Splicing of the Conduit**

19  
20  
21 Splice or join sections of conduit(s) using manufacturer’s recommended  
22 splice kits. Upon approval, a junction box or pull box may be installed  
23 at locations where splicing or coupling of the conduit is necessary due to  
24 problems encountered with the installation.  
25

#### 26 **(ii) Duct Plugs and Mechanical Sealing Devices**

27  
28 1. Following the installation of conduit where the communications cable is not  
29 immediately installed use a duct plug to seal the ends of the conduit. Secure  
30 the pull line to the duct plug in such a manner that it will not interfere with  
31 the installation of the duct plug and provide a watertight seal.  
32

33 2. In conduits containing communications cable, seal the conduit with an  
34 approved mechanical sealing device. Ensure the installation provides a  
35 watertight seal.  
36

#### 37 **(iii) Conduit Seals and Couplings**

38  
39 Conduit in which cable is placed shall be sealed with urethane foam duct seal; this  
40 material shall be inserted between the cable and the conduit.  
41

### 42 **(d) Testing of Conduit**

43  
44 (i) After installation of the conduit and completion of tamping/backfill process, a mandrel  
45 test shall be performed to ensure the conduit has not been damaged. A non-metallic  
46 mandrel with an outer diameter of at least 95% of the internal diameter of the conduit

1 shall be passed through the conduit. If the mandrel fails to pass through the conduit, the  
2 defect shall be exposed and corrected. The test shall be repeated to assure that the defect  
3 has been satisfactorily corrected.  
4

5 (ii) The PSLUSD may accept alternative testing to demonstrate that the conductor can be  
6 pulled through the conduit if a written justification is submitted by the contractor.  
7

## 8 **(2) Pull Boxes, Splice Boxes, Splice Vaults, and Splice Cabinets**

9

### 10 **(a) Pull Boxes**

11  
12 (i) Pull boxes shall be lightweight, high strength, resistant to sunlight, resistant to  
13 petrochemicals, straight sided, flush fit with sidewalk or grass, and be capable of anchor  
14 inserts to allow for mounting rail attachment.  
15

16 (ii) Pull boxes shall be manufactured of a composite mixture of polymer and concrete and  
17 reinforced by a heavy-weave fiberglass creating a material compressive strength of no  
18 less than 110 psi. Pull boxes shall have a minimum design rating of 20,800 lbs over a 10"  
19 x 10" area.  
20

21 (iii) Pull boxes shall be of one piece box construction; no stacking of box sections shall  
22 be allowed. Minimum size shall be 17" x 30"  
23

24 (iv) Pull boxes shall be provided with a traffic-rated heavy-duty cover having a minimum  
25 elastic design load of 20,800 lbs. over a 10-inch by 10-inch area . All covers shall be  
26 produced to the AASHTO H-20 Cover Rating and meet a ASTM C857 load test of  
27 20,800 lbs., performed as stated in AASHTO T280-87, "Standard Method Of Testing  
28 For Concrete Pipe, Section, Or Tile", Section 5, and as referenced in ASTM C497. A  
29 minimum of two stainless steel hex head bolts with washers shall be provided to secure  
30 the cover to the pull box. Covers shall be embossed with "FIBER OPTIC" on the  
31 outside and shall have "J" hook slots [1-inch (W) x 4-inches (L)].  
32

33 (v) The excavation shall be a minimum of 6" deeper than the depth of the box. A  
34 minimum of 6" crushed rock shall be added for drainage as required for raising the top of  
35 the box to finished grade. When box cover is in place, the excavation shall be filled and  
36 the soil compacted to grade level. If grade level is raised later, the box can be pulled up  
37 and bricked at the bottom with one brick per side (a total of four). The cavity created by  
38 raising the box shall be filled with crushed rock.  
39

40 (vi) Conduit runs shall enter pull box utilizing upward sweeps. For pull box depth less  
41 than 30" a 22.5 degree conduit sweep shall be installed. For conduit ends, the sweep shall  
42 be aligned in the box so that fiber is not subjected to more than 75% of the maximum  
43 bending radius of the cable. A minimum of 50 feet of cable slack shall be left in each pull  
44 box.  
45

46 (vii) The pull boxes shall have a 12" wide x 6" thick concrete collar placed around the

1 top of the box if within the FDOT right-of-way.  
2

3 (viii) A pull box shall be installed at each location as shown on the approved plans and  
4 shall not exceed 1000' spacing.  
5

6 **(b) Splice Boxes**  
7

8 (i) Splice boxes shall be lightweight, high strength, resistant to sunlight, resistant to  
9 petrochemicals, straight sided, flush fit with sidewalk or grass, and be capable of anchor  
10 inserts to allow for mounting rail attachment.  
11

12 (ii) Splice boxes shall be manufactured of a composite mixture of polymer and concrete  
13 and reinforced by a heavy-weave fiberglass creating a material compressive strength of  
14 no less than 110 psi. Pull boxes shall have a minimum design rating of 20,800 lbs over a  
15 10" x 10" area.  
16

17 (iii) Splice boxes shall be of one piece box construction; no stacking of box sections shall  
18 be allowed. Minimum size shall be 30" x 48".  
19

20 (iv) Splice boxes shall be provided with a traffic-rated heavy-duty cover having a  
21 minimum elastic design load of 20,800 lbs. over a 10-inch by 10-inch area. All covers  
22 shall be produced to the AASHTO H-20 Cover Rating and meet a ASTM C857 load  
23 test of 20,800 lbs., performed as stated in AASHTO T280-87, "Standard Method Of  
24 Testing For Concrete Pipe, Section, Or Tile", Section 5, and as referenced in ASTM  
25 C497. A minimum of two stainless steel hex head bolts with washers shall be provided  
26 to secure the cover to the pull box. Covers shall be embossed with "FIBER OPTIC"  
27 on the outside and shall have "J" hook slots [1-inch (W) x 4-inches (L)].  
28

29 (v) Splice box installations, the excavation shall be a minimum of 6" deeper than the  
30 depth of the box and a minimum of 6" crushed rock shall be placed in the vault. When  
31 box cover is in place, the excavation shall be filled and the soil compacted to grade level.  
32 If grade level is raised later, the box can be pulled up and bricked at the bottom with one  
33 brick per side (a total of four). The cavity created by raising the box shall be filled with  
34 crushed rock.  
35

36 (vi) Conduit runs shall enter pull box utilizing upward sweeps. For pull box depth less  
37 than 30" a 22.5 degree conduit sweep shall be installed. For conduit ends, the sweep shall  
38 be aligned in the box so that fiber is not subjected to more than 75% of the maximum  
39 bending radius of the cable. A minimum of 100 feet of cable slack shall be left in each  
40 splice box.  
41

42 (vii) The pull boxes shall have a 12" wide x 6" thick concrete collar placed around the  
43 top of the box if within the FDOT right-of-way.  
44

45 **(c) Splice Vault**  
46

1 (i) The splice vault shall have dimensions of 48" x 48" x 48" D and shall be an open  
2 bottom manhole.

3  
4 (ii) Splice vault shall be concrete constructed, with a ¼" x 36" Diameter Traffic Steel  
5 Cover (Diamond Plate) with intermediate beam supports. Vault shall have "FIBER  
6 OPTIC" cast in on the top of the cover.

7  
8 (iii) Splice vault installations, the excavation shall be a minimum of 12" deeper than the  
9 depth of the box and a minimum of 12" crushed rock shall be placed in the vault. When  
10 box cover is in place, the excavation shall be filled and the soil compacted to grade level.  
11 If grade level is raised later, the box can be pulled up and bricked at the bottom with one  
12 brick per side (a total of four). The cavity created by raising the box shall be filled with  
13 crushed rock.

14  
15 (iv) Conduit runs shall enter splice vault utilizing upward sweeps. For pull box depth less  
16 than 30" a 22.5 degree conduit sweep shall be installed. For conduit ends, the sweep shall  
17 be aligned in the box so that fiber is not subjected to more than 75% of the maximum  
18 bending radius of the cable. A minimum of 100 feet of cable slack shall be in each splice  
19 box.

20  
21 (v) The splice vaults shall have a 12" wide x 6" thick concrete collar placed around the  
22 top of the box if within the FDOT right-of-way.

23  
24 **(d) Splice Cabinet**

25  
26 (i) Cabinets shall be fabricated from 5052-H32 aluminum with stainless steel hinges and  
27 base mounted. A 3 point locking system with a Corbin #2 lock and padlock hasp shall be  
28 provided. The cabinet shall have neoprene gaskets (closed cell), vertical rails for 19' rack  
29 equipment or shelves, and double doors front and back. A 100 CFM fan with thermostatic  
30 control optional, fluorescent lamp front and/or optional back shall be provided inside the  
31 cabinet. The finish shall be UNF alum or powder-coat to specifications.

32  
33 (ii) Cabinet shall be based mounted on a concrete pad 12" thick and two inches larger than  
34 the cabinet footprint on all four sides.

35  
36 (iii) Conduits shall enter the cabinet through the slab and into the bottom of the cabinet.

37  
38 (iv) A minimum of 25 to 50 feet of cable slack shall be left in each cabinet.

39  
40 (v) Cabinets shall be installed in locations identified by the City.

41  
42 **(3) Fiber Optic Cable**

43  
44 **(a) Material Specifications**

1 (i) Cable shall be suitable for installation in an underground conduit environment including  
2 constant immersion for outdoor installations. Cable shall be of loose-tube, non-metallic  
3 construction. The cable shall be installed in continuous lengths.  
4

5 (ii) Provide cable of a water-blocked, loose tube construction with up to 12 buffer  
6 tubes wrapped around a dielectric central strength member. All fiber(s) shall be  
7 contained within buffer tubes, and each buffer tube shall have an inside diameter  
8 much greater than the total diameter(s) of the fiber(s) it supports. The fiber optic  
9 cable shall have a reverse oscillation or planetary stranding structure.  
10

11 (iii) The buffer tubes shall be color coded in compliance with EIA/TIA-598  
12 "Color Coding of Fiber Optic Cables". All fibers shall be color coded in compliance  
13 with EIA/TIA-598 "Color Coding of Fiber Optic Cables".  
14

15 (iv) Jacket construction and the configuration of the groups shall be such that they  
16 can easily be separated at splice points, permitting one set of fibers to be cut and  
17 spliced while the others remain continuous.  
18

19 (v) Submit proposed cable designs for the Engineer's System Manager approval prior  
20 to procurement and installation of cable plant.  
21

22 (vi) The cable shall have a water-block tape over the buffer tubes and throughout  
23 the remainder of the cable to prevent entry of water.  
24

25 (vii) Each fiber or group of fibers shall be free-floating within the tubes such  
26 that all Mechanically or environmentally induced stress placed upon the cable is de-  
27 coupled from the fibers. The air within the buffer tubes shall be displaced with a  
28 gel to prevent entry by water and to facilitate free movement of the fiber(s) within.  
29

30 (viii) The cable shall be capable of withstanding a pulling tension of 2700 N (600 lbs)  
31 under load conditions and 600 N (135 lbs) under static conditions and a crush  
32 resistance of 220 N/cm (length of cable), without changing the characteristics of the  
33 optical fibers.  
34

35 (ix) The outer jacket shall be UV and fungus resistant.  
36

37 (x) All fibers in the fiber optic cable shall be spliced and/or terminated.  
38

39 (xi) The cable shall be capable of withstanding a minimum-bending radius of 10 times  
40 its outer diameter during operation and 20 times its outer diameter during installation  
41 without changing the characteristics of the optical fibers.  
42

43 (xii) The specifications for the Single mode & Multimode fiber are as follows:  
44

45 **Table: Optical Fiber Specifications**  
46

PARAMETERS	SINGLE MODE	MULTI MODE
Type	Step Index	62.5µm only
Core Diameter	8.3µm (Nominal)	62.5 +/- 3.0
Cladding Diameter	125µm +/-0.7µm	125mm +/- 2.0µm
Core to Cladding Offset	£ 0.8µm	£ 5%µm
Coating Diameter (OSP)	245µm +/-5µm	245µm +/-5µm
Coating Diameter (IP)	900µm ± 15µm	900µm ± 15µm
Cladding Non-circularity	£ 0.7%	£ 1.5%
Proof Tensile Test	100 kpsi (0.7 GN/m <sup>2</sup> )	100 kpsi (0.7 GN/m <sup>2</sup> )
<i>Attenuation:</i>		
@ 850nm(MM)	N/A	£ 3.4 dB/km
@ 1300nm(MM)	N/A	£ 1.0 dB/km
@ 1310nm(SM)	£ 0.4 dB/km	N/A
@ 1550nm(SM)	£ 0.3 dB/km	N/A
<i>Bandwidth:</i>		
@ 850nm(MM)	N/A	Up to 300 Mhz-Km
@ 1300nm(MM)	N/A	Up to 500 Mhz-Km
<i>Chromatic Dispersion</i>		
Zero Dispersion	1301.5/1321.5nm	
<i>Wavelength Zero</i>		
Dispersion Slope	0.089 ps/(nm <sup>2</sup> ·km)	
Maximum Dispersion	3.3 ps/(nm·km) for 1285-1330nm < 18 ps/(nm·km) for 1550nm	
Cut-Off Wavelength	1260nm	
<i>Numerical Aperture:</i>		
(EIA-455-47)	N/A	

(xiii) All optical fibers shall be proof tested by the fiber manufacturer at a minimum load of 100-kpsi. All optical fibers shall be 100% attenuation tested at the factory for compliance with performance specifications described herein. The attenuation data for each fiber shall be provided with each cable reel.

**(b) Installation Requirements**

(i) Before starting any construction, all Contractor personnel (including subcontractors) shall be thoroughly familiar with and shall comply with Occupational Safety and Hazard Act (OSHA) regulations and FDOT safety practices and policies.

(ii) Fiber optic cable installation techniques shall be utilized such that the optical and mechanical characteristics of the cables are not degraded at the time of installation

(iii) Perform the cable pulling operation in such a manner that the minimum-bending radius of the cable shall not be exceeded in the unreeling and pulling operations. Use entry guide chutes to guide the cable into the pull-box conduit ports. Utilize lubricating compound to minimize cable-to-conduit friction. Lubricating compound must be a water-based compound specifically produced for fiber optic cable lubrication. Lubricants such as dish soap and other substitutes are not allowed.

1 (iv) Corner rollers (wheels), if used, shall not have radii less than the minimum  
2 installation bend radius of the cable. A series array of smaller wheels can be used for  
3 accomplishing the bend if the cable manufacturer specifically approves the array.  
4 Continuously measure the cable pulling tension; the pulling process shall not be  
5 allowed to exceed the maximum tension specified by the manufacturer of the cable.  
6 Fuse links and breaks shall be used to insure during the pulling process the cable will  
7 not be subjected to pulling stresses exceeding exceed 2700 N (600 lbs).  
8

9 (v) When simultaneously pulling fiber optic cable with other cables, separate  
10 grooved rollers shall be used for each cable.  
11

12 (vi) The Contractor is permitted to use air-assisted blowing for the fiber optic  
13 cable installation within the conduit. Air-assisted blowing may consist of either the  
14 high air speed blowing (HASB) method or the piston method.  
15

16 (vii) While using the HASB method, the volume of air passing through the conduit  
17 shall not exceed 600 cfm or that air pressure stipulated by the conduit  
18 manufacturer. In using the piston method the volume of air passing through the  
19 conduit shall not exceed 300 cfm or the conduit manufacturer's recommended air  
20 volume, whichever is more restrictive.  
21

22 (viii) The Contractor shall insure that the fiber optic cable procured for this  
23 project is flexible and approved by the cable manufacturer for air-assisted blowing  
24 installation methods.  
25

26 (ix) The Contractor shall also be responsible for ensuring that the type of  
27 conduit procured for this project does not have physical characteristics that would  
28 disrupt the flow of air needed for proper cable installation (e.g., circumferential ribs  
29 or corrugations).  
30

31 (x) The conduit shall be able to hold up to 100 psi of air without leaks. Conduit  
32 splices are critical and must not reduce the interior diameter of the conduit.  
33

34 (xi) Aluminum couplers, suitable for air-assisted blowing of fiber optic cable, shall  
35 be used for both HASB and piston method cable installations.  
36

37 (xii) A factory furnished lubrication, especially engineered for blowing methods of  
38 cable installation, shall be used, and regular cable-pulling lubricants will not be  
39 permitted for air-assisted blowing installation methods. Fiber optic simplex duct plugs  
40 used with air-assisted blowing installations shall require seals sized to the cable in  
41 order to prevent leakage from the pressure chamber around the entering cable.  
42

43 (xiii) General field procedures for air-assisted blowing installations of fiber optic  
44 cable shall be as follows:  
45

- 46 1. Ensure that the conduit system is properly installed with pressure-tight conduit  
47 splices. Test the conduit system prior to cable installation by sealing one end of

1 the conduit and pressurizing the conduit using a sealed blowing machine. The  
2 conduit should not lose air pressure at any significant rate as determined by the  
3 Engineer's System Manager.  
4

5 2. If using the HASB method, cap the front end of the cable to prevent it from  
6 hanging up in the conduit. Use air seals that fit properly around the outside  
7 diameter of the cable being installed.  
8

9 3. Clean, dry and establish the airtight integrity of the conduit, by blowing a hard  
10 mandrel through the conduit to establish that the conduit is not crushed. Blow a  
11 tight-fitting foam carrier through the conduit at high pressure. The foam carrier  
12 should travel through at approximately 100 fps in a clean conduit. If excess  
13 water or dirt comes from the conduit, repeat the process. At the Engineer  
14 System Manager's discretion, dry the conduit with dry airflow prior to cable  
15 installation.  
16

17 4. For the HASB method, inject the recommended amount of lubricant and spread  
18 it by blowing another foam carrier through. For the piston method, inject the  
19 majority of the lubricant in front of the missile, with some lubricant placed  
20 behind it.  
21

22 5. Connect the blowing machine to the conduit. For HASB machines, hand feed  
23 approximately 100 feet of cable into the duct prior to closing and sealing the  
24 cable and air chamber on the blowing machine. For piston machines, attach the  
25 piston to the cable and insert the piston into the duct. For both installation  
26 methods, follow the machine manufacturer's instructions for all operations.  
27

28 6. Check all pneumatic and hydraulic hook-ups prior to increasing the air  
29 pressure.

30 7. Keep cable ends sealed at all times during installation, using an approved  
31 cable end cap. Do not use tape to seal the cable end. The cable end shall remain  
32 sealed until termination takes place.  
33

34 8. Install fiber optic cable such that the optical characteristics are not degraded  
35 in any manner. Provide adequately trained personnel for the installation of the  
36 cable and for the fusion splicing. Test all fiber links.  
37

### 38 (c) Cable Slack Requirements

39  
40 (i) Throughout the cable plant, pull and store excess cable slack at each pull box,  
41 splice box, hub, and each TMC or TOC. The following lengths of slack cable are  
42 minimums:  
43

- |    |                        |         |
|----|------------------------|---------|
| 44 | 1. Fiber Pull Box      | 50 ft.  |
| 45 | 2. Fiber Splice Box    | 100 ft. |
| 46 | 3. Bridge Barrier Wall | 20 ft.  |

1	4. Device Cabinet	20 ft.
2	a. Hub Building (Inside)	100 ft.
3	b. TMC (OSP Entrance)	100 ft. Maximum
4	5. RTMC ( <i>IP @ Equipment Room</i> )	50 ft. Slack at Fiber
5		Distribution Panel

6  
7 (ii) Provide proper storage of slack cable, both long term and short term. Do not leave  
8 slack cable lying free on the ground, bottom of a pull box, or floor of a Device Cabinet,  
9 Hub Building, or RTMC, except during the actual pulling process.

10  
11 **(d) Fiber Optic Drop Cable (12 STR SM Pre-Terminated Assembly)**

12  
13 (i) The City of Port St. Lucie may allow use of pre-terminated drop cables for specific  
14 device connections to maintain the expandability of the infrastructure. Use a Field  
15 Installed or Factory Pre-Terminated /Encapsulated Patch Assembly shall be  
16 specifically designed for ITS applications. The drop cable and patch panel assembly  
17 shall be supplied complete as one unit. The drop cable and patch panel assembly shall  
18 be manufactured either in the field or at the factory using customized lengths of drop  
19 cable specific to each installation location. It shall be the complete responsibility of the  
20 contractor to verify the length requirement for each pre-terminated drop assembly as  
21 defined by the location of each independent ITS device cabinet and the trunk cable.

22  
23 (ii) Provide a drop cable assembly comprised of a field terminated or factory  
24 terminated drop cable integrated into a protective housing and a custom length of  
25 drop cable. The Patch Panel shall be black in color and built of an ABS Plastic, and  
26 shall have 4, 6 or 12 ST SM couplers (based on drop cable fiber count requirement)  
27 with ceramic inserts along the length of the housing. The couplers shall be  
28 configured in an arrangement to facilitate easy access to each coupler pair. Each  
29 coupler port shall have a label affixed to designate the port number and the fiber  
30 numbers terminated to that port respectively. The fiber optic connectors on the  
31 inside of the housing shall be constructed with all ceramic ferrules. A full 100% of  
32 the fiber terminations shall be optically and visually tested for attenuation and  
33 reflectance, and shall exhibit an optical performance with a maximum insertion loss  
34 and a minimum return loss as stated in **Table: Optical Termination Losses**.

35  
36 (iii) The housing shall incorporate a 2.5-inch minimum strain relief boot around the  
37 exiting drop cable to provide bend radius protection and short-term cable retention of  
38 at least 200 lb/ft. The housing shall have integrated mounting notches for field  
39 mounting.

40  
41 **(e) Optical Splicing Requirements**

42  
43 **(i) Fusion Splicing**

44  
45 Utilize the fusion technique for all splices. Utilize fusion splicing equipment that has  
46 been cleaned, calibrated and specifically adjusted to the fiber and environmental

1 conditions at the start of each shift. Provide splice enclosures, organizers and  
2 incidentals, and cable end preparation tools and procedures, compatible with the cable  
3 type being delivered.  
4

5 **(ii) Splice Protection**  
6

7 Each spliced fiber shall be packaged in a heat shrinkable splice protection sleeve with  
8 strength member. The protection sleeve shall cover the splice and any bare fiber  
9 stripped of its coating. The use of RTV or silicone is strictly prohibited.  
10

11 **(iii) Splice Enclosures**  
12

13 1. Provide outdoor optical splice enclosures capable of aerial, duct  
14 or buried applications. The splice enclosure shall consist of an outer  
15 enclosure, an inner enclosure, and splice trays. The splice enclosure shall  
16 provide space-enabling entry of fiber optic cable without exceeding the  
17 minimum bend radius of the cable. The splice enclosure shall be capable of  
18 through, branch, or mid-span type splice locations, however; all splice  
19 enclosure cable entry for this project shall be in butt configuration. All  
20 cables shall enter into the splice enclosure on only one side. This allows ease  
21 in cable handling, bend radius and maximizes the space inside the  
22 communications box. Only one cable per entry port shall be allowed. Furnish  
23 and install the splice closure with the correct number of entry ports as  
24 dictated by each fiber optic splice location.  
25

26 2. The splice enclosure shall be designed to permit selective fiber splicing  
27 (looping a backbone cable in and out while only cutting into the desired fibers  
28 – known as Mid- Span Splicing). Accomplish loose tube entry using a mid-  
29 access tool or split-entry tool.

30 3. The splice enclosure shall allow splicing of all fibers in the cables being  
31 terminated.  
32

33 4. The outer enclosure shall be waterproof, re-enterable and shall utilize an  
34 encapsulant between the inner and outer enclosure to prevent the ingress of  
35 moisture.  
36

37 5. The inner enclosure shall be designed to protect the buffer tubes and the  
38 splice trays. The inner enclosure shall be re-enterable.  
39

40 6. The splice trays within the inner enclosure shall be capable of  
41 accommodating the required number of splices including storage and  
42 protection of slack fiber.  
43

44 **(iv) Interconnect Centers**  
45

46 1. Furnish compact, modular interconnect centers designed to mount (rack or

1 wall) inside the equipment cabinets. Design and size interconnect centers to  
2 accommodate all fibers entering equipment cabinets.

3  
4 2. Provide splice trays that hold, protect and organize optical fibers and that  
5 secure fibers inside the splice tray. Design and size splice trays that fit  
6 accordingly in the rack or wall mount unit, that accommodate all fibers entering  
7 the splice tray and that will provide sufficient space to prevent micro-bending  
8 of optical fibers.

9  
10 **(v) Splice Slack**

11  
12 A maintenance loop at each Pull Box or Fiber Splice Box shall be per Section  
13 e.(3)(c) Cable Slack Requirements; the slack cable shall be coiled up and neatly  
14 placed in the splice box. This will allow for future splices in the event of a  
15 damaged splice. Additionally, every effort shall be made to maintain a  
16 minimum of 10 feet of cable from each cable entering the enclosure (i.e. 20  
17 feet of trunk cable in mid-span splicing) shall be prepared and installed within  
18 the enclosure.

19  
20 **(vi) Splice Loss**

21  
22 Individual splice loss shall not exceed 0.07 dB loss.

23  
24 **(f) Optical Termination Requirements**

25  
26 (i) ST, SC and LC fiber optic connectors are acceptable for use on each project and  
27 should be utilized by function in the following manner. Utilize ST type Fiber Optic  
28 Connectors at the field device level. ST Connectors shall be comprised of a ceramic  
29 ferrule, nickel-plated zinc or composite connector body to accommodate a field bayonet  
30 connection.

31  
32 (ii) Utilize SC type Fiber Optic Connectors at Hub and TMC Equipment locations. SC  
33 Connectors shall be comprised of a ceramic ferrule, nickel-plated zinc or composite  
34 connector body to accommodate interconnections.

35  
36 (iii) Utilize LC type connectors for Network 100BaseF and Gigabit Switches. LC  
37 connectors shall meet the device optical interface for fiber type and size  
38 associated with this project.

39  
40 **(iv) Patch Cords and Pigtails**

41  
42 Utilize factory pre-terminated assemblies that adhere to the applicable cable, cordage  
43 and fiber specifications stated within this Technical Special Provision. All inside plant  
44 (IP) assemblies shall meet NEC jacketing requirements for this project's application and  
45 shall have outer jacket coloration of yellow for single mode. All connectors used shall  
46 meet the requirements in (f) above. The connector shall accommodate the fiber type

1 and size associated with this project.  
2

3 **(v) Table: Optical Termination Losses**  
4

Connector Type	Installation	Max. Loss	Return Loss
ST/SC/LC Single Mode	Field	0.30dB	>.40dB
ST/SC/LC Single Mode	Factory	0.25dB	>.45dB

5  
6 **(g) Acceptance Testing**  
7

8 **(i) Manufacturer's Test and Certification**  
9

10 1. Each reel of fiber optic cable shall be accompanied by the manufacturer's  
11 test data showing the conformance to the requirements herein. The  
12 manufacturer's test data shall identify each fiber in each cable and list its  
13 factory-tested attenuation in dB/km. This attenuation shall meet as a minimum,  
14 the attenuation requirements set forth in **Table: Optical Fiber Specifications**.

15  
16 2. Ensure that each finished and installed fiber optic cable segment shall be  
17 traceable to the test date on file for each step in its manufacturing process.  
18

19 3. Provide the Engineer's System Manager five calendar days advance notice  
20 of the date the cable will be ready for final testing so that the Engineer's  
21 System Manager may be present at the tests, if he/she so elects.  
22

23 **(ii) Pre-Installation Tests (Reel Test)**  
24

25 At the directions of PSLUSD, test the fiber optic cable at the site storage area prior to  
26 installation. Test each optical fiber in the cable from one end and one wavelength  
27 with an OTDR compatible with wavelength and fiber type. Check for continuity,  
28 length, anomalies, and approximate attenuation. Record each measurement with  
29 color, location and type of fiber measured. If the tested loss per kilometer exceeds  
30 the loss from the manufacturer's test data the Engineer's System Manager will  
31 reject the cable.  
32

33 **(iii) Post Installation Tests (Final Test)**  
34

35 1. After installation (splicing and termination complete), test the optical fiber  
36 in the cable again for the loss characteristics. Perform a full bi-directional  
37 test (using bi-directional averaging) on all terminated fibers using the  
38 Optical Time Domain Reflectometer (OTDR). No manual calculations of bi-  
39 directional averages are allowed. Test these fibers at both 1310 nm and 1550  
40 nm and provide printouts and electronic files of the post installation tests.  
41

42 2. Submit all of the above installation test data to the Engineer's System

1 Manager as basis for acceptance.

2  
3 3. Notify the Engineer's System Manager in writing five calendar days in  
4 advance of the testing of the cable so that the Engineer's System Manager, or  
5 its representative, may be present for the tests, if the Engineer's System  
6 Manager so elects.

7  
8 4 Perform optical testing on fibers within each cable, including those extra  
9 fibers which the Contractor elects to include above those invoiced, in order to  
10 meet the 100 percent fiber quality requirement as outlined in this Technical  
11 Special Provision.

12  
13 5. Test result printouts shall include, but not be limited to, the following:

- 14  
15 a. Distance of trace;  
16 b. Total Loss;  
17 c. Splice Loss;  
18 d. Cable ID;  
19 e. Fiber ID;  
20 f. Beginning Testing Location;  
21 g. End of Fiber Testing Location;  
22 h. Operator/Technician Name or Initials;  
23 i. Date and Time test was performed;  
24 j. Test Wavelength;  
25 k. Test Pulse Width;  
26 l. Refractory Index.

27  
28  
29 6. The method of connectivity between the OTDR and each tested fiber shall  
30 be factory assembled patch cords, pulse suppression, or launch cables equal to  
31 a length of 150% of the Dead Zone as published by the OTDR Manufacturer.  
32 The launch cable shall have the appropriate connectors to allow for  
33 connection to the terminated fiber port without the use of additional couplers.

34  
35 **(h)Multi-pair Cables**

36  
37 (i) Furnish and install multi-pair data cable (CAT5e) that will support full-duplex  
38 Fast Ethernet and Gigabit Ethernet operations and is compliant with standard  
39 *EIA/TIA 568-A, Commercial Building Telecommunications Cabling Standard* pinouts.  
40 Furnish all tools, materials, connectors, and required consumables, and perform all  
41 installation operations necessary to provide a complete, fully operational multi-pair  
42 data cable (CAT5e).

1 Multi-pair data cable, CAT5e shall meet the following minimum specifications:  
2

Frequency	100 MHz
Attenuation (min. at 100 MHz)	22 dB
Characteristic Impedance	100 ohms $\pm$ 15%
NEXT (min. at 100 MHz)	35.3 dB
PS-NEXT (min. at 100 MHz)	32.3 dB
ELFEXT (min. at 100 MHz)	23.8 dB
PS-ELFEXT (min. at 100 MHz)	20.8 dB
Return Loss (min. at 100 MHz)	20.1 dB
Delay Skew (min. at 100 MHz)	45 ns

3  
4 NEXT = Near-End Crosstalk

5 PS-NEXT = Power Sum Near-End Crosstalk

6 ELFEXT = Equal-Level Far-End Crosstalk

7 PS-ELFEXT = Power Sum Equal-Level Far-End Crosstalk  
8

9 **(4) Device Server**

10  
11 **(a) General**

12  
13 (i) Furnish and install a device server as shown in the plans. Provide a device server that  
14 includes a central processing unit (CPU), realtime operating system (RTOS),  
15 Transmission Control Protocol/Internet Protocol (TCP/IP) stack, and Ethernet and serial  
16 data ports to allow connection of serial devices with EIA-232, EIA-422, and EIA-485  
17 connections to an Ethernet network. Ensure that the device server (also referred to as a  
18 terminal server) encapsulates serial data in network packets and transports them across IP  
19 networks.  
20

21 (ii) Ensure that the device server provides a TCP/IP interface to one or more field devices  
22 using EIA-232/422/485 standard connections. Ensure that the device server supports  
23 TCP/IP, User Datagram Protocol (UDP)/IP, Dynamic Host Configuration Protocol  
24 (DHCP), Address Resolution Protocol (ARP), Internet Control Message Protocol  
25 (ICMP), Simple Network Management Protocol (SNMP), Hypertext Transfer Protocol  
26 (HTTP), and telnet.  
27

28 (iii) Ensure that the device server provides 99.999% error-free operation and EIA-  
29 compatible Ethernet data communication by way of a Category 5E copper or fiber optic  
30 transmission medium, as shown in the plans.  
31

32 (iv) Ensure that the device server is resistant to all electromagnetic interference  
33

34 (v) Use a device server having an encryption feature that provides data security and  
35 prevents interception or “sniffing” of transmitted information by unauthorized parties.  
36 Data security shall comply with Version 2 of the Secure Shell Protocol (SSHv2), or the

1 NIST requirements as defined in the Federal Information Processing Standard (FIPS)  
2 Publication (PUB)-197 for the Advanced Encryption Standard (AES).

3  
4 (vi) Ensure that the device server has a minimum mean time between failures (MTBF) of  
5 10 years, or 87,600 hours.  
6

7 **(b) Materials**

8  
9 **(i) Serial Interface**

10  
11 1. Ensure that the device server provides a minimum of one serial data interface  
12 and connector as specified in the plans that conforms to EIA-232/422/485  
13 standards. Ensure that the device server supports 2-wire and 4-wire EIA-485  
14 connections. Ensure that the device server serial port(s) support data rates up to  
15 230 kbps; error detection procedures utilizing parity bits (i.e., none, even, odd,  
16 mark, and space); and stop bits (1 or 2).  
17

18 2. Ensure that the device server provides flow control (request to send [RTS]/clear  
19 to send [CTS] and transmit on/transmit off [XON/XOFF]), as well as allow  
20 control of the data terminal ready (DTR), data carrier detect (DCD), data set ready  
21 (DSR), CTS, and RTS signals. Ensure that the device server supports RTS toggle  
22 for half-duplex emulation.  
23

24 **(ii) Network Interface**

25  
26 1. Ensure that the device server includes a minimum of one Ethernet port, which  
27 must provide a 10/100 Base-TX or a 10/100 Base-FX connection as specified in  
28 the plans.  
29

30 2. Verify that all Category 5E, unshielded twisted pair/shielded twisted pair  
31 network cables and connectors comply with the EIA and Telecommunications  
32 Industry Association (TIA) requirements as detailed in the EIA/TIA-568-A  
33 standard.  
34

35 3. Verify that all copper-based network interface ports utilize registered jack (RJ)-  
36 45 connectors.  
37

38 **(iii) Configuration and Management**

39  
40 1. Provide a device server that supports local and remote configuration and  
41 management, which must include access to all user- programmable features,  
42 including but not limited to addressing, port configuration, device monitoring,  
43 diagnostic utilities, and security functions.  
44

45 2. Ensure that the device server supports configuration and management via serial  
46 login, SNMP, telnet login, and browser-based interface.  
47

1           **(iv) Mechanical Specifications**  
2

3           1. Ensure that all parts are made of corrosion-resistant materials, such as plastic,  
4           stainless steel, anodized aluminum, brass, or gold- plated metal. Ensure that all  
5           exposed fasteners are stainless steel.  
6

7           2. Ensure that the dimensions of the device server accommodate the unit's  
8           installation in a control cabinet as specified in the plans.  
9

10           **(v) Electrical Specifications**  
11

12           1. Verify that all wiring meets applicable NEC requirements and that the device  
13           server operates using a nominal input voltage of 120 volts alternating current ( $V_{AC}$ ).  
14           The input voltage range shall be 89 to 135  $V_{AC}$ . If the device requires nominal input  
15           voltage of less than 120  $V_{AC}$ , furnish the appropriate voltage converter. Verify that  
16           the maximum power consumption does not exceed 12 watts.  
17

18           2. Ensure that the device server includes diagnostic status indicators in the  
19           form of light emitting diodes (LEDs) that provide link, transmit (TX), receive  
20           (RX), and power status information.  
21

22           **(vi) Environmental Specifications**  
23

24           1. Verify that the device server meets all specifications and is capable of performing  
25           all of its functions during and after being subjected to an ambient operating  
26           temperature range of  $-31^{\circ}$  to  $165^{\circ}$  Fahrenheit (F) [ $-34^{\circ}$  to  $74^{\circ}$  Celsius (C)], as  
27           required in the NEMA TS 2 standard, with a non-condensing relative humidity of  
28           0% to 95%.  
29

30           2. Install the device server in an enclosure that provides protection from moisture  
31           and airborne contaminants, blowing rain, wind, blowing dust, temperature,  
32           humidity, roadside pollutants, vandalism, pests, and theft of equipment.  
33

34           3. Verify that the device server meets the vibration and shock resistance  
35           specifications as provided in Section 2.1.9 and 2.1.10, respectively, of the NEMA  
36           TS 2 standard.  
37

38           **(c) Installation Requirements**  
39

40           (i) Install all equipment and software according to the manufacturer's recommendations  
41           or as directed by the Engineer. Mount the device server securely in a location in the  
42           equipment cabinet that allows the unit to be fully accessible by field technicians.  
43

44           (ii) Due to the nature of the equipment, complexity of the electronics, and harsh  
45           environmental conditions at installation locations, use device servers that can be replaced  
46           immediately when defective or damaged units must be removed and replaced. The

1 Department shall return damaged units to the manufacturer for warranty repair or  
2 replacement.  
3

4 **(d) Device and Subsystem Testing**

5  
6 **(i) Contractor's Test Results**

7  
8 1. Supply documentation of all test results to the Engineer prior to approval of  
9 the system.

10  
11 2. In lieu of or in addition to the above, the Engineer may consider outside  
12 contractor and third party test results.  
13

14 **(ii) Environmental Testing**

15  
16 Provide two device servers for testing and evaluation purposes at no cost to  
17 the Department. The servers shall be tested and evaluated as specified in this  
18 section.  
19

20 **(iii) Transient, Temperature, Voltage, and Humidity Test Specifications**

21  
22 The Department's Traffic Engineering Research Laboratory (TERL), or an independent  
23 testing facility of the Engineer's choice, shall test the device servers. The testing shall be  
24 performed according to the procedures in Section 8.7 of the NEMA TS 2 standard and  
25 shall include:  
26

- 27 1. Test A: (DAT) Placement in Environmental Chamber & Checkout of Hook-up.  
28 2. Test B: (DAT) Temperature Cycling & Applied Transient Tests (Power  
29 Service).  
30 3. Test C: (DAT and Production Testing) Low-Temperature Low-Voltage Tests.  
31 4. Test D: (DAT and Production Testing) Low-Temperature High-Voltage Tests.  
32 5. Test E: (DAT and Production Testing) High-Temperature High-Voltage Tests.  
33 6. Test F: (DAT and Production Testing) High-Temperature Low-Voltage Tests.  
34 7. Test G: Test Termination (All Tests).  
35 8. Test H: Appraisal of Equipment under Test.  
36

37 **(iv) Field Test Requirements**

38  
39 Perform local field operational tests at device server field sites according to the test  
40 procedures stated herein.  
41

- 42 1. Verify that physical construction has been completed as detailed in the plans.  
43  
44 2. Inspect the quality and tightness of ground and surge protector connections.  
45  
46 3. Verify proper voltages for all power supplies and related power circuits.  
47

- 1 4. Connect devices to the power sources.
- 2
- 3 5. Verify all connections, including correct installation of communication and
- 4 power cables.
- 5
- 6 6. Verify configuration of the MFES Internet Protocol (IP) addresses and
- 7 subnetwork mask.
- 8
- 9 7. Verify the network connection to the MFES through ping and telnet sessions
- 10 from a remote personal computer (PC).
- 11
- 12 8. Perform testing on multicast routing functionality.
- 13

## 14 **(5) Network Devices**

### 15 **(a) Description**

16 Furnish and install a hardened, device-level managed field Ethernet switch (Managed Field  
17 Ethernet Switch or MFES) for intelligent transportation system (ITS) projects. Ensure that the  
18 MFES provides wire-speed fast Ethernet connectivity at transmission rates of 100 megabits  
19 per second from the remote ITS device installation location to the ITS network trunk  
20 interconnection point.  
21  
22

### 23 **(b) Materials**

#### 24 **(i) General**

25  
26 1. Ensure that the ITS network administrator will be able to manage each  
27 MFES individually or as a group/cluster for switch configuration, performance  
28 monitoring, and troubleshooting. These specifications require additional  
29 minimum management intelligence (i.e., Layer 2+) typical of most current  
30 industrial Ethernet deployments. Ensure that the MFES includes Layer 2+  
31

32 capability providing architecture standardization, open connectivity (i.e.,  
33 interoperability), bandwidth management, rate limiting, security filtering, and  
34 general integration management of an advanced Ethernet switching  
35 architecture.  
36  
37

38  
39 2. Ensure that the furnished MFES is fully compatible and interoperable with  
40 the ITS trunk Ethernet network interface, and that the MFES supports half and  
41 full duplex Ethernet communications.  
42

43 3. Furnish an MFES that provides 99.999% error-free operation, and that  
44 complies with the Electronic Industries Alliance (EIA) Ethernet data  
45 communication requirements using single-mode fiber optic transmission  
46 medium and Category 5E copper transmission medium. Provide a switched  
47 Ethernet connection for each remote ITS field device.  
48

1 4. Ensure that the MFES has a minimum mean time between failures (MTBF)  
2 of 10 years, or 87,600 hours, as calculated using the Bellcore/Telcordia SR-332  
3 standard for reliability prediction.  
4

## 5 **(ii) Networking Standards**

6

7 Ensure that the MFES complies with all applicable IEEE networking standards for  
8 Ethernet communications, including but not limited to:  
9

- 10 1. IEEE 802.1D standard for media access control (MAC) bridges used with  
11 the Spanning Tree Protocol (STP).
- 12 2. IEEE 802.1Q standard for port-based virtual local area networks (VLANs).
- 13 3. IEEE 802.1P standard for Quality of Service (QoS).
- 14 4. IEEE 802.1w standard for MAC bridges used with the Rapid Spanning Tree  
15 Protocol (RSTP).
- 16 5. IEEE 802.1s standard for MAC bridges used with the Multiple Spanning  
17 Tree Protocol.
- 18 6. IEEE 802.3 standard for local area network (LAN) and metropolitan area  
19 network (MAN) access and physical layer specifications.
- 20 7. IEEE 802.3u supplement standard regarding 100 Base TX/100 Base FX
- 21 8. IEEE 802.3x standard regarding flow control with full duplex operation.  
22

## 23 **(iii) Optical Ports**

24

25 1. Ensure that all fiber optic link ports operate at 1,310 or 1,550 nanometers in  
26 single mode. Verify that the optical ports are Type ST, SC, LC, or FC only, as  
27 specified in the plans or by the Engineer. Do not use mechanical transfer  
28 registered jack (MTRJ) type connectors.  
29

30 2. Provide an MFES having a minimum of two optical 100 Base FX ports  
31 capable of transmitting data at 100 megabits per second. Each optical port shall  
32 consist of a pair of fibers; one fiber will transmit (TX) data and one fiber will  
33 receive (RX) data. The optical ports shall have an optical power budget of at  
34 least 15 dB.  
35

## 36 **(iv) Copper Ports**

37

38 1. Provide an MFES that includes a minimum of four copper ports. All copper  
39 ports shall be Type RJ-45 and shall auto-negotiate speed (i.e., 10/100 Base) and  
40 duplex (i.e., full or half). All 10/100 Base TX ports shall meet the  
41 specifications detailed in this section and shall be compliant with the IEEE  
42 802.3 standard pinouts.  
43

44 2. All Category 5E unshielded twisted pair/shielded twisted pair network cables  
45 shall be compliant with the EIA/TIA-568-A standard.  
46

1           **(v) Management Capability**  
2

3           Ensure that the MFES supports all Layer 2 management features and certain Layer 3  
4           features related to multicast data transmission and routing. These features shall  
5           include, but not be limited to:  
6

- 7           1. An STP healing rate that meets or exceeds specifications published in the  
8           IEEE 802.1D standard.  
9
- 10          2. An RSTP healing rate that meets or exceeds specifications published in the  
11          IEEE 802.1w standard.  
12
- 13          3. An MFES that is a port-based VLAN and supports VLAN tagging that meets  
14          or exceeds specifications as published in the IEEE 802.1Q standard, and has a  
15          minimum 4-kilobit VLAN address table.  
16
- 17          4. A forwarding/filtering rate that is a minimum of 14,880 packets per second  
18          for 10 megabits per second and 148,800 packets per second for 100 megabits  
19          per second.  
20
- 21          5. A minimum 4-kilobit MAC address table.  
22
- 23          6. Support of Traffic Class Expediting and Dynamic Multicast Filtering.  
24
- 25          7. Support of, at a minimum, Version 2 of the Internet Group Management  
26          Protocol (IGMP).  
27
- 28          8. Support of remote and local setup and management via telnet or secure Web-  
29          based GUI and command line interfaces.
- 30          9. Support of the Simple Network Management Protocol (SNMP). Verify that  
31          the MFES can be accessed using the resident EIA-232 management port, a  
32          telecommunication network, or the Trivial File Transfer Protocol (TFTP).  
33
- 34          10. Port security through controlling access by the users. Ensure that the MFES  
35          has the capability to generate an alarm and shut down ports when an  
36          unauthorized user accesses the network.  
37
- 38          11. Support of remote monitoring (RMON) of the Ethernet agent and the ability  
39          to be upgraded to switch monitoring (SMON), if necessary.  
40
- 41          12. Support of the TFTP, the Network Time Protocol (NTP), or the Simple  
42          Network Time Protocol (SNTP). Ensure that the MFES supports port mirroring  
43          for troubleshooting purposes when combined with a network analyzer.  
44

45           **(vi) Mechanical Specifications**  
46

- 47          1. Ensure that all wiring complies with NEC requirements and standards.  
48          Furnish and identify all equipment and appurtenances by name, model number,  
49          serial number, technical support and warranty telephone numbers, and any

1 other pertinent information required to facilitate equipment maintenance.

2  
3 2. Ensure that every conductive contact surface or pin is gold-plated or made of  
4 a noncorrosive, non-rusting, conductive metal.

5  
6 3. Ensure that all external screws, nuts, and locking washers are stainless steel.  
7 Do not use self-tapping screws unless the Engineer provides prior approval.

8  
9 4. All parts shall be made of corrosion-resistant materials, such as plastic,  
10 stainless steel, anodized aluminum, brass, or gold-plated metal.

11  
12 5. Ensure that all parts are made of corrosion-resistant materials, such as plastic,  
13 stainless steel, anodized aluminum, brass, or gold-plated metal. Ensure that all  
14 exposed fasteners are stainless steel.

15  
16 **(vii) Electrical Specifications**

17  
18 1. Ensure that the MFES operates and power is supplied with 115 volts of  
19 alternating current (VAC). Ensure that the MFES has a minimum operating  
20 input of 85 VAC and a maximum operating input of 265 VAC. If the device  
21 requires operating voltages other than 120 VAC, supply the required voltage  
22 converter. Ensure that the maximum power consumption does not exceed 50  
23 watts.

24  
25 2. Ensure that the MFES has diagnostic light emitting diodes (LEDs), including  
26 link, TX, RX, speed (for Category 5E ports only), and power LEDs.

27  
28 **(viii) Environmental Specifications**

29  
30 1. Ensure that the MFES performs all of the required functions during and after  
31 being subjected to an ambient operating temperature range of -30 degrees (°) to  
32 165° Fahrenheit (F) [-34° to 74° Celsius (C)] ] as defined in the environmental  
33 requirements section of the NEMA TS 2 standard, with a noncondensing  
34 humidity of 0 to 95%.

35  
36 2. Verify that the MFES manufacturer certifies their device has successfully  
37 completed environmental testing as defined in the environmental requirements  
38 section of the NEMA TS 2 standard. Verify that vibration and shock resistance  
39 meet the requirements of Sections 2.1.9 and 2.1.10, respectively, of the NEMA  
40 TS 2 standard.

41  
42 3. Ensure that the MFES is protected from rain, dust, corrosive elements, and  
43 typical conditions found in a roadside environment.

1           **(ix) Installation Requirements**  
2

3           Mount the MFES inside a field site cabinet. Ensure that the MFES is resistant to all  
4           electromagnetic interference (EMI). Ensure that the MFES is mounted securely in 19  
5           inches [483 mm] EIA racking and is fully accessible by field technicians. Due to the  
6           nature of the equipment, complexity of the electronics, and harsh environmental  
7           conditions at installation locations, use MFES units that can be serviced or replaced  
8           immediately when defective or damaged units must be removed and replaced. The  
9           Department shall return damaged units to the manufacturer for warranty repair or  
10          replacement.

11  
12          **(x) Testing Requirements**  
13

14                   **1. General**  
15

16                   a. Subject the MFES to design approval tests (DATs) and field acceptance tests  
17                   (FATs). Develop and submit a test plan for DATs and FATs to the Engineer for  
18                   consideration and approval.  
19

20                   b. The Engineer may accept certification by an independent testing laboratory  
21                   in lieu of the DATs to satisfy the requirement that certain features and  
22                   functions have been witnessed and documented as performing satisfactorily.  
23                   The Contractor shall arrange for and conduct the tests and is responsible for  
24                   satisfying all inspection requirements prior to submission for the Engineer's  
25                   inspection and acceptance.  
26

27                   c. The Engineer reserves the right to witness all DATs and FATs. Complete the  
28                   tests within five calendar days.  
29

30                   **2. Transient, Temperature, Voltage, and Humidity Test Specifications**  
31

32                   The selected manufacturer will provide two MFES units for testing and  
33                   evaluation purposes at no cost to the Department. The Department's Traffic  
34                   Engineering Research Laboratory (TERL), or an independent testing facility of  
35                   the Engineer's choice, shall test the device servers. The testing shall be  
36                   performed according to the procedures in Section 8.7 of the NEMA TS 2  
37                   standard and shall include:  
38

39                   a. Test A: (DAT) Placement in Environmental Chamber and Check-Out of Hook-  
40                   Up.

41                   b. Test B: (DAT) Temperature Cycling and Applied Transient Tests (Power  
42                   Service).

43                   c. Test C: (DAT and Production Testing) Low-Temperature Low-Voltage Tests.

44                   d. Test D: (DAT and Production Testing) Low-Temperature High-Voltage Tests.

45                   e. Test E: (DAT and Production Testing) High-Temperature High-Voltage Tests.

46                   f. Test F: (DAT and Production Testing) High-Temperature Low-Voltage Tests.

- g. Test G: Test Termination (All Tests).
- h. Test H: Appraisal of Equipment under Test.

**(v) Field Test Requirements**

Once the MFES has been installed, conduct local FATs at the MFES field site according to the test procedures stated herein.

1. Verify that physical construction has been completed as detailed in the plans.
2. Inspect the quality and tightness of ground and surge protector connections.
3. Verify proper voltages for all power supplies and related power circuits.
4. Connect devices to the power sources.
5. Verify all connections, including correct installation of communication and power cables.
6. Verify configuration of the MFES Internet Protocol (IP) addresses and subnetwork mask.
7. Verify the network connection to the MFES through ping and telnet sessions from a remote personal computer (PC).
8. Perform testing on multicast routing functionality.

**(6) Locate Tracer Wire**

(a) Tracer wire shall be placed inside all conduits, terminating at the nearest pull box. The wire shall not be run into the cabinet.

(b) The tracer wire shall be continuous and un-spliced between pull boxes, except in places where a directional drill occurs. The tracer wire shall be inside the conduit with fiber.

(c) A continuity test shall be performed after installation to confirm that a continuous run of tracer wire was installed between pull boxes or directional drill. The tracer wire shall be tested before and after backfilling. The purpose of this test is to document that no damage or separation of the tracer wire has occurred during the installation of wire, backfilling of the trench, or box installation

**(7) Marking Tape**

(a) Marking tape shall be bright orange color, minimum 6" wide.

(b) Marking tape shall be per the QPL, as specified, with " CAUTION PSL FIBER OPTIC CABLE CALL BEFORE DIGGING (800) 638-4097 " printed every 3' in black letters.

1 (c) The tape shall be a dielectric, polyolefin film tape that is tear resistant, and corrosion  
2 resistant. The tape shall be constructed using material and ink colors, which will not change  
3 when exposed to acids and other destructive substances commonly found in the soil.  
4

5 (d) A marking tape shall be placed in the trench during cable installation, directly above the  
6 cable, 18” below grade. All conduit installed by use of directional boring shall not include the  
7 marking tape.  
8

9 (e) Marking tape shall be installed for the full length of the cable or conduit run.  
10

### 11 **(8) Pull Tape - Detectable**

12  
13 (a) Pull tape shall only be utilized if fiber optic cable is to be installed by the pull method.  
14 Pull tape shall be per the QPL. A detectable pull tape shall be pulled in unison with the cable and  
15 left in all duct/s. In the case of conduit without fiber being pulled, a pull tape shall be pulled and  
16 left in the duct/s.  
17

18 (b) The tape shall have the following properties:  
19

20 (i) Tensile strength of 800 lbs

21 (ii) Flat, not round, construction

22 (iii) Printed foot markings

23 (iv) Pre-lubricated for reduced pulling tension at start of cable pull, low susceptibility to  
24 absorption of moisture: moisture resistant

25 (c) Wire continuity testing shall be done.  
26

### 27 **(9) Cable Route Markers**

28  
29 (a) Markers shall be tubular in design and constructed of Type III high-density polyethylene  
30 material ultraviolet stabilized to help prevent their components from color fading, warping,  
31 absorbing water and deteriorating with prolonged exposure to the elements. Marker posts shall  
32 be orange in color.  
33

34 (b) The marker assemblies shall include the descriptive information “ CITY OF PSL FIBER  
35 OPTIC CABLE – CALL BEFORE DIGGING (800) 638-4097” printed in black on an orange  
36 reflective background material that will not fade or deteriorate over time. The printed message  
37 shall be visible from all directions approaching the assembly.  
38

39 (c) As field conditions dictate, fiber markers shall be placed at approximately 500 foot  
40 intervals or as approved by the City on the rights-of-way line, but should be placed to avoid  
41 visual clutter in urban areas. Markers shall be placed at every pull box and midpoint.  
42 In unique situations, they could be shortened up to 250 feet or lengthened out to 750 feet,  
43 as approved by the City.  
44

45 (d) As field conditions dictate, fiber markers shall be placed at approximately 500 foot  
46 intervals or as approved by the City on the rights-of-way line, but should be placed to avoid

1 visual clutter in urban areas. Markers should be as close to the property lines as possible. In  
2 unique situations, they could be shortened up to 250 feet or lengthened out to 750 feet, as  
3 approved by the City.  
4

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**CHAPTER III**  
**CONSTRUCTION COORDINATION, INSPECTIONS AND TESTING**

**A. GENERAL**

1. The Engineer of Record (EOR) shall have a pre-construction meeting with the PSLUSD and the contractor prior to starting construction. The meeting shall be held at the Utility Department Office.

2. The EOR shall coordinate all construction and inspections on the project and shall be the point of contact with PSLUSD. Testing shall be conducted by or at the direction of the EOR in the presence of a PSLUSD inspector.

3. The contractor shall contact the EOR, the appropriate governmental jurisdictional agency, and all utility companies at least 48 hours prior to commencement of construction for coordination of any utilities.

4. There shall be no field changes or deviations from design without prior written approval of the PSLUSD and EOR.

5. All materials, construction methods, testing, and disinfection shall conform to the requirements of the PSLUSD and AWWA current standards.

6. It is the EOR's responsibility to coordinate the installation of other public utilities near the PSLUSD facilities.

7. The contractor shall strictly adhere to the horizontal and vertical separation requirements specified in the PSLUSD utility standards and applicable standard detail. All crossings between PSLUSD facilities as well as with other utilities shall be left exposed until observed by a PSLUSD inspector.

8. Contractor shall adhere to the approved Maintenance of Traffic Plan at all times where work is in progress. Traffic control, barricades, etc., shall be in accordance with applicable permits, local regulations and Florida Department of Transportation and OSHA standards.

9. Contractor shall repair any damage caused to existing utilities by construction activity in accordance with applicable standards.

10. No pollution or erosion caused by this project will be allowed off site or in the stormwater drainage system. The contractor shall install any devices necessary to prevent pollution or erosion and comply with the City's code for erosion and sediment control standards. The cost of pollution and erosion control shall be incidental to the cost of construction.

1 **B. INSPECTIONS & TESTING**

2  
3 The EOR shall perform inspections, observations, and tests necessary to assure compliance with  
4 utility standards; complete the required PSLUSD forms for inspections and testing; and certify  
5 completion of the utility facilities. The contractor shall not cover newly constructed facilities  
6 prior to a required inspection being conducted by the EOR and the PSLUSD. If any construction  
7 is covered before an inspection by PSLUSD, the contractor shall be required to uncover it at his  
8 expense. All work that has been rejected or condemned shall be repaired, or if it cannot be  
9 satisfactorily repaired, shall be removed and replaced at the contractor/developer's expense.  
10 Materials not conforming to the requirements of the specifications shall be removed immediately  
11 from the site of work and replaced with satisfactory material by the contractor/developer. The  
12 PSLUSD shall have the right to require additional inspections, certifications and/or testing to  
13 confirm that the deficient work has been corrected.

14  
15 **1. PSLUSD INSPECTOR'S AUTHORITY**

16  
17 a. The PSLUSD inspections are intended to make observations for verification of compliance  
18 and do not relieve the EOR or contractor from fulfilling their responsibilities. Any items found to  
19 be deficient after PSLUSD has passed an inspection will still require correction at the  
20 contractor/developer's expense.

21  
22 b. The PSLUSD inspector is not authorized to revoke, alter or waive any requirements of the  
23 specifications, but is authorized and expected to call to the attention of the EOR and/or  
24 contractor any failure of work or materials to conform to the plans or specifications. The  
25 PSLUSD inspector does NOT have the authority to make changes to the approved plans. The  
26 inspector shall have the authority to reject materials or suspend the work until questions of issue  
27 can be referred to and decided upon by the Utility Director or his designated representative.

28  
29 c. The inspector shall in no case either act as foreman or perform other duties for the EOR and/or  
30 contractor nor interfere with the management of the work. Advice that the inspector may give  
31 shall in no way be construed as binding to the City of Port St. Lucie or releasing the developer,  
32 his engineer or contractor from performing according to the intent of the plans and minimum  
33 PSLUSD Standards.

34  
35 **2. SCHEDULING OF INSPECTIONS**

36  
37 a. It shall be the responsibility of the EOR to schedule inspections and their qualified  
38 representative shall be present at all scheduled tests and inspections. Pre-testing is encouraged to  
39 be completed prior to scheduled inspections, to minimize failures. A scheduled inspection will be  
40 canceled, and a re-inspection fee assessed if one of the three following situations occurs:

- 41  
42 (1) Failure to show for inspection by the EOR or contractor,  
43 (2) Cancellation of the inspection with less than 24 hours notice,  
44 (3) A failing test result.

1 Re-inspection fees shall be assessed per scheduled hour of the inspection; the exception is for TV  
2 inspection of gravity sewer, for which the re-inspection fee will be assessed on the hours  
3 scheduled for the repairs and the TV inspection. The EOR will be notified or given a Failed  
4 Inspection Notice at the time of the failed inspection. All re-inspection fees shall be paid to the  
5 PSLUSD prior to any scheduling of further inspections.  
6

7 b. The PSLUSD shall be provided with at least two (2) full working days notice for scheduled  
8 inspections. Inspectors will make unscheduled visits as needed to observe such items as ongoing  
9 work on site, restraints and clearances between conflicting lines.  
10

11 c. Scheduled inspections will be conducted during normal business hours, Monday through  
12 Friday, except when service disruptions are anticipated. When progress of a project requires, for  
13 the convenience of the contractor, the periodic presence of a PSLUSD representative during  
14 after hours, weekends and/or city holidays, the contractor/developer shall accept the financial  
15 responsibility for the overtime hours (at overtime rates) with a minimum of four (4) hours,  
16 including travel time.  
17

### 18 **3. REQUIRED INSPECTIONS (In no specific order)**

19  
20 Scheduled inspections are required for the following:  
21

#### 22 **a. Water**

- 23 (1) Materials Inspection
- 24 (2) Connection to existing mains, tie-ins, wet taps, etc
- 25 (3) Jack & Bores and installation of the carrier pipes
- 26 (4) Jumper installation and initial meter reading
- 27 (5) Flushing (Pigging)
- 28 (6) Pressure Testing
- 29 (9) Chlorination Test
- 30 (10) Disinfection
- 31 (11) Removal and plugging of sample points
- 32 (12) Fire Hydrant Flow Test
- 33 (13) Wire Trace Continuity and electronic marker verification
- 34 (14) Any re-construction repairs and field changes, including lines that have not been turned over  
35 to the PSLUSD
- 36 (15) Removal of jumper and final meter reading
- 37 (16) Concrete pad formwork/rebar placement
- 38 (17) Final Inspection  
39  
40

#### 41 **b. Wastewater (gravity sewer, interceptor, pump station, force main & reclaimed water 42 main)**

- 43 (1) Materials Inspections
- 44 (2) Connection to existing mains, tie-ins, wet taps, manholes, etc.
- 45 (3) Jack & Bores and installation of carrier pipes  
46

- 1 (4) Jumper installation and initial meter reading
- 2 (5) Flushing (Pigging)
- 3 (6) Pressure Test Report (force main, low pressure mains and reclaimed water mains)
- 4 (7) Installation of the first manhole of the lift station and the first manhole to be installed
- 5 (10) TV Inspection (gravity sewer)
- 6 (11) Infiltration/Ex-filtration Test Report (gravity sewer, manholes and pump station)
- 7 (12) Deflection Test
- 8 (13) **Interceptors**- materials, installation, infiltration/ex-filtration test (Form 10), and final
- 9 inspection.
- 10 (14) Installation of lift station/grinder structures/valve vault
- 11 (15) Wire Trace Continuity and electronic marker verification
- 12 (16) Electrical components of pump station
- 13 (17) Pump Station Start-up
- 14 (18) Any re-construction repairs and field changes, including lines that have not been turned over
- 15 to the PSLUSD
- 16 (19) Concrete pad formwork/rebar placement
- 17 (20) Removal of jumper and final meter reading
- 18 (21) Final Inspection

19

20 The PSLUSD forms for the scheduled inspections noted in a. & b. above shall be completed by  
21 the EOR and submitted to PSLUSD with a sealed and signed cover letter. The forms are can be  
22 downloaded from the city's website at <http://www.cityofpsl.com/utility/commercial>  
23 [development/utility-commercial-development.html](http://www.cityofpsl.com/utility/commercial) .

24

25 Inspections are required for pipe restraints and crossings between utility pipes but do not have to  
26 be specifically scheduled. All pipe restraints and crossings shall be left exposed until inspected  
27 and approved by the PSLUSD. Such inspections may be combined with scheduled inspections or  
28 will be conducted at a time mutually agreed by the contractor and PSLUSD inspector.

29

#### 30 **4. REQUIRED TESTING**

31

32 The testing for various components of the water, wastewater and reclaimed water system  
33 components shall be performed as detailed below. The EOR shall provide the PSLUSD with  
34 written test results on PSLUSD forms noted above in 3.a. & b. for each required test with a  
35 signed and sealed cover letter from the EOR.

36

##### 37 **a. Performance testing of pressure pipe**

38

##### 39 **(1) Type of Testing**

40

41 The following performance testing must be conducted:

42

- 43 (a) Water Main: Hydrostatic, Leakage and Bacteriological Testing
- 44 (b) Force Main: Hydrostatic, and Leakage Testing
- 45 (c) Low Pressure Main: Hydrostatic, and Leakage Testing

46

1 **(2) References** - Testing shall be performed in accordance with the following references:  
2

- 3 (a) ANSI/AWWA C600 - Standard for Ductile Iron Pipe Installation and Testing.
- 4 (b) ANSI/AWWA C605 – Standard for Polyvinyl Chloride (PVC) Pipe Installation and Testing
- 5 (c) ANSI/AWWA C651 - Standard for Disinfecting Water Mains.
- 6 (d) ANSI/AWWA C900 - Standard for PVC Pipe, 4"-12" for Water Distribution.
- 7 (e) ANSI/AWWA C905 - Standard for PVC Pipe 14"& above for Water Distribution.

8  
9 **(3) Regulations** -Testing shall conform to PSLUSD requirements and FDEP regulations.

10  
11 **(4) Temporary Connection to PSLUSD Water Main**

12  
13 (a) A temporary jumper connection is required between an existing active water main and a  
14 newly constructed main until a clearance is obtained from the PSLUSD. The temporary  
15 connection shall be used at point (s) of filling in accordance with the standard details for  
16 potable and non-potable water jumper connection.

17  
18 (b) The EOR shall contact the PSLUSD via e-mail at (inspectors@cityofpsl.com ) regarding  
19 scheduling of required inspections listed in this chapter or any other inspections deemed  
20 necessary by the PSLUSD and shall strictly follow all procedures detailed in this chapter.

21  
22 (c) The temporary jumper assembly (flange to flange) will be supplied, installed and tested by  
23 the PSLUSD, in coordination with the EOR and contractor. Other materials and installation  
24 required for the connection shall be responsibility of the contractor. The contractor shall disinfect  
25 the tapping sleeve and exterior of the main to be tapped by spraying and swabbing with chlorine  
26 in the presence of a PSLUSD inspector. The underground fittings shall be restrained mechanical  
27 joint type. All materials shall be per the PSLUSD approved Qualified Products List.

28  
29 (d) The jumper connection shall be maintained by the contractor until filling, flushing,  
30 hydrostatic pressure/leakage testing, disinfection and bacteriological sampling have been  
31 satisfactorily completed by the contractor and the test results are in compliance with the  
32 PSLUSD and FDEP standards. Disinfection and bacteriological sampling is not required for  
33 newly constructed force mains and reclaimed water mains.

34  
35 (e) A physical separation shall be maintained between an existing water main and the newly  
36 constructed water main, except as noted herein. If the new main is of a size or length that  
37 pigging/flushing cannot be effectively accomplished with the jumper connection, the PSLUSD  
38 may allow a physical connection under controlled conditions as follows:

39  
40 (i) The procedure will be conducted by the contractor in the presence of a PSLUSD  
41 inspector and the Engineer-of-Record (EOR) or representative.

42  
43 (ii) The new valve(s) shown in this detail shall be pressure/leakage tested and  
44 replaced if leakage is observed. The valves will be kept closed by the PSLUSD and  
45 shall not be operated by any one other than PSLUSD personnel.  
46

1 (iii) The jumper connection shall be used to fill the new main.

2  
3 (iv) The contractor shall disinfect the pipe and fittings used to make the connection by  
4 spraying and swabbing with chlorine.

5  
6 (v) All valves in the new system downstream of the jumper shall be opened by the  
7 contractor prior to flushing. The valves shown in the standard detail shall be opened  
8 by PSLUSD personnel only.

9  
10 (vi) The pigging and flushing shall be performed by the contractor in the presence of a  
11 PSLUSD inspector. The valves will be closed by PSLUSD personnel after the main  
12 has been flushed.

13  
14 (vii) The main shall be pressure tested after flushing and prior to disinfection. All  
15 valves shall be kept closed during the pressure test and will be opened by PSLUSD  
16 personnel if the test results are satisfactory.

17  
18 (viii) Disinfection shall be conducted in accordance with AWWA C651. A minimum  
19 pressure of 20 psi shall be maintained in the new water main after disinfection.

20  
21 (f) Bacteriological sampling and testing of the new water main shall be conducted per section  
22 B.4a.(8) of this Chapter and a clearance obtained from the PSLUSD or FDEP, as applicable. The  
23 sampling points shall be removed and plugged, and the permanent connection made by the  
24 contractor. The contractor shall disinfect the pipe and fittings used to make the connection by  
25 spraying and swabbing with chlorine.

26  
27 (g) The PSLUSD will remove the jumper assembly (flange to flange) after the corporation stop  
28 valves to the jumper have been closed; the valves shall be plugged by the contractor after  
29 removal of the assembly.

30  
31 (h) The contractor shall pay the PSLUSD for all the water used, based on the initial and final  
32 reading of the water meter.

### 33 34 **(5) Cleaning/Flushing**

35  
36 (a) Flushing shall be conducted to clean the mains and remove all foreign matter.

37  
38 (b) For water mains, flushing shall be conducted prior to disinfection. Hoses, fittings and  
39 temporary pipes in ditches shall be provided as required to dispose flushing water without  
40 damage to adjacent properties. Flushing velocities shall be at least 2.5 fps.

41  
42 (c) All mains shall be cleaned using a poly-pig cleaning system as detailed in Chapter II,  
43 Section J.9. All equipment and piping shall be provided by the contractor. Testing shall be  
44 conducted to ensure proper cleanliness of the pipe as detailed in this section. PSLUSD will not  
45 accept any utility mains that do not pass the cleanliness test.

1 (d) Prior to the actual line flushing operation, the contractor shall properly notify the PSLUSD  
2 and EOR of such intended water use a minimum of 48 hours prior to flushing of mains up to 8"  
3 diameter, and at least 1 week prior to flushing of mains larger than 8". All flushing times will be  
4 limited to off peak times of water system demand and consumption. No flushing shall take place  
5 without the PSLUSD inspector and EOR being present.  
6

7 (e) The contractor shall pay the PSLUSD for all water used.  
8

9 (f) The flushing report shall be submitted by the EOR on PSLUSD form prior to disinfection.  
10

### 11 **(6) Hydrostatic and Leakage Testing** 12

13 (a) Hydrostatic and leakage tests shall be made between valves and/or connectors for each  
14 section tested using the procedure outlined in ANSI/AWWA C600 for DIP and C605 for PVC.  
15

16 (b) The contractor shall provide all necessary equipment such as pumps, gauges and water  
17 measuring tanks and shall perform all work required for pipe pressure and leakage test. The  
18 gauge shall read in 2 pound increments.  
19

20 (c) Hydrostatic testing shall be performed for a period of not less than two hours at 150 psi  
21 pressure for water/force/reclaimed water mains and at 100 psi for low-pressure mains. The  
22 allowable rate of leakage shall be less than the number of gallons per hour determined by the  
23 following formula:  
24

$$L = \frac{SD \sqrt{P}}{148,000}$$

L = Allowable leakage in gallons per hour.

S = Length of pipe tested in feet.

D = Nominal diameter of the pipe in inches.

P = Average test pressure maintained during the test in pounds per square inch gauge.

25  
26 (d) The testing procedure shall include the continued application of the specified pressure to  
27 the test system for the two-hour period using a suitable pump connected to the pipeline. The  
28 pipeline shall be allowed to stabilize at the test pressure before conducting the hydrostatic test.  
29 The pressure shall not vary by more than  $\pm 5$  psi from the required pressure for the duration of the  
30 test. Test pressure shall be maintained with this tolerance by adding makeup water through the  
31 pump into the pipeline. The amount of makeup water shall be accurately measured and shall not  
32 exceed the allowable leakage rate (L) as determined using the above formula. If at any point  
33 during the test the pressure loss exceeds 5 psi, the test is considered failed. Should the test fail,  
34 the contractor shall make necessary repairs and the test shall be repeated until satisfactory results  
35 are obtained.  
36

37 (e) Any exposed pipe, fittings, valves, hydrants, and joints shall be examined during the test to  
38 ensure there are no visible leaks. Any damaged or defective pipe fittings, valves, or hydrants that

1 are discovered following the pressure test shall be repaired or replaced with sound material, and  
2 the test shall be repeated.

3  
4 (f) The pressure test report shall be submitted by the EOR on PSLUSD form prior to  
5 disinfection.

6  
7 **(7) Disinfection (Water Facilities Only)**

8  
9 (a) Disinfection of mains shall comply with AWWA C651. Each unit of completed water main  
10 and distribution system shall be thoroughly flushed and then disinfected with chlorine.

11  
12 (b) Chemicals:

13  
14 (i) Sodium or calcium hypochlorite conforming to ANSI/AWWA B300 shall be  
15 used.

16  
17 (ii) Calcium hypochlorite intended for use in swimming pools shall not be used.

18  
19 (iii) Chlorine tablets shall not be used unless specifically approved in writing by the  
20 PSLUSD.

21  
22 (iv) Pure chlorine gas or liquid shall not be used

23  
24 (c) The disinfection test report shall be submitted by the EOR on PSLUSD form prior to final  
25 inspection.

26  
27 **(8) Bacteriological Sampling & Testing (Water Facilities Only)**

28  
29 (a) The contractor shall verify that piping system has been cleaned and properly isolated. The  
30 maximum length of line to be tested as one section will be 2500’.

31  
32 (b) Bacteriological testing shall not begin until after the pressure test has been passed.

33  
34 (c) The contractor shall install sampling points required to take all necessary water samples at  
35 locations designated in the approved plans.

36  
37 (d) The contractor shall coordinate with a Florida Department of Health certified testing  
38 laboratory to take all water samples required for bacteriological tests and shall maintain  
39 continuous running bacteriological sample taps. Water mains being tested must remain under  
40 line pressure until release of system into service by the PSLUSD and FDEP.

41 (e) The test report shall include the following information:

42  
43 (i) Date issued, project name, and testing laboratory name, address, telephone number  
44 and State Certification Number.

45 (ii) Time and date of water sample collection

46 (iii) Name of person collecting samples

- 1 (iv) Test locations
- 2 (v) Coliform bacteria test results for each outlet tested
- 3 (vi) Certification that water conforms to bacterial standards
- 4 (vii) Bacteriologist's signature and authority

5  
6 (f) The bacteriological test results shall be submitted to the PSLUSD with the Final  
7 Inspection Package, as required in Section C. of this chapter.

### 8 9 **b. Fire Hydrant Flow Testing**

10  
11 (1) A flow test to verify the fire flow rates shall be performed by the EOR on all new fire  
12 hydrants prior to the project's final inspection. The gauges for the test will be provided by the  
13 PSLUSD. The flow tests shall be witnessed by the PSLUSD and contractor. The contractor shall  
14 make provisions for minimizing interruptions to traffic and for adequate drainage of water.

15  
16 (2) Each hydrant shall be capable of delivering a minimum flow of 600 gpm for residential areas,  
17 and 1250 gpm for non-residential areas (or a higher flow as required by the Fire Chief), with a  
18 residual pressure of not less than 20 psi.

19  
20 (3) The contractor shall provide one hydrant wrench, fire hydrant repair kits and maintenance  
21 manuals to the PSLUSD at the time of flow testing. One fire hydrant repair kit shall be provided  
22 per every five fire hydrants. If there are less than five hydrants, one kit will be required. These  
23 kits shall be turned over to the PSLUSD with the turnover package. Each kit shall include a  
24 sufficient quantity of parts and lubricant to facilitate quick repairs, and a copy of the maintenance  
25 manual. The repair kit items required for each approved manufacturer are mentioned on the  
26 Qualified Products List.

27  
28 (4) The test results shall be submitted by the EOR on PSLUSD form prior to final inspection.

### 29 30 **c. Infiltration/Ex-filtration Test (pump station and interceptor)**

31  
32 Infiltration and ex-filtration testing shall be performed on interceptors and pump stations to  
33 assure there are no leaks from joints or as a result of improper construction. The following  
34 observation and test shall be conducted by the EOR in the presence of PSLUSD inspector:

35  
36 (1) Visual – During and after construction the inside of the structure shall be closely observed for  
37 signs of wetness and leaks. The PSLUSD will fail the inspection if wetness and leaks are visible.

38  
39 (2) Ex-filtration Test – All pipe openings shall be plugged and the interceptor/wet-well shall be  
40 filled with water to the level of the underside of the access covers. After allowing for an initial  
41 drop in elevation the chamber shall be refilled and the level observed for duration of 2 hours.  
42 Any drop in water level is unacceptable and result in the inspection being failed by PSLUSD.  
43 Pressure grouting shall not be considered an acceptable method of repair.

44  
45 (3) The results of the test shall be submitted by the EOR on PSLUSD form prior to final  
46 inspection.

1 **d. Pump Station Start-up and Testing**

2  
3 Upon completion of the entire pump station, an inspection shall be coordinated with the EOR,  
4 PSLUSD, contractor and manufacturer’s representative for the station. The EOR and  
5 PSLUSD shall be notified 48 hours in advance of the start-up. The following items shall be the  
6 basis of a satisfactory inspection:  
7

- 8 (1) The station was built in accordance with the approved plans and utility standards.  
9  
10 (2) The station is functioning as designed.  
11  
12 (3) Tests shall be conducted to determine if the pumps conform to the specifications.  
13 Specifically, the testing shall confirm that –  
14  
15 (a) The pumps are working per the design curve.  
16 (b) The design amperage is not being exceeded.  
17 (c) Both pumps can be removed and re-installed without obstructions.  
18 (d) The pump station can be operated with a generator in the same manner as with electric  
19 power.  
20

21 If the pump performance does not meet the specifications, corrective measures shall be taken or  
22 pumps shall be removed and replaced with pumps that satisfy the conditions specified.  
23

- 24 (4) The contractor/manufacturer representative shall check direction of rotation of all motors and  
25 reverse connections if necessary.  
26  
27 (5) All pump operation settings, alarms, and shutdown devices shall be calibrated and tested  
28 during the field test.  
29  
30 (6) Should any material or installation fail to meet the specifications, the contractor shall take  
31 corrective measures or the item shall be removed and replaced.  
32  
33 (7) A repair kit shall be provided to the PSLUSD at the time of start up and testing inspection;  
34 the kit shall include one full set of fuses for entire control panel, one full set of fuses for the  
35 disconnect box (if fused) and one set of contacts for the motor starts for each pump station.  
36  
37 (8) The test report shall be submitted by the EOR on PSLUSD form prior to final inspection.

38 **e. Gravity Sewer Inspection and Testing**

39  
40 The contractor shall perform testing of all wastewater gravity mains, as set forth in the following,  
41 and shall conduct said tests in the presence of representatives from the PSLUSD and EOR.  
42  
43  
44  
45  
46

1 **(1) TV Inspection**

2  
3 A television inspection shall be performed by the contractor or his representative as stated below,  
4 prior to final inspection by the PSLUSD. Testing shall not proceed until the facilities have been  
5 backfilled and the compaction of roadway base is complete.  
6

7 (a) At time of inspection, the lines shall be clean with sufficient water having been introduced  
8 into each segment of the line to show any sags or dips present. The video camera shall have a  
9 depth gauge attached to the front of the camera that will show depth of water in the line dips.  
10

11 (b) If inspection reveals cracked, broken, or defective pipe or pipe misalignment resulting in  
12 vertical sags  $\frac{3}{4}$ " or more, the contractor shall be required to repair or replace the pipeline at no  
13 cost to the PSLUSD. Prior to repair or replacement of failed sewer pipe, the method of  
14 replacement shall be submitted to the PSLUSD for approval. Pressure grouting shall not be  
15 considered as an acceptable method of repair.  
16

17 (c) The test results shall be submitted on PSLUSD form by the EOR prior to the infiltration/ex-  
18 filtration test. Color CD/DVD and inspection logs shall be provided prior to final inspection.  
19

20 **(2) Infiltration/Ex-filtration Test**

21  
22 The gravity sewer shall be subjected to infiltration and/or ex-filtration tests after it has passed the  
23 TV inspection. The test shall be conducted as follows:  
24

25 (a) When testing mains and laterals separate of the manholes and the groundwater is at least 2'  
26 above the highest invert, infiltration testing shall be performed.  
27

28 (b) When testing mains and laterals separate of the manholes and the groundwater is less than  
29 2' above the highest invert, ex-filtration testing shall be performed.  
30

31 (c) All manholes shall be subject to an ex-filtration test and may be conducted in conjunction  
32 with the testing of the mains and laterals. A maximum of 1000' of mainline and four structures  
33 shall be tested; the PSLUSD inspector must be able to view all the manholes from one location at  
34 the site.  
35

36 (d) The allowable leakage shall not exceed 50 gallons/day/inch of diameter/mile.  
37

38 (e) Should the test fail, the contractor shall accomplish necessary repairs and the test repeated  
39 until the results are satisfactory. The contractor shall furnish the necessary labor, water, and all  
40 other items required to conduct the testing and shall perform the necessary system repairs  
41 required to comply with the specified test. All re-testing shall be at the contractor's expense.

42 (f) Pressure grouting is not considered an acceptable repair.  
43

44 (g) The test results shall be submitted by the EOR on PSLUSD form prior to final inspection.  
45

1 **(3) Deflection Test**

2  
3 Testing is required for all flexible pipes to assure that deflection does not exceed 5%. The test  
4 shall be performed as follows using a mandrel or a calibrated television/video camera.

5  
6 (a) Test shall be conducted at least 30 days after the final backfill has been in place to allow for  
7 stabilization of the soil-pipe system.

8  
9 (b) If a mandrel is utilized, its diameter shall be 95% of the inside diameter of the pipe being  
10 tested. Prior to use the mandrel shall be certified by the EOR and the PSLUSD. Use of an  
11 uncertified mandrel or a mandrel altered or modified after certification will invalidate the test.  
12 The mandrel shall be flushed with water or pulled through the pipe by hand with a ¼” nylon  
13 rope; mechanical pulling devices shall not be used. Excessive force shall not be applied in  
14 pulling the mandrel that may damage the pipe or erroneously indicate that deflection was within  
15 acceptable limits by temporarily expanding the pipe. The pipe shall be deemed acceptable if the  
16 mandrel passes completely through the pipe without restriction. When the mandrel does not pass  
17 through the pipe, the contractor shall locate and correct the defect to the satisfaction of the EOR  
18 and PSLUSD. Re-testing of the pipe after correction of the defect shall be no sooner than 30 days  
19 after final backfill has been in place.

20  
21 (c) The test report shall be submitted by the EOR on PSLUSD form with the Final Inspection  
22 Package.

23  
24 **f. Reclaimed Water System Start-up and Testing**

25  
26 (1) All reclaimed water main shall be tested in accordance with the Hydrostatic and Leakage  
27 Testing procedure specified in this section. The test results shall be submitted by the EOR on  
28 PSLUSD form prior to final inspection.

29  
30 (2) The EOR and PSLUSD shall be notified 48 hours prior to start-up and final inspection of the  
31 reuse metering station.

32  
33 (3) All systems shall be exercised through operational tests in the presence of the EOR and  
34 PSLUSD representatives to demonstrate achievement of the specified performance. The  
35 scheduling of tests shall be coordinated by the contractor, so that the tests may proceed without  
36 delays or disruption by incomplete work.

37  
38 (4) During start-up the contractor’s and/or manufacturer's representative shall be present at the  
39 job site.

40  
41 **C. FINAL INSPECTION PACKAGE**

42  
43 The final inspection shall be scheduled by contacting the Utility Engineering Division Inspection  
44 Group at [inspectors@cityofpsl.com](mailto:inspectors@cityofpsl.com) . The Utility Final Inspection Package shall be submitted  
45 **prior** to the PSLUSD scheduling a final inspection, including but not limited to the following  
46 items:

1 **01 Utility Final Inspection Checklist**

2  
3 The Utility Final Inspection Package Checklist and other related forms can be downloaded from  
4 the PSLUSD web site at [www.cityofpsl.com/utility/commercial-development/utility-](http://www.cityofpsl.com/utility/commercial-development/utility-commercial-development.html)  
5 [commercial-development.html](http://www.cityofpsl.com/utility/commercial-development/utility-commercial-development.html). The EOR must initial each applicable item on the form to certify  
6 that the information is satisfactory and meets the PSLUSD requirements. The required  
7 information must be submitted together with the completed form; submittal of incomplete or  
8 unsatisfactory information will delay transfer of the system to PSLUSD.

9  
10 **02. As-Built Survey**

11  
12 One black or blue line set of as-built survey shall be submitted to PSLUSD at least 7 days prior  
13 to the desired inspection date together with a completed form for Project Completion. If as-built  
14 survey is not correct, the final inspection will be completed but considered a failed inspection. A  
15 punch list compiled by the EOR of incomplete minor items and a schedule for completion shall  
16 be submitted with the as-built survey.

17  
18 **03. Utility Easement Document**

19  
20 a. City approved documents shall be used to convey utility easements. The documents shall  
21 include legal description of the property, the Parcel ID Number and sketch of the easements  
22 drawn to scale with a legal description of the easements, sealed and signed by a surveyor  
23 licensed in Florida.

24  
25 b. Easements shall be recorded by the PSLUSD.

26  
27 **04. Material and Installation Warranty**

28  
29 a. Any cost associated with the repair or adjustment of PSLUSD facilities during the warranty  
30 period shall be the responsibility of the contractor and/or developer. The PSLUSD may perform  
31 the necessary work and bill the contractor and/or developer for the expenses. The developer may  
32 perform this work with prior approval, and inspection of the PSLUSD.

33  
34 b. The materials and workmanship shall be warranted on all equipment supplied for a period of  
35 one (1) year. Warranty period shall commence on the date of PSLUSD acceptance.

36  
37 c. The equipment shall be warranted to be free from defects in workmanship, design and  
38 materials. If any part of the equipment should fail during the warranty period, it shall be replaced  
39 in the machine(s) and the unit(s) restored to service at no expense to the PSLUSD.

40  
41 d. The warranty shall be submitted on the City's standard form on contractor's letterhead.

42  
43 **05. Request to Place Water Distribution and/or Sewage Collection/Transmission System**  
44 **into Operation**

1 A Request to Place a Water Distribution and/or Sewage Collection/Transmission System into  
2 Operation shall be submitted on FDEP or PSLUSD forms, as applicable.

3  
4 If the water and wastewater system are permitted by FDEP for construction al approval to place  
5 the system into operation must be obtained from FDEP. The PSLUSD will not release the water  
6 and wastewater facilities for use until an approval has been issued by FDEP. The FDEP forms  
7 must be completed and submitted to PSLUSD for signature. The forms will be signed by the  
8 PSLUSD after the system has passed final inspection.

9  
10 **06. Pump Station/Metering Station Start-up Report & Manuals (If applicable)**

11  
12 a. Pump Station

13  
14 Two (2) sets of the documents indicated below shall be submitted.

- 15  
16 (1) Pump Station Record Information on PSLUSD form.  
17 (2) Parts manual  
18 (3) O & M manuals (2 hard copies & 1 electronic copy in pdf format).  
19 (4) Pump Station Data Sheet.

20  
21 b. Metering Station

22  
23 Two (2) sets of the documents indicated below shall be submitted.

- 24  
25 (1) Parts manual  
26 (2) O & M manuals and warranties  
27 (3) Electrical schematics in pdf. and dwg. formats  
28 (4) One (1) copy of the installed system software on CD-ROM disk  
29 (5) Start-up reports indicating all start-up parameters and results and station performance  
30 certification (the control valve manufacturer’s representative shall also sign off on the startup  
31 documentation)

32  
33 **07. Bill of sale**

- 34  
35 a. Bill of sale shall be submitted on the City’s standard form.  
36 b. Exhibit A – shall contain the legal description of the property.  
37 c. Exhibit B – shall contain the list that includes the “furnish and install” price of all materials,  
38 equipment and labor. This shall be submitted on the City’s standard form.

39  
40 **08. Test reports**

41  
42 **a. Current Bacteriological Report (water system)**

43  
44 The report shall be submitted, as required in Section 4.a.8 of this chapter, prior to the expiration  
45 date for bacteriological results. The EOR must allow for proper review time by the PSLUSD.  
46 Expiring tests do not warrant shorter review times. The bacteriological report may be submitted

1 on PSLUSD Form No. 58.

2 **b. Backflow Prevention Assembly Certification (per assembly)**

3  
4 Certification shall be submitted from a certified ‘Backflow Tester’ that the device is functioning  
5 per specifications. PSLUSD Form No. 47 may be used for certification.

6  
7 **c. All Test Reports**

8  
9 All test reports shall be submitted on PSLUSD forms by the EOR with a sealed and signed cover  
10 letter.

11  
12 **d. Interceptor (Existing)**

13  
14 A pump-out report shall be submitted for each interceptor.

15  
16 **e. Density Test Reports**

17  
18 Density test reports shall be submitted as required in Section J.1.h. (2) of Chapter 1.

19  
20 **09. Gate Codes and Contact Information**

21  
22 If applicable, submit all gate codes and contact information to gain entry to the property for  
23 maintenance and repair of all PSLUSD facilities.

24  
25 **D. AS-BUILT SURVEYS**

26  
27 As-built surveys are required for all newly constructed facilities prior to final inspection, and  
28 must be accompanied by the Completion Certification . As-built surveys shall be prepared by a  
29 Professional Surveyor and Mapper licensed in the State of Florida. Each page of the as-built  
30 survey shall include the name, original signature, date, and seal of the Professional Surveyor and  
31 Mapper. The signature shall certify that as-built survey reflects the true as-built conditions as  
32 located under direct supervision of the Professional Surveyor and Mapper. Record drawings are  
33 not an acceptable substitution for an as-built survey, but may be submitted in addition to the as-  
34 built survey.

35  
36 **1. General As-Built Requirements**

37  
38 As-built surveys shall be prepared at the same scale as the approved construction plans and shall  
39 contain the following information:

40  
41 a. Cover sheet with the name of project, developer and engineer; detailed location map with  
42 street names and legal description; an index and a revision block. Each sheet shall be labeled  
43 “As-built” in 1” high block printed letters and shall be on 24" x 36" sheets; the as-built surveys  
44 shall match, sheet by sheet, the construction plans approved by PSLUSD; additional sheets may  
45 be submitted if necessary.

- 1 b. A vicinity map with street names for all streets and right-of-ways.  
2 c. The City of Port St. Lucie section, lot and block numbers and street names.  
3  
4 d. Elevation information, where required, shall be referenced to the North American Vertical  
5 Datum of 1988 (NAVD 88). A complete description, including material, location and elevation  
6 of at least one benchmark shall be shown on the as-built plans. The horizontal survey  
7 information shall be referenced to the State Plane Coordinate System, Florida East Zone, North  
8 American Datum of 1983 (NAD 83). A description of the control points upon which the as-built  
9 survey is based shall be included with the plans.  
10  
11 e. At least 2 ties to all valves, service lines, fitting and fire hydrants from permanent points  
12 (manholes, property lines, property corners, curbs, or pavement). Station and offset system may  
13 be used if referencing the same baseline as the approved construction plans.  
14  
15 f. Location of mains from property or easement lines and alignment distance from centerline of  
16 road at 300+/-ft. intervals.  
17  
18 g. Size, length and type of material, used to construct all mains.  
19  
20 h. Distance of mains from buildings or structures within 20' of the main.  
21  
22 i. Special detail drawings where installations are not as shown on the contract drawings due to  
23 the field conditions or where required for clarity.  
24  
25 j. Right-of-way, easements and lot lines and pertinent easement information, showing Official  
26 Record Book and page number.  
27  
28 k. For horizontal directionally drilled (HDD) segments of pipe mains, a pre-drill survey shall be  
29 performed by a Professional Surveyor and Mapper to obtain reference measurements, as required  
30 to tie the HDD tracking information from the driller to the project survey control. As a minimum,  
31 this will include vertical (NAVD) and horizontal location at the point of entry for the borehole.  
32 This shall include the alignment vector for the drill rig relative to the project control baseline  
33 survey.  
34  
35 l. Show actual location and elevation of all tees, crosses, bends, terminal ends, valves, fire  
36 hydrants, air release valves, and sampling points, etc., by distances from known reference points.  
37  
38 m. Show actual location, size and type of material of all sleeves and casing pipes.  
39  
40 n. Elevation and horizontal location of all storm sewers, gravity sewers including laterals, force  
41 mains, water mains, etc. which are crossed; including clearance dimension at all conflicts or  
42 crossings.  
43  
44 o. Top of pipe elevation and horizontal location of all water and force main stub outs.  
45  
46 p. Horizontal location of all services at the termination point.

1  
2 q. Location of fire lines.  
3

4 r. A Valve Table including the Plan ID, Size, Type, Manufacturer, Date Set, Cover, Number of  
5 Turns, Open Direction, Joint Type and Position.  
6

7 **2. Water Mains**  
8

9 a. The location of all valves, fittings, fire hydrants, casings and points of connection to the  
10 existing system shall be referenced in two perpendicular directions. Horizontal dimensions shall  
11 be to the nearest tenth of a foot and vertical dimensions shall be to the nearest hundredth of a  
12 foot.  
13

14 b. Horizontal locations will be required perpendicular to the right-of-way at 100' intervals.

15 c. Elevations on the main and finished grade will also be required at all pipe dead ends,  
16 intersections, size changes, points of connection to existing system, at fittings, at intersections of  
17 pipe, at 100' intervals, and where the depth of cover is less than 36" or greater than 60".  
18

19 d. Separation between the storm water, reclaimed water mains, force mains and water mains.  
20

21 e. Distance from hydrant to hydrant valve.  
22

23 **3. Gravity Sewer**  
24

25 a. The location of all piping, wyes, tees, manholes, cleanouts and points of connection to the  
26 existing system shall be referenced in two perpendicular directions. Horizontal dimensions shall  
27 be to the nearest tenth of a foot and vertical dimensions shall be to the nearest hundredth of a  
28 foot. Runs of gravity sewers shall be identified (e.g., 300' of 8" PVC SDR 26 at S=.004).  
29 Elevations shall be given for the north rim of the top of all manhole covers and all manhole  
30 inverts.  
31

32 b. Elevations on the service piping and finished grade will be required at the property line.  
33 Location of the end of sewer services shall be given to the plug and be located from the side  
34 property line.  
35

36 c. Manhole types shall be identified (e.g. Type A, B, etc.)  
37

38 d. Elevation of manhole top rim and invert of each line.  
39

40 e. Show distance between manholes center-to-center and horizontal location.  
41

42 f. Show material size and type used to construct sewer mains.  
43

44 g. Show length (center of manhole to end of stub) distances from known reference points or  
45 baseline offsets, and elevation of stub-outs.

1 h. Show station and offset location of sanitary services' at property line. Particular care in  
2 dimensioning needed in special situations, i.e., cul-de-sacs and locations where services are not  
3 perpendicular to the wye.

4  
5 i. Show invert elevation of sanitary service at property line.  
6

#### 7 **4. Wastewater Pump Stations**

8  
9 a. Wet-well size and location shall be indicated and located to property lines and/or ROW lines.  
10

11 b. All lines within the pump station site shall be located to property lines and/or ROW lines.  
12 Elevations shall be indicated at inverts, wet-well top/bottom, and at ground adjacent to wet-well.  
13

14 c. All types and sizes of lines and fittings shall be indicated.

15 d. All schedules that show pump, motor and electrical data shall be corrected to show the as-built  
16 condition and submitted with the pump station drawings. As-built survey shall indicate the make,  
17 model number, horsepower, impeller and condition point of pumps selected and installed, shape  
18 of wet well, location of control panel, location of pump out connection, control level settings,  
19 any deviation from the plans, and serial number of the pumps.  
20

21 e. Within the pump station boundaries the following shall be located horizontally: pump-out,  
22 hose bib and RPZ device, wet-well, control panel, bends, fittings, manholes, generator and fuel  
23 tank, transformer, irrigation system, fence, and auxiliary electrical enclosures, as applicable.  
24

25 f. A detail of the pump station site showing above and below ground improvements is required.  
26

27 g. All buried electrical conduit shall be labeled and located to property lines and/or right-of-way  
28 lines including electrical service from utility transformer to station meter and to control panel.  
29

#### 30 **5. Force Mains**

31  
32 a. The location of valves, fittings, casings and points of connection to the existing system shall  
33 be referenced in two perpendicular directions. Horizontal dimensions shall be to the nearest tenth  
34 (1/10) of a foot and vertical dimensions shall be to the nearest hundredth (1/100) of a foot.  
35

36 b. Horizontal locations will be required perpendicular to the right-of-way at 100' intervals.  
37

38 c. Elevations on the main and finished grade will be required at points of connection to the  
39 existing system at fittings, 100' intervals, at high points, and where the depth of cover is less than  
40 36" or greater than 60".  
41

#### 42 **6. Reclaimed Water Mains**

43  
44 a. The location of valves, fittings, casings and points of connection to the existing system shall  
45 be referenced in two perpendicular directions.  
46

- 1 b. Horizontal dimensions shall be to the nearest tenth (1/10) of a foot and vertical dimensions  
2 shall be to the nearest hundredth of a foot.  
3
- 4 c. Horizontal locations will be required perpendicular to the right-of-way at 100' intervals.  
5
- 6 d. Elevations on the main and finished grade will be required where the depth of cover is less  
7 than 36" or greater than 60", at fittings, and at 100' intervals.  
8
- 9 e. Elevations on the main and finished grade will be required at all pipe dead ends, intersections,  
10 and size changes.  
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**CHAPTER IV**  
**ACCEPTANCE OF SYSTEM FOR OPERATION**

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14

**A. GENERAL**

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Upon completion of construction by the contractor and passing of final inspection by PSLUSD, the Engineer of Record must submit the turnover package to the PSLUSD office, in person by appointment. The submittal will undergo an initial review for content only and shall be accepted or rejected for a complete review. If the submittal is incomplete and rejected, it will be returned to the EOR in its entirety. Once the submittal has been accepted by the PSLUSD for complete review, the detailed review will be completed within 7 days.

26  
27

**B. UTILITY ACCEPTANCE TURNOVER PACKAGE**

28  
29  
30

The Utility Acceptance Turnover Package includes the following:

31  
32

**01. Utility Acceptance Turnover Checklist**

33  
34  
35  
36  
37  
38

The Utility Acceptance Turnover Checklist and other related forms can be downloaded from the PSLUSD web site at [www.cityofpsl.com/utility/commercial-development/utility-commercial-development.html](http://www.cityofpsl.com/utility/commercial-development/utility-commercial-development.html). The EOR must initial each applicable item on the form to certify that the information is satisfactory and meets the PSLUSD requirements. The required information must be submitted together with the completed form; submittal of incomplete or unsatisfactory information will delay transfer of the system to PSLUSD.

39  
40

**02. As-built Survey**

41  
42  
43  
44

As-built survey shall be prepared in accordance with the requirements of Section D., Chapter III. The survey must be submitted as follows:

- 45  
46  
47  
48  
49  
50  
51  
52
- a. Two sets of signed and sealed black or blue line as-built surveys (utility sheets only).
  - b. PDF files on a CD or DVD (utility sheets only).
  - c. An electronic file (AutoCAD format on a CD or DVD) for the entire project, which includes road, drainage, signalization, lighting, landscaping, etc. Standard AutoCAD fonts must be used or special font files shall be included on the CD.

53  
54

**03. Contractor's Affidavit & Release of Lien**

- 55  
56  
57  
58  
59  
60
- a. Contractor's affidavit and final release of lien shall be submitted on the City's standard form.
  - b. All Contractors who performed work on the utility portion of the project must submit an affidavit and release of lean.

61  
62

**04. Owner's Affidavit**

- 63  
64  
65  
66
- a. Owner's affidavit shall be submitted on the City's standard form.
  - b. Exhibit A shall contain the legal description of the property.

1 **05. Final Inspection Report, Inspection Overtime/Re-Inspection Fees, and Other**  
2 **Fees/Charges**

3  
4 a. Final Inspection Report

5  
6 Final inspection report completed by the EOR on PSLUSD forms must indicate compliance with  
7 all items on the form. The final inspection shall be considered unsatisfactory by the PSLUSD if  
8 any items on the report do not comply with the utility standards even if the EOR has noted that  
9 the project did pass final inspection.

10  
11 b. Fees & Charges

12  
13 All fees and charges must be paid prior to acceptance of the turnover package, including:

- 14  
15 (1) Overtime inspection fees  
16 (2) Re-Inspection fees  
17 (3) Guaranteed Revenue  
18 (4) All other fees incurred.

19  
20 **C. APPROVAL TO PLACE SYSTEM INTO OPERATION**

21  
22 When all the items, as required in Sections A. and B. above, are in compliance, the PSLUSD will  
23 issue a Letter of Acceptance and give clearance to the Building Department for issuance of a  
24 Certificate of Occupancy.