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## **SANITARY SEWER - PLAN NOTES**

1. A pre-construction conference shall be held prior to the start of construction. The Contractor shall be responsible for securing all necessary permits prior to construction.
2. All construction and materials shall conform to City of Kirkland Department of Public Works and current WSDOT/APWA standards and specifications for road, bridge, and municipal construction.
3. Approximate locations of existing utilities have been obtained from available records and are shown for convenience. The Contractor shall be responsible for verification of the locations shown and for discovery of possible additional utilities not shown so as to avoid damage or disturbance. The underground utility location service shall be contacted for field location prior to any construction. The owner or their representative shall be contacted if a utility conflict exists. For utility location in King County, call 1-800-424-5555. The Contractor is responsible to ensure that utility locates are maintained throughout the life of the project.
4. It shall be the Contractor's responsibility to coordinate their activities with local utility companies to ensure that all utilities are installed according to these plans and the requirements of the individual utility companies.
5. All manholes shall conform to WSDOT/APWA standards, eccentric cones with manufacturer-approved gaskets and 1/2" polypropylene-encapsulated safety steps and ladders. All manholes shall have cast iron rings and ductile iron covers. Lids shall have 2" raised letters marked "SEWER." All cleanouts shall have cast iron rings and covers marked "CO" that are in paved areas.
6. All side sewers shall be tested for acceptance at the same time the main sewer is tested. Side sewer locations shall be verified in the field prior to construction and backfilling. All side sewers shall be capped with a watertight plug, have a cleanout and test tee installed, and shall be marked for location with a 2" x 4" stake painted white, marked sewer, with 3' exposed, and the depth of the cap written on the stake. See Standard Detail S.18. The stake shall be secured to the end of the plug with wire a minimum of 16 gauge. Initial side sewer installation shall run to the property line. The remaining side sewer shall not be installed until testing and acceptance of the sewer trunk line by the City of Kirkland is completed. Number and location of side sewers shown are approximate only and may be changed as required during construction. Contractor shall notify Engineer when exact locations are determined and provide the Engineer and the City of Kirkland Department of Public Works with an as-built. If approved by the Public Works Department, all double-sided sewer wyes must be at the property line.
7. All main-line trenches shall be compacted prior to testing sewer lines for acceptance.
8. Pressure testing of gravity sewer mains shall conform to the following standards: (1) air testing will require a minimum of 4 psi for 15 minutes with no pressure drop; (2) water testing will require a minimum of 10' of head in a standpipe at the test location for 15 minutes with no drop in the water level in the standpipe. Either test is acceptable.

9. Pressure testing of force mains and laterals will require an air test of 25 psi minimum for 15 minutes with no pressure drop.
10. New connections to existing manholes or sewer lines shall be sealed off until upstream construction is finished, tested, cleaned, and accepted. All construction debris and water shall be removed prior to opening the seal.
11. All PVC sewer pipe and fittings shall meet the requirements of ASTM Specifications D-3034 for 4" to 15" diameter and ASTM F679 for 18" to 27" diameter. Pipe shall be SDR-35 and shall conform to standard specifications. Bedding and backfill shall meet WSDOT and APWA specifications.
12. Minimum slope for side sewers shall be two percent (2%).
13. An approved copy of the sewer plan must be on site whenever construction is in progress.
14. Prior to construction of sewer lines, the necessary lot corners must be set, and the Contractor shall be responsible for the verification of the location of pipes, manholes, and invert elevations.
15. Pipe anchors, if used, shall be installed: not over 36' center to center on grades from 20 percent to 35 percent; not over 24' center to center on grades from 35 percent to 50 percent; and not over 16' center to center on grades 50 percent and greater.
16. All manholes shall have a minimum of 0.10' to a maximum of 1.00' drop between invert in and invert out.
17. PVC sewer pipe shall be tested for deflection according to WSDOT/APWA specifications.
18. All trench backfill shall be compacted to 95 percent density in roadways, roadway shoulders, roadway prism and driveways, and 85 percent density in unpaved areas. All pipe zone compaction shall be 95 percent.
19. It shall be the responsibility of the Contractor to adjust all manhole lids and cleanout lids to match final asphalt elevations in roadways or ground elevations in landscaped areas.
20. When tying into existing manholes that are below minimum standards, the existing manhole must be upgraded to meet current standards.
21. All new sewer main extensions shall be videoed prior to final acceptance.
22. All fasteners (bolts, nuts, washers, etc.) on manhole and catch basin lids to be standard size. No metric fasteners allowed.

## **SANITARY SEWER - DESIGN CRITERIA**

### **I. MATERIALS**

#### **A. Pipe**

1. PVC pipe shall conform to the provisions of ASTM D-3034 for SDR-35 wall thickness. Pipe joints shall be rubber gasket type. Solvent cement joints shall not be used.
2. Pipe fittings shall be furnished with bells and spigots which are integral with the pipe wall.
3. PVC pipe for force mains and laterals shall be Schedule 40 with glue joints. Run tracer wire along length of force main/lateral pipe.
4. Ductile iron pipe, Class 50, shall be used when minimum cover or minimum separation from water main cannot be obtained.

#### **B. Manhole**

1. Concrete manhole adapters shall be Kor-n-seal boot or an approved equal.
2. Manholes shall be pre-cast and shall conform to Standard Plan No. S.09, S.10, and S.11. All holes for inlet and outlet pipe shall be blocked out when manhole sections are cast.
3. Ladder rungs and steps shall be 1/2" polypropylene-coated, safety-type step, 12" minimum width. Ladder side bars shall be 9/16" round bar, polypropylene coated (see Standard Plan No. S.14).
4. Manhole frames shall be cast iron and covers shall be ductile iron with a combined weight of not less than 360 pounds, and shall have a minimum clear opening of 23-3/4". Frames and covers shall be equal to Olympic Foundry MH 30D/T. Cover to be marked "SEWER" in 2" raised letters. In unimproved areas and easements, manhole shall extend a minimum of 6" and a maximum of 18" above grade. Manhole ring cover shall have three recessed 5/8" x 1-1/4" stainless steel socket head cap screws for locking.
5. Reducing cones shall provide an eccentric reduction from 48" to 24" and shall not be less than 17" in height.
6. Manhole sections shall be jointed with flexible joint using rubber gaskets conforming to ASTM C443. Joints shall be watertight.

### **II. JOINTING**

- A. Care shall be taken in making all joints in order to secure complete watertightness.

- B. Deflection in the pipe shall not be allowed either vertically or horizontally unless instructed by the Engineer. If a deflection is necessary, as determined by the Engineer, the allowable deflection shall not exceed that recommended by the pipe manufacturer.

### **III. CONNECTION TO EXISTING LINES**

- A. The method of making connections to existing lines shall be approved by the Engineer prior to construction. No existing lines shall be abandoned and no new lines shall be put in operation until the new lines have been tested and accepted by the Engineer.
- B. It is the Contractor's sole responsibility to maintain the existing sewer lines in service before the new lines are put in operation.
- C. PVC pipe connections into new concrete manholes shall be made using Kor-n-seal boot or approved equal. Connections to existing concrete manholes shall be made by using a PVC manhole adaptor (sand collar).
- D. Grouting shall be non-shrink type.

### **IV. MANHOLES**

- A. Drop manhole assembly shall be constructed using PVC fitting with gasket-fitted joints. Glue jointing is not acceptable. Drop assembly shall conform to Standard Plan No. S.12. No outside drops are allowed. Dry manholes shall be allowed only when no other feasible alternative exists.
- B. Flow line inverts shall be channeled using concrete and shall be finished with smooth flow line and surface finished. When connecting into an existing manhole, the new flow channel shall interface with the existing channel. Channeling shall conform to Standard Plan No. S.13.
- C. All joints in the manhole shall be sealed against leaks.
- D. The manhole cover shall be adjusted to final grade with approved methods.
- E. Ladders and steps shall be secured and grouted in the new manholes before the manhole is put into service.
- F. Manholes shall be constructed at all horizontal and vertical bends and at changes in pipe material.

### **V. TESTING**

- A. Lamping of lines to check deflection in the pipe will be conducted prior to any pressure tests.
- B. Mandreling and/or video taping the sewer main may be required by the Public Works Department.
- C. A 15-minute, 4 psi air test with no pressure drop will be required to ensure joint seals.
- D. Force laterals require a 15 minute, 25 psi air test with no pressure drop.

## **VI. LATERALS**

### **A. Joint-Use Laterals**

1. Minimum pipe size shall be 6".
2. Maximum of two houses can be served on a single 6" line, unless otherwise approved by the Public Works Department.
3. One cleanout must be installed for every 100' of length and at each elbow greater than 22 1/2 degrees. Place locator tape on cap when outside of paved surface.
4. Any lateral under a structure such as a rockery and with less than 3' of cover below the structure base shall be ductile iron for 5' on each side of the structure.
5. Backflow valve/check valve will be required by the Engineer per Title 15 of the Kirkland Municipal Code.
6. Testing of laterals shall conform to Title 15 of the Kirkland Municipal Code.

### **B. Single-Family Laterals**

1. Minimum pipe size off the main channel to the property/right-of-way line shall be 6".
2. Minimum cover of 6' is required at the property/right-of-way line.
3. One service lateral for each family unit, unless otherwise approved by the Public Works Department.
4. Location of lateral shall be at lowest property corner or as conditions dictate.
5. Any lateral under a structure such as a rockery and with less than 3' of cover below the structure base shall be ductile iron for 5' on each side of the structure.
6. Backflow valve/check valve may be required by the Engineer.

### **C. Multifamily Laterals**

Backflow valve/check valve will be required by the Engineer per Title 15 of the Kirkland Municipal Code.

### **D. Laterals for commercial and multifamily applications shall be tied into a manhole whenever possible. When this is not feasible, laterals shall be connected to the sewer main by one of the following approved methods:**

1. Cut in a wye connection

2. PVC saddle
  3. Romac sewer saddle
  4. Inserta Tee
  5. Thermal Fusion for HDPE Mains.
- E. Existing Lateral
1. Existing PVC laterals may be reused. A video inspection must be submitted for review to determine size and condition.
  2. All other lateral types must be replaced to meet current specifications.
  3. Existing 6" concrete laterals may be slip line. A video inspection must be submitted for review to determine size and condition.

## **VII. SEWER LIFT STATIONS - PRIVATE**

- A. General Requirements
1. All pumps within lift stations must be submersible grinder pumps, manufactured by Hydromatic or equal.
  2. All equipment and accessories shall be standard manufactured items and those coming in direct contact with sewage shall be specifically manufactured for such use.
  3. The pressure piping downstream of the lift station must tie into a 6-inch side sewer which flows by gravity into the sewer main. No direct connections of force laterals and sewer mains will be allowed.
  4. Lift station chamber must be either concrete or fiberglass.
  5. The lift station must be cycled on/off ten times to ensure all floats and alarms function properly before being signed off by the City. This test must be witnessed by the Public Works Inspector.
- B. Single-Family Lift Stations - Specific Requirements
1. Lift station to be a minimum of a simplex system (one pump).
  2. There shall be a minimum of three mercury level control floats; one for turning the pump ON, the second for turning the pump OFF, and the third for a high-water alarm.
  3. Grinder pump shall be two HP minimum, which is adequate for a single residence with up to 70 feet of head.
  4. Audio and visual alarm panel to be located inside the single-family residence.

5. Pre-designed lift station packages are acceptable.
- C. Commercial and Multi-Family Lift Stations - Specific Requirements
1. Lift station to be a duplex system (dual pumps) and must be designed by a licensed professional engineer.
  2. Audio and visual alarms are required. Alarms are to be located within the building structure near the maintenance office or property manager's office.
  3. For multi-family projects, the Public Works Department shall determine if the development is to be served by individual lift stations for each unit/building or if the entire development may be served by one lift station. When the entire development is to be served by one lift station, a three-party maintenance agreement between the City of Kirkland, the development, and a lift station maintenance company shall be recorded with the property.

## **VIII. CONSTRUCTION**

- A. Through Sewer Main Line
1. Minimum pipe size shall be 8" (size as required by flow calculations).
  2. Maximum distance between manholes shall not exceed 400'.
  3. Normal depth of pipe shall be 7' to 12'. All other depths to be approved by the Public Works Department.
- B. Dead End Sewer Main Line
- Dead end sewer main shall terminate with a manhole unless otherwise approved by the Public Works Department.
- C. Required Separation Between Water Lines and Sanitary Sewers (Reference Standard Detail No. S.02).
1. *Horizontal Separation (Parallel)* - A minimum horizontal separation of ten (10) feet between gravity sanitary sewers and any potable water lines shall be maintained, whenever possible. The distance shall be measured from edge to edge.
  2. *Unusual Conditions (Parallel)* - When local conditions prevent a horizontal separation as described above, a gravity sewer line may be laid closer than ten (10) feet to a water line provided:
    - a) It is laid in a separate trench; or it is laid in the same trench with the water line that is located at one side on a bench of undisturbed earth; and
    - b) In either case, the elevation of the crown of the gravity sewer must be at least 18 inches below the invert of the water line. When this vertical separation cannot be obtained, the gravity sewer shall be constructed of materials and joints that are

equivalent to water main standards of construction and shall be pressure tested to assure water tightness prior to backfilling.

3. *Vertical Separation (Perpendicular)* - Sewer lines crossing water lines shall be laid below the water lines to provide a separation of at least 18 inches between the invert of the water line and the crown of the sewer line, whenever possible.
4. *Unusual Conditions (Perpendicular)* - When local conditions prevent a vertical separation as described above, the following construction shall be used:
  - a) Gravity sewers passing over or under water lines shall be:
    - i. Constructed of material described in Standard Detail No. S.02. The one segment of the maximum standard length of pipe (but no less than 18 feet long) shall be used with the pipes centered to maximize joint separation; or
    - ii. Constructed of standard gravity sewer material encased in concrete or in a 1/4" thick continuous steel casing with all voids pressure-grouted with sand-cement grout.
    - iii. The length of the sewer pipe, in both i. and ii. above, shall be centered at the point of crossing so that the joints will be equidistant and as far as possible from the water line. The sewer pipe shall be the longest standard length available from the manufacturer.
  - b) Water lines passing under gravity sewers, in addition, shall be protected by providing:
    - i. A vertical separation of at least 18 inches between the invert of the sewer and the crown of the water line;
    - ii. Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking of the water lines; and
    - iii. The length of the sewer pipe shall be centered at the point of crossing so that the joints will be equidistant and as far as possible from the water line. The sewer pipe shall be the longest standard length available from the manufacturer.
  - c) Pressure sewers shall only be constructed under water lines with ductile iron pipe or standard sewer pipe in a steel casing for a distance of at least ten (10) feet on each side of the crossing.

#### D. Trench and Bedding Detail

1. Trench section shall conform to Standard Plan No. S.01.
2. The trench width to 6" above the top of pipe shall not be greater than 1 1/2 times the outside diameter of pipe plus 18", except that the trench width shall be such as to provide adequate space for workmen to place and joint the pipe properly and safely. Trench walls shall be kept vertical, except the walls of the trenches above an elevation 6" above the top of pipe may be sloped back to prevent the banks from sloughing into the ditch.

3. When soft or unstable material is encountered at the subgrade which, in the opinion of the City Engineer, will not uniformly support the pipe, such material shall be excavated to an additional depth as required by the City Engineer and backfilled with foundation rock material placed in 12" lifts and compacted to 95 percent of the maximum dry density to the pipe foundation grade.

Where unusually bad foundation conditions are encountered at the bottom of the trench, the City Engineer may order special foundation material to be placed.

4. Wherever necessary to prevent caving, excavations in sand, gravel, sandy soil, or other unstable material shall be adequately sheeted and braced. Where sheeting and bracing are used, the trench width may be increased accordingly. Trench sheeting shall remain in place until the pipe has been laid, tested for defects, and repaired if necessary, and the earth around it compacted to a depth of 2' over the top of the pipe.
5. Excavation for manholes and other appurtenances shall be sufficient to leave 12" minimum and 24" maximum clearance on all sides.
6. Joints shall not be left uncovered except in the immediate area of pipe laying. Under no circumstances shall water be permitted to rise in the trench until after the pipe has been placed, tested, and backfilled.
7. Regardless of the method of densification used, materials shall be brought up at substantially the same rate on both sides of the pipe, and care shall be taken so that the pipe is not floated or displaced. Fill material shall not be dropped directly on the pipe.
8. Pipe zone material shall consist of excavated or imported material free from roots or other organic material, mud, muck, and frozen material.
9. Pipe zone material shall be densified by compaction using mechanical tamping to a density of 95 percent of maximum dry soil density using a modified proctor. Equipment with suitably-shaped tamping feet shall be used to compact the material and ensure that the specified soil density is obtained beneath the haunches of the pipe. At the time of placement, the materials shall have the optimum moisture content required for compaction and the moisture content shall be uniform throughout each layer. Materials shall be placed in layers not more than 6" thick after each compaction.
10. Trench backfill above the pipe zone to the surface of the finish grade or native ground shall be placed so that the resulting density will be 95 percent of maximum dry soil density, modified proctor, within travelled ways and 85 percent of maximum dry soil density for areas outside travelled ways. Backfill material shall be placed in continuous horizontal layers not exceeding 12" in thickness. This will be strictly adhered to for all pipes placed in the right-of-way.
11. Native backfill shall be mounded to a height of 4" over the top of the trench for ordinary backfill outside travelled ways.

12. Material for backfilling around manholes and other appurtenances shall be gravel barrow. Materials shall be deposited in a manner to ensure that the manhole or other appurtenance is not disturbed from the proper alignment, and backfill shall be compacted to the ground surface.
13. All interior bracing placed inside the pipe by the manufacturer shall be removed only after the backfill is complete.