

**DESIGN STANDARDS
AND
CONSTRUCTION SPECIFICATIONS
FOR
MIDVALLEY IMPROVEMENT DISTRICT**



Revised October 2012

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**DESIGN STANDARDS AND CONSTRUCTION SPECIFICATIONS FOR
MIDVALLEY IMPROVEMENT DISTRICT**

1. GENERAL REQUIREMENTS

1.1. INTRODUCTION

The following Midvalley Improvement District Design Standards and Construction Specifications" were developed to establish practical, uniform design and construction of sanitary sewers in the Midvalley Improvement District. These criteria are not intended to cover extraordinary situations, and in such instances, deviations from the criteria may be allowed where justified, upon approval of the Midvalley Improvement District.

1.2. DEFINITIONS

AASHTO - American Association of State Highway and Transportation Officials

ACI - American Concrete Institute

ACPA - American Concrete Pipe Association

AI - Asphalt Institute

ANSI - American National Standards Institute

ASTM - American Society for Testing and Materials

AWWA - American Water Works Association

PPI - Plastic Pipe Institute

UDEQ - DWQ - Utah Department of Environmental Quality, Division of Water Quality

Approved Drawings - Final construction drawings approved by the District.

"As-Built"/ "As-Constructed"/"Record" Drawings - As-built, as-constructed and Record drawings are synonymous terms. These are plans to be submitted by the Developer which show any changes in the project or variations from the Approved Drawings due to unforeseen circumstances or conditions encountered during the course of construction.

Contractor - The person, company or firm performing the construction work.

Design Standards and Construction Specifications - The latest version adopted by the Midvalley Improvement District Board of Trustees.

Developer - The owner, builder or person sponsoring the construction.

District - The Midvalley Improvement District (the "District").

District Engineer - The professional engineer who is a District employee or outside consultant, including such assistants as are authorized to represent him, who represents the Midvalley Improvement District.

Engineer - The company or firm and its employees providing the engineering services for the project through the developer.

Inspector - The authorized agent of the District or District Engineer assigned to make detailed inspections of any or all portions of the sewer system construction.

Lateral - The sewer line and appurtenances extending from the building to the public sewer line.

Public Sewer - The sewer line, 8" or larger, and not designated as a lateral, which collects and transports sewage and owned by the District.

"Shall"/"Should" - Where the term "shall" is used, it is intended to mean a mandatory requirement. Other terms such as "should" and "recommend", indicate discretionary use.

SSPWC – Standard Specifications for Public Works Construction (the "Green Book").

1.3. REVISIONS OF STANDARDS AND SPECIFICATIONS

When reference is made to the Standard Specifications (ASTM, District Standards, etc.), the specification to which referred shall be understood to mean the latest revision of said specification.

These specifications may be modified or deleted by appropriate notes on Approved Drawings.

1.4. CONTRACTORS

All Contractors (including subcontractors) performing sewer construction within Midvalley Improvement District shall possess a valid Utah Contractors License and shall

be licensed to perform sewer construction. The license numbers of all contractors and subcontractors performing work on a project shall be included in a Developer's Application.

2. DESIGN AND CONSTRUCTION REQUIREMENTS

2.1 General Design and Construction Process

The following is an outline and general description of the design and construction process for sewer improvements and additions in the Midvalley Improvement District (District). Developers', owners' and contractors' work in the District is governed by the District's Design Standards and Construction Specifications as well as statutes, rules and regulations of the State of Utah. If there are any inconsistencies among these materials, the actual statutes, rules and regulations shall govern design and construction activities in the District.

Work in the District shall proceed in a manner consistent with the following steps:

STEP 1: SEWER AVAILABILITY & CONDITIONS

Verify that sewer services are available to the project using the following general steps:

1. Obtain a copy of the District's Design Standards and Construction Specifications. A copy may be obtained for free on-line at www.mvdst.com or by purchasing a printed copy from the District office at 160 E. 7800 South, Midvale, Utah, for a cost of \$50.00 per set. Initial questions about the project may be directed to the District or to the District Engineer.
2. Submit two (2) sets of the Project Summary to the District. Project Summary shall include:
 - a. Site Location Map – The proposed development shall be shown on a vicinity map of the Midvalley Improvement District area. The map shall include the street address and legal description of the property where the project will be built.
 - b. Detailed description of the proposed use of the property, the estimated maximum number of units to be served, number of levels per building, zoning, project acreage, and estimated peak and average flows.
3. Based on the information provided in the Project Summary, the District will determine if sewer service is available to the project and will communicate, in writing, the basic requirements of the District for the project.

STEP 2: DESIGN PHASE

Prepare the design plans for the project and pay fees associated with the design for review by the District's Engineer.

1. The Developer shall submit two (2) copies or a PDF set of its design plans to the District. The Design Plans shall be accompanied by an initial plan review fee of \$500.00. These Plans shall comply with the requirements of the most recent version of the District's Design Standards and Construction Specifications and meet any special requirements needed for the particular project. The Plans shall also comply with the latest revision of the Utah State Department of Environmental Quality, Division of Water Quality, Rules and Regulations.
2. The Design Plans shall be on 22 x 34 or 11 x 17 inch paper. Design plans may be submitted in PDF form.
3. The Plans shall include a topographic map, and shall also identify, by name, all streets within, and in the vicinity of, the project.
4. A copy of all proposed sewer line easements shall be included. These easements shall be on forms approved by the District.
5. A proposed Dedication Plat shall be included with the Plans. This shall show the location of all utility and other easements affecting the project, including without limitation, easements for sewer, water, electrical, telecommunications, cable television, etc. The proposed Dedication Plat shall comply with laws relating to the execution and recording of plats.
6. Once received by the District, the Design Plans will be reviewed by the District engineer for completeness and for compliance with all applicable standards, statutes, ordinances and regulations. If the Plans are incomplete or inadequate in any way, the District will provide the Developer with detailed instructions of the changes that are required before the Plans will be approved. At the discretion of the District, the changes may be outlined in letter form or in "red-line" format on the Plans submitted by the Developer. The District may impose and collect additional fees for each review of plans, in an amount to be determined by the District Engineer for time, costs and expenses associated with the additional review(s). The Developer will be given a statement from the District showing the charges for each review. Said charges shall be paid when each set of plans, as revised, is submitted to the District, and in any event, all fees shall be paid in full before any approval may be issued or before any further review is provided.

7. When the Design Plans are approved, the District will issue a preliminary design approval letter. The letter will include the District's estimate of the project construction costs, a manhole fee of \$400.00 per manhole, and the amount of the bond to be posted by the Developer before construction is started. The letter will also include the District Engineer's fees and costs for inspections and other construction related engineering services, based on 6 percent of the project contractor's bid or the District Engineer's construction cost estimate, which shall be paid in full to the District by the Developer before the pre-construction meeting. Minimum Engineer's fee is \$500.00.
8. The Developer's proposed construction bond shall be submitted with the Plans. This may be a cash bond, an irrevocable letter of credit or a corporate surety bond. The amount of the bond shall be One Hundred Twenty percent (120.0%) of the District Engineer's estimated sewer construction cost. The final amount thereof will be determined by the District, and will be communicated to the Developer upon approval of the Design Plans.
9. A final design approval letter will be issued by the District at a pre-construction meeting and upon receipt of all funds required in the preliminary approval letter including the estimated District engineering fees, the manhole fee and the bond.

STEP 3: CONSTRUCTION PHASE

In this phase, the project will be built by the Developer and periodically inspected by the District. The sequence of this phase will be as follows:

1. Prior to any construction on the project, a pre-construction meeting will be held at the District's offices. The Developer shall deliver the manhole deposit, its executed bond and its payment of the estimated engineering fees prior to the pre-construction meeting. Those to attend shall include: the District engineer and inspectors, the Developer and the Developer's contractor(s). The purpose of the meeting will be to coordinate all aspects of construction and to formulate a proposed schedule for construction.
2. After the pre-construction meeting and before actual construction begins, the Developer shall survey and mark the new sewer line(s) and manholes. Following the completion of the survey, the Developer shall notify the District, and within one business day, the District's inspectors will inspect the proposed alignment of the line(s) and manholes. Construction shall not take place until the alignment is approved by the District engineers.
3. The Developer shall construct the sewer lines and manholes in accordance with the approved Design Plans, as well as all applicable standards, statutes, ordinances and regulations.

4. The District's Engineer and inspectors will visit the construction site and perform periodic inspections of the project. In the event that the District Engineer determines that construction is inadequate, inconsistent with the approved Plans, or otherwise inconsistent with applicable standards, statutes, ordinances and regulations, construction shall cease until the deficiency is corrected.
5. Upon completion of manhole and pipeline construction, and prior to paving, the District shall be notified by the Developer that the lines are ready to be televised. The Developer shall provide the District with not less than two (2) business days' notice that the project is ready for televised inspection.
6. Upon completion of the televised inspection, the District will prepare a preliminary "Punch List" for any defects discovered by televised inspection.
7. The Developer shall remedy to the District's satisfaction any defects noted on the preliminary Punch List. Once this is done, the Developer may pave over the sewer project.
8. Once paving is complete, the District will perform another inspection and issue a final Punch List, to include without limitation, the manhole acceptance requirements set forth below, and any and all other matters required to bring the project into compliance with the Design Plans and applicable standards, statutes, ordinances and regulations.
9. Before the District issues its Preliminary Construction Approval, and releases the initial portion of the Developer's bond (eighty three and one-third percent (83.33%) of the bond posted before the pre-construction meeting, the Developer shall meet the following requirements:
 - a. Manhole testing and requirements: All manholes not set at finished grade of surfaced roads within the subdivision shall be raised or lowered to meet the finished road surface.
 - b. The Developer shall submit written proof of a satisfactory manhole vacuum test conducted by an independent testing contractor on all manholes. Should the Developer elect to perform or have the Developer's contractor perform the testing, the District Engineer shall be notified not less than two (2) business days in advance of testing to ensure that the District's engineer is available to witness the test. All manholes shall pass vacuum test prior to acceptance and the Developer shall clean out all manholes to the District's satisfaction.

- c. The Developer shall submit written proof of a satisfactory pipeline air test conducted by an independent testing contractor on all pipelines. Should the Developer elect to perform or have the Developer's contractor perform the testing, the District Engineer shall be notified not less than two (2) business days in advance of testing so the testing can be witnessed by the District's inspector. All pipelines shall pass air tests prior to acceptance and the Developer shall clean out all lines to the District's satisfaction.
- d. The Developer shall deliver to the District "as constructed" drawings of the project, as well as any revised easements as may have been identified as necessary during the course of construction.
- e. The Developer shall deliver to the District all record ("as-constructed") drawings, maps, plats and unrecorded easements that were approved by the District Engineer. "As-constructed" drawings shall include coordinates for each new manhole in the following format: NAD 1983 State Plane Utah Central FIPS 4302 Feet.
- f. The Developer shall deliver to the District, on CD, DVD, or other approved media, digital copies of all drawings and maps of the project. Drawings and maps shall be in AutoCAD format (.dwg) of the latest revision approved by the District Engineer. Other documents may be submitted in "DOC" or "PDF" format.

STEP 4: CONTINUING WARRANTY & FINAL CONSTRUCTION APPROVAL

Final construction approval will not be issued by the District and the remaining portion of the Developer's bond will not be released until the conclusion of the two (2) year Warranty Period and the Developer's faithful compliance with the District's regulations.

1. After construction is completed and the District has issued its written Preliminary Construction Approval, the project remains subject to a two (2) year Warranty Period. During this time the District will continue to hold 16.67% of the Developer's bond.
2. During the Warranty Period, the District may conduct periodic inspections of the project. If deficiencies are noted by the District, the same will be communicated to the Developer who shall diligently and promptly endeavor to remedy the same. If, in the District's opinion, the Developer fails to diligently and promptly remedy the deficiency, the District may perform the repairs. In that event, the cost of the repairs, plus an overhead fee of fifteen percent (15.0%) shall be paid by the Developer to the District. The District may, at its discretion, draw on the continuing bond for payment of the repair costs and overhead. The failure of

the District to draw on the continuing bond will not be a waiver of any of its rights thereunder.

3. No later than thirty (30) days prior to the expiration of the Warranty Period, the Developer shall notify the District to conduct its final inspection of the Project. When this is done, the District will communicate any deficiencies to the Developer, who shall diligently and promptly remedy the same. When the required remedial work is performed to the District's satisfaction the District will issue its Final Construction Approval and the remaining portion of the bond will be released and returned to the Developer. If, in the District's opinion, the Developer fails to diligently and promptly remedy any deficiency, the District may perform the repairs. In that event, the cost of the repairs, plus an overhead fee of fifteen percent (15.0%) shall be paid by the Developer to the District. The District may, at its discretion, draw on the continuing bond for payment of the repair costs and overhead. The failure of the District to draw on the continuing bond will not be a waiver of any of its rights thereunder.
4. The District will have no duty to perform a final inspection or to release the remaining portion of the bond until the Developer has: (1) given the notice required in subparagraph 3, above; (2) complied with all requirements of the District to remedy any deficiencies associated with the project; and (3) otherwise complied with all applicable rules, regulations, statutes and ordinances affecting the project.

BONDING REQUIREMENTS. Upon approval of the Developer's Design Plans, the District Engineer will estimate the total sewer extension cost and will calculate the expected bond amount, to be equivalent to One Hundred Twenty percent (120.0%) of the estimated total sewer extension cost. The purpose of the bond is to ensure that the construction of the sewer line and related improvements are completed in a timely and workmanlike manner; and meets all requirements of the Design Plans, the District's Design Standards and Construction Specifications and other applicable laws, rules and regulations. The bond will also secure the Developer's performance during the two (2) year Warranty Period. The Warranty Bond or Continuing Warranty shall be equal to sixteen and two-thirds percent (16.67%) of the total bond posted by the Developer prior to the pre-construction meeting and will be held as a warranty for workmanship and materials for two (2) years. At the conclusion of the two (2) year warranty period, and if the Developer has met all warranty requirements, the Warranty Bond will be refunded. The refund shall be requested in writing to the District.

The Developer may use a bond consisting of: a corporate surety bond; a cash bond; or an irrevocable letter of credit. The forms of these bonds are available from the District. The District will not accept property bonds. If the Developer desires to use a bond form which is different from those approved by the District, it must submit its proposed bond

to the District for review by the District's legal counsel, and must pay all costs and fees incurred by the District for that legal review.

WARRANTY PERIOD. The continuing two (2) year warranty period shall commence at such time as: (a) the District has issued its written Preliminary Construction Approval; and (b) the development subject to the continuing two (2) year Warranty Period is fully physically occupied, or if the development has more than five (5) units, not less than fifty percent (50.0%) of the units are occupied. Upon application for release of the Warranty Bond, the developer shall provide written evidence of the date the development was fully occupied, or if the development has more than five (5) units, written evidence showing the date when at least fifty percent (50.0%) of the units were occupied.

2.2 DESIGN CRITERIA

2.2.1 DESIGN REGULATIONS

- A. All sanitary sewer systems shall be designed to exclude all storm water and water from underdrain systems, roofs, streets, and other paved areas.
- B. Downspout connections, foundation and basement drains, sumps and storm drain connections shall be prohibited from discharging into the sanitary sewer system.

2.2.2 LATERALS

Laterals connected to the public sewers shall meet the following requirements:

- A. Laterals will be of PVC, ductile iron, concrete, HDPE or other material approved by the District.
- B. Laterals shall have a nominal inside diameter of not less than 4 inches nor greater than 6 inches.
- C. Each dwelling unit shall be served by an individual lateral. "Stacked" dwelling units (such as in a condominium project where there are multiple levels on which dwelling units are located) may be served otherwise with prior written approval of the District. For commercial developments, all laterals will be evaluated and approved by the District's engineers on a case by case basis.
- D. Minimum lateral grades shall be 2% for 4-inch laterals and 1% for 6-inch laterals.
- E. Laterals should not be located under driveways.

- F. Cleanouts shall be installed at 50-foot intervals for 4" laterals, 100-foot intervals for 6" laterals, and at all changes in direction greater than 45 degrees.
- G. In all cases where a lateral is under pressure (meaning a situation where the effluent is pumped, by use of a mechanical device, from a property owner's property to the District's line), the section of lateral from the street right-of-way or easement line to the main sewer line shall be a gravity flow line. Maintenance for the line, including any pumping equipment, from the structure to the main line shall be the responsibility of the property owner.
- H. Laterals shall not be connected directly to any manhole.
- I. Laterals shall conform to these Midvalley Improvement District" Design Standards and Construction Specifications."

2.2.3 DESIGN PERIOD

The sewer system shall be designed to serve the estimated built-out tributary area and shall be based on the most current approved information available, including area master plans, current zoning regulations and approved planning and zoning reports when available.

2.2.4 DESIGN CAPACITY

Design average flow shall be estimated at not less than 100 gallons per capita per day, including infiltration at 200 gallons per diameter inch per mile per day. To accommodate peak flows, sewers shall be designed, flowing full, to carry not less than the following contributions:

- A.
 - (1) 4-inch and 6-inch laterals: 400 gallons per capita per day.
 - (2) 8-inch thru 15-inch sewers: 400 gallons per capita per day.
 - (3) Larger than 15-inch sewers: 250 gallons per capita per day.
- B. Flow from commercial, municipal and industrial connections shall be established on a case by case basis by the District's Engineer, and designed and constructed in accordance with plans approved by the District.
- C. Additional ground water infiltration, if applicable.

2.2.5 ALTERNATE METHODS OF DESIGN

If use is made of methods of sewer design other than those described above, a complete description of methods used shall be presented to the District Engineer for prior written approval. The District reserves the right to approve or deny alternate design methods, based on the District Engineer's discretion.

2.2.6 SEWER SIZE

All public sewers shall be 8 inches in diameter or larger.

2.2.7 SEWER DEPTH

Sewers shall be placed deep enough to serve all basements, assuming a 2% grade on house sewers. They shall be well below frost line at all points and also the top of the sewer line shall be 2 feet lower than the bottom of any water lines placed in the same street. Minimum cover shall be 36 inches from the top of the pipe. Sewers at depths greater than 16 feet shall be given special design considerations, and shall be designed and built as required by the written directive of the District Engineer.

2.2.8 SEWER SLOPES

All sewers shall be designed and constructed for mean flow velocities, when flowing full, of not less than 2.0 feet per second, based on Manning's Hydraulic formula using an "n" value of 0.013. The following are the minimum slopes which shall be provided; however, slopes greater than these are desirable, especially in the upper reaches of sewer systems.

Sewer Size	Minimum Slope in feet per 100 feet
8"	0.334
10"	0.248
12"	0.194
14"	0.158
15"	0.144
16"	0.132
18"	0.113
21"	0.092
24"	0.077

Sewers on slopes 20 percent or greater shall be anchored immediately downstream from bells with concrete anchors or approved equal as follows:

- A. Not over 36 feet center-to-center on grades 20 percent up to 35 percent
- B. Not over 24 feet center-to-center on grades 35 percent to 50 percent.
- C. Not over 16 feet center-to-center on grades greater than 50percent.

2.2.9 SEWER ALIGNMENT

- A. Sewers shall be designed on straight alignment between manholes.

- B. Sewer lines shall be designed so that they are consistent with the requirements of Utah law, including UAC 317-3-2.9. In addition, all sewer pipes shall be subject the following horizontal distance requirements: (a) they shall run parallel to the curb line or other boundary of the easement in which the sewer line lies; (b) be at least five (5) feet from the nearest curb or easement boundary, which ever is furthest; and (c) be at least five (5) feet from the any other buried utility line. Special needs due to unique conditions presented by the project may be recommended by the Developer. However, any variation from these Standards shall be approved, in writing, by the District Engineer. The District reserves the right to approve or deny variations based on the District Engineer's discretion.

2.2.10 PIPE TRANSITIONS

At manholes, where sewer diameters change, the flow energy gradient shall be continuous. The 0.8 depth point of the two sewers shall be placed at the same elevation, with proper allowance for any manhole head loss or as required to provide proper flow.

2.2.11 MANHOLES

- 2.2.11.1 Location: Manholes shall be installed at the end of each line, at all changes in pipe size or changes in alignment or grade; and at intervals not to exceed 400 feet.

Manholes shall be provided at street intersections.

Watertight, seal-down covers shall be provided in areas subject to flooding.

Manholes shall not be positioned in waterways, such as gutters.

Manholes shall not be placed within 10 feet of storm drain, catch basins or in low points where catch basins are located.

- 2.2.11.2 Inverts: Flow channels through manholes shall be shaped to conform to cross-sections and slopes of connecting sewers. Floors and channels shall be shaped such that television camera access will not be impeded. The minimum drop through manholes shall be 0.2 feet if an alignment change of more than 45 degrees is designed.

- 2.2.11.3 Drop Connections: Drop Connections may be used only with the prior written approval of the District Engineer, and may be considered only where the elevation difference between the flowlines of the inflow pipe and the outflow pipe exceed 18 inches. All drop connections shall conform to the Standard Detail Drawing for "Drop Manholes."

2.2.11.4 Diameters: Manhole diameters shall be at least 60 inches. Manholes deeper than 16 feet shall have a minimum diameter of 72 inches and have landings installed in compliance with the current OSHA Requirements.

2.2.11.5 Shallow Manholes: Shallow manholes may only be used for depths less than 6 feet. See Standard Detail Drawing.

2.2.12 CLEANOUTS

Cleanouts shall not be used as an alternative to manholes on sewer lines 8 inches in diameter and greater and shall only be used when approved, in writing, by the District Engineer.

Cleanouts for laterals shall conform to the District's Standard Detail Drawings.

2.2.13 PROTECTION OF WATER SUPPLIES

It is generally recognized that sewers and appurtenances must be kept remote from public water supply wells and other water supply sources and structures. The following specific requirements shall be observed at all times:

- A. There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenances thereto, which could permit the passage of any wastewater or polluted water into the potable supply.
- B. Sewers shall be laid at least 10-feet horizontally from any existing or proposed water main. Separation distances shall be measured pipe edge to pipe edge.
- C. Where the 10-foot separation stated above is not achieved, the water line shall be located above the sewer either in a separate trench, or on a bench of undisturbed earth with at least 18 inches of vertical depth between bottom of the water main and top of the sewer pipe except as specified in paragraph "D" below.
- D. Where sewer and water mains must cross and the vertical separation mentioned above is not possible, both mains should be constructed of mechanical-joint ductile iron pipe, or equivalent for a distance of at least 10 feet on either side of the point of crossing.
- E. The above requirements shall apply to building sewers and water service lines to buildings except that copper tubing service laterals (not plastic) may pass under sewer mains or laterals. This copper tubing must pass at least 18 inches under the sewer.

2.2.14 EASEMENTS

- A. Easements shall be required on all public sewers not located in dedicated roadways.
- B. All easements shall be at least 20 feet wide, and shall extend at least ten (10) feet to either side of the center line of the sewer pipe.
- C. Easements shall extend 20 feet beyond the last manhole on any sewer line.
- D. When a sewer is located in an easement, not abutting a street right-of-way, access easements shall be provided, and recorded prior to construction.
- E. Signed easements shall be submitted to the District along with Final Design Plans.
- F. Easements shall be obtained as required by the District's Resolutions.

2.2.15 WASTEWATER PUMPING STATIONS

Use of wastewater pumping stations shall be avoided whenever possible. Pumping stations are subject to approval and review by the Board of Trustees and the District Engineer.

2.2.16 BORINGS

- A. Borings shall be designed and constructed in accordance with the applicable City, County, State, Federal and Railroad Standards, permits, and/or as designated on Approved Plans.
- B. Steel casings for bored construction shall be steel pipe conforming to ASTM A-53 Grade B. Steel pipe shall have a minimum yield stress of 42,000 psi and have a minimum wall thickness in accordance with the following table:

Diameter of Casing (inches)	Nominal Wall Thickness (inches)	
	Under Railroads	All Other Uses
12" – 18"	0.375	0.375
Greater than 18" to 22"	0.375	0.375
Greater than 22" to 28"	0.438	0.375
Greater than 28" to 34"	0.500	0.375
Greater than 34" to 42"	0.562	0.500
Greater than 42" to 48"	0.625	0.562

- C. Casings under interstates shall extend from right-of-way to right-of-way and be designed for the height of fill material.

- D. Casing material, size, length and invert elevations shall be shown on Final Design plans.
- E. Sewer pipe material shall be shown on Final Design plans.
- F. Redwood skids shall be used throughout the length of the pipe, tied at every pipe diameter length to brace pipe installed in casing to prevent shifting or flotation during backfilling of annular ring between the casing and carrier pipe.
- G. The annular space between the casing and sewer pipe shall be filled with sand, "pea" gravel, or Portland Cement grout.
- H. The ends of the casing shall be sealed and watertight as specified on Final Design plans.
- I. Pipe barrels shall be installed to rest upon support blocks with the pipe bells clearing the casing invert by at least 1/2".
- J. The bored portion of the sewer should be completed before construction of the adjacent portions to allow for discrepancies in alignment and grade which may occur during the boring operation.

2.2.17 PREVENTION OF GROUNDWATER MIGRATION

The Engineer shall consider methods to prevent the continuous migration of groundwater along the trench line.

3. MATERIAL REQUIREMENTS

3.1 GENERAL

Unless specifically designated otherwise in each case, all materials and equipment furnished for permanent installation in the work shall conform to applicable standard specifications and shall be new, unused and undamaged when installed or otherwise incorporated in the work. No material or equipment shall be used by the Contractor for any purpose other than that intended or specified. All materials not conforming to these specifications shall be specifically approved in writing by the District Engineer prior to delivery to the jobsite.

Any material or equipment found by the Inspector not conforming with District Standards and Specifications shall be rejected.

3.2 SEWER PIPE

3.2.1 CONCRETE SEWER PIPE

3.2.1.1 Materials: All concrete pipe shall be made using Type V cement. Admixtures and pozzolans may be used only with approval of District Engineer.

3.2.1.2 Non-Reinforced Concrete Pipe:

- A. Shall be Class 3 (or III) non-reinforced concrete sewer pipe conforming to ASTM C-14.
- B. Joints shall be of the bell-and-spigot, compression type rubber gasket design conforming to ASTM C-443.

3.2.1.3 Reinforced Concrete Pipe:

- A. Shall be used for sanitary sewers 18 inches in diameter and larger.
- B. Shall be Class III, minimum, reinforced concrete sewer pipe conforming to ASTM C-76. Reinforcement shall be circular.
- C. Joints shall be of the bell-and-spigot, compression type rubber gasket design conforming to ASTM C-443.

3.2.2 DUCTILE IRON SEWER PIPE

3.2.2.1 Ductile Iron Pipe: Shall conform to AWWA Specifications C-150/151 thickness class for corresponding buried depth, ANSI Specifications A21.51 Ductile Iron Pipe. Cement-mortar or bituminous lining shall be specified on the Approved Plans.

3.2.2.2 Fittings: Shall be ductile iron and conform to AWWA C-110 (ANSI A21.10). Fittings shall be consistent with the specified pipe.

3.2.2.3 Joints: All joints shall be mechanical type conforming to the dimensions and weights specified in ANSI A21.11 (AWWA C-111).

3.2.3 POLYVINYL CHLORIDE (PVC) PIPE

3.2.3.1 Materials: All PVC sewer pipe shall be made from PVC plastic conforming to ASTM D-1784 Class 12454-B or 12454-C.

- 3.2.3.2 PVC Sewer Pipe: PVC sewer pipe will be permitted for installation up to 27 inch diameter and shall conform to the requirements of ASTM D-3034, Class SDR 35 for pipe sizes 4" thru 15" and ASTM F-679 for pipe sizes 18" thru 27". Pipe lengths shall not be greater than 12 feet.
- 3.2.3.3 Joints: Joints shall be bell-and-spigot compression type with flexible elastomeric seals conforming to the requirements of ASTM D-3212.
- 3.2.3.4 Fittings: All fittings shall conform to ASTM D-2241. The strength class shall be not less than the strength class of any adjoining pipe.
- 3.2.3.5 Low-Head Pressure PVC Sewer Pipe: Shall conform to AWWA C-900. Minimum wall thickness shall be DR-18 or Pressure Class 150. Joints shall be bell-and-spigot type with integral bell gasketed joints.
- 3.2.3.6 Installation: The pipe shall be installed in accordance with the requirements of ASTM D-2321 and as specified herein and as shown on the "Pipe Installation Detail" contained herein.

3.3 MANHOLES

3.3.1 GENERAL

Manholes shall be watertight, precast, reinforced manholes, complete with adapter rings, frame, cover, pipe connections, concrete sections and cast-in-place. Prefabricated base monolithic concrete manholes may be allowed subject to approval by the District.

3.3.2 PRECAST REINFORCED CONCRETE MANHOLES

Manholes shall conform to ASTM C-478 and the Standard Detail Drawing for "Precast Manholes".

Precast base sections shall include a base riser section with integral floor and shall be supplied with a flexible pipe connector conforming to ASTM C-923. Precast reinforced concrete cone sections shall be of the ECCENTRIC type.

Manholes deeper than 16 feet shall have precast reinforced concrete cone sections of the ECCENTRIC type.

All joints and lift holes shall be sealed with non-shrinking grout or a continuous bead of bituminastic material. In wet areas both sides of the joint shall be grouted.

3.3.3 CAST-IN-PLACE CONCRETE MANHOLES

Cast-in-place bases shall have a 28-day minimum compressive strength of 4000 psi and contain not less than 6-1/2 bags of Type V cement per cubic yard and shall conform with the Standard Specification for Portland Cement ASTM C-150.

Cast-in-place bases over live main lines shall have not less than a 24-hour cure period before stacking sections on the poured base.

Wall, cone sections and risers shall be precast reinforced concrete conforming to ASTM C-478 and the Standard Detail Drawing for "Cast-in-Place Manholes". Precast reinforced concrete cone sections shall be of the ECCENTRIC type.

All joints and lift holes shall be sealed with non-shrinking grout or a continuous bead of bituminastic material. In wet areas both sides of the joint shall be grouted.

Manholes deeper than 16 feet shall have precast reinforced concrete cone sections of the ECCENTRIC type.

3.3.4 MANHOLE CASTINGS

All castings shall be cast iron rings and covers conforming to ASTM A-48 Class 30. Castings shall be cleaned and painted with an asphalt coating prior to delivery to the site. All castings shall have a combined minimum weight of 400 pounds with the cover approximately 150 pounds and the ring approximately 250 pounds. The foundry name and casting number shall appear on the casting.

Covers shall be in accordance with the following:

- A. Covers shall be 24 inches in diameter.
- B. Covers shall be vented with a pick-hole for opening.
- C. All covers shall be marked "Midvalley Improvement District".
- D. Watertight seal down covers shall be of the gasket and bolt down type, with countersunk, hexagonal bolts.

3.3.5 MANHOLE STEPS

Manholes that are more than 4 feet deep shall have sections provided with plastic encapsulated steel or fiber glass reinforced plastic steps cast-in-place, with maximum spacing of 16 inches.

4. CONSTRUCTION REQUIREMENTS

4.1 GENERAL

4.1.1 MATERIALS HANDLING

All sewer pipe, manhole sections, castings and appurtenances shall be transported, handled and stored in a manner which will insure proper installation in an undamaged condition. The Contractor shall replace all material found to be defective or which has been damaged. This includes the replacement of material found to be defective prior to expiration of the guarantee period.

4.1.2 INSPECTION

All work and materials, from the beginning of the construction until the completion and acceptance of the proposed project shall be subject to inspection by Midvalley Improvement District or its authorized representative, at their convenience. The Inspector shall have access to the work at all times. Any work found by the Inspector not conforming with Approved Plans and/or these District "Standards and Specifications" is subject to rejection.

The Contractor shall notify the District Engineer 48 hours prior to the start of construction.

4.2 TRENCH EXCAVATION

4.2.1 GENERAL

The work included under "Trench Excavation" shall include: every operation necessary for excavation of all materials of whatever nature within the designated limits of the trenches; maintaining the excavation by shoring, bracing or other accepted methods and its removal; providing for the uninterrupted flow of surface water or sewage during construction; and protecting all pipes, conduits, culverts, bridges and all other public and private property which may be endangered by the work.

4.2.2 TRENCHING

4.2.2.1 Alignment: Trench excavation for pipe installation shall be performed to the alignment and grade as indicated on the approved plans or as required by the Engineer.

4.2.2.2 Tunneling: Tunneling may be permitted by the Engineer for economy of construction or necessity or preserving existing improvements.

4.2.2.3 Pavement Removal: All pavement removal shall be in accordance with the applicable City, County or State Standards and permits.

4.2.2.4 Trench Width: Trenches shall be excavated to a width which will provide adequate working space for proper pipe installation, jointing and embedment. Minimum sidewall clearance shall be 6 inches and the maximum sidewall clearance shall be 12 inches, measured from the outside wall of the installed pipe at a depth of 12 inches above the pipe.

4.2.2.5 Limitation of Excavation: Except by expressed written permission of the District Engineer or Inspector, the maximum length of open trench shall be 300 feet, or the distance necessary to accommodate the amount of pipe installed in a single day (including open excavation, pipe laying and appurtenances, construction and backfill which has not been temporarily resurfaced).

4.2.2.6 Trenching by Machine or by Hand: The use of mechanical equipment will be permitted except in places where machines may cause damage to existing structures above or below ground, in which case, hand methods shall be employed.

4.2.2.7 Structure Protection: The Contractor shall provide temporary support, adequate protection and maintenance of all underground and surface structures, pipes, drains, sewers and other obstructions affected by the construction work. Any structure that has been disturbed shall be restored or replaced.

4.2.3 DEWATERING

All excavation shall be dewatered before any construction is undertaken therein. Concrete shall be placed only upon dry, firm foundation material and pipe shall be laid only in dry trenches.

4.2.4 BLASTING

The Contractor's responsibility with respect to the use of explosives during blasting includes compliance with all laws, rules and regulations of the Federal, State, the City and the insurer, governing the keeping, storage, use, manufacture, sales, handling, transportation or other distribution of explosives. All operations involving the handling, storage and use of explosives shall be conducted with every precaution by trained, reliable workers under satisfactory supervision. Blasts shall not be fired until all persons in the vicinity have had ample notice and have reached positions out of danger therefrom. The Contractor shall advise the Engineer, all utility companies, the Midvale City Public Works Department, Salt Lake County Unified Police and Fire Departments, Sandy City, Sandy City Fire Department, Murray City Police and Fire Departments, Murray City Public Works Department, the Salt Lake County Public Works Department, and any public body that should be advised in advance as to when and where charges are to be set off.

4.2.5 SAFETY

- A. Excavations shall be performed, protected and supported as required for safety and in the manner set in "Excavations, Trenching and Shoring" of the Utah Occupational Safety and Health Standard for Construction. Additional precautions shall be implemented if deemed necessary by the Engineer or Inspector and shall be at the expense of the Contractor.
- B. The Contractor shall furnish and maintain all necessary safety equipment, such as barrier signs, warning lights and guards to provide adequate protection for persons and property during all phases of construction.
- C. The Contractor shall give reasonable notice to the owners of public or private property and utilities when such property and utilities are within the construction area.
- D. The Contractor shall at all times observe and comply with all Federal, State and local laws, ordinances and regulations which will in any manner affect the work.

4.3 PIPE EMBEDMENT

4.3.1 GENERAL

The pipe shall be carefully bedded as specified on Approved Plans and shall meet the requirements of these District "Design Standards and Construction Specifications".

4.3.2. EMBEDMENT

Bedding material, one-fourth the diameter of the pipe (8 inches minimum) shall be required. This material shall be 1/4" to 3/4" clean, angular rock. This same material shall be used for haunching and a minimum of (1) one foot above the pipe. Haunching shall be placed to the spring line of the pipe. Selected backfill material consisting of earth or sand (shall be free of stones larger than 1 inch, hard clods, frozen material or other debris) shall be placed in the trench simultaneously on each side of the pipe for the full width of the trench in such a manner as not to damage or disturb the pipe. The density of backfilled material shall be ninety-five percent (95%) of maximum density determined by the compaction control test specified in AASHTO T-180 and verified by AASHTO T-238 or AASHTO T-191.

Requirement for bedding and haunching material may be altered with the pre-approval of the District Engineer.

4.4 PIPE INSTALLATION

4.4.1 GENERAL

This section covers the installation of all sanitary sewer pipe, fittings, manholes and appurtenances. No connection to existing structures shall be made without approval of the District. All designs and construction shall be in accordance with Utah law, including UAC R317-3-2.

4.4.2 PIPE LAYING

All work shall be in accordance with the following related standards and these specifications.

4.4.2.1 Concrete Sewer Pipe: As per manufacturer's recommendations for pipe installation.

4.4.2.2 Ductile Iron Pipe: AWWA C-600 "Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances".

4.4.2.3 PVC Sewer Pipe: ASTM D-2321 "Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe". ASTM D-2855 "Standard Recommended Practice for Making Solvent-Cement Joints with PVC Pipe and Fittings".

4.4.2.4 General Requirements:

A. Piping shall be laid to the alignment and grades indicated on approved construction drawings within the following limits provided that such variation does not result in a level or reverse grade:

Alignment	1 inch per 100 feet
Grade	+/- one-half (1/2) inch

B. Install pipe of size, material, strength, class and joint type with embedment as shown on the Approved Construction Plans and/or conforming to the Midvalley Improvement District" Standards and Specifications".

C. Pipe shall be laid in a straight line at a uniform grade between manholes.

D. Pipe laying shall begin at the lowest elevation and proceed upstream with the bell end of bell-and-spigot pipe positioned upstream.

E. The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until the work has been accepted.

F. Pipe shall not be laid in water nor under unsuitable weather or trench conditions.

- G. All field cuts shall be made at right angles to the axis of the pipe. All pipe shall be filed to remove roughness.
- H. All connections between two piping materials or between two field cuts of the same material shall be made with adapters designed and intended for that specific purpose.
- I. All joint preparation and jointing operations shall comply with the recommendation of the pipe manufacturer.
- J. Whenever pipe laying is stopped, the open end of the pipe shall be plugged with a watertight plug and the trench shall be properly backfilled to protect the pipe from floating.
- K. If adjustment of position of a pipe length is required after being laid, it shall be removed and rejoined.
- L. Any pipe that has floated shall be removed from the trench and the pipe shall be relaid as directed by the Engineer.
- M. In addition to the above general requirements, all pipe installation shall comply to the specific requirements of the pipe manufacturer.

4.5 TRENCH BACKFILL

4.5.1 GENERAL

The work included under "Trench Backfill" shall include every operation above the pipe embedment zone

4.5.2 BACKFILLING

All backfilling shall be in accordance with the applicable City, County or State Standards, permits and/or as designed on the Approved Plans. Backfilling shall, however, comply with the Embedment requirements of the District as specified above.

4.5.3 PAVEMENT REPLACEMENT

All pavement replacement shall be in accordance with the applicable City, County or State Standards, permits and/or as designated on Approved Plans.

4.6 MANHOLES

4.6.1 GENERAL

Manholes shall be constructed at the locations indicated and in accordance with details as shown on the Approved Plans and/or Standard Detail Drawings.

4.6.2 SUBGRADE

Manholes are to be constructed on a stable foundation capable of supporting the loads imposed.

4.6.3 MANHOLE BASE

4.6.3.1 Cast-in-Place Bases:

- A. The base shall be a continuous pour of concrete.
- B. Cast-in-place bases shall be at least 6 inches in thickness below the invert and shall extend at least 6 inches radially outside of the outside dimensions of the precast manhole wall section. The base shall extend at least 6 inches above the bottom of the wall section on the outside of the wall section.
- C. The initial precast wall section shall be supported on concrete blocks and adjusted to proper alignment and grade prior to pouring of the base.
- D. The precast wall section shall not bear directly on any of the pipes.

4.6.3.2 Precast Base Sections: Precast base sections shall be placed so as to be fully and uniformly supported in proper alignment.

4.6.4 INVERTS

All inverts, precast bases, cast-in-place bases or connections to existing manholes shall meet the following requirements:

- A. Invert channels shall be smooth with a uniform grade from inflow to outflow pipe flowlines.
- B. Minimum drop through manholes shall be 0.2 feet at all alignment changes of 45 degrees or greater.
- C. Changes in flow direction shall be smooth, uniform and made with the longest radius possible.

- D. The cross-sectional shape of the invert channels shall match the lower halves of the inflow and outflow pipes.
- E. All openings around pipes shall be grouted to form a permanent watertight seal such as with grout.
- F. The pipe shall protrude into the manhole a maximum of 4 inches.
- G. Floors and channels shall be shaped such that television camera access will not be impeded.

4.6.5 WALL SECTIONS

Precast sections shall be placed and aligned to provide vertical sides.

4.6.6 JOINTS

All joints between sections, grade rings and castings shall be sealed with a continuous bead of watertight bituminastic material or non-shrinking grout. All manholes shall have joints and lift holes grouted on the outside of the manhole in addition to standard sealing procedures. Precast manholes shall have rubber boots to connect pipes to the manhole. The pipes shall be banded to the boot with steel bands.

4.6.7 BACKFILLING

Backfill according to Section 4.5.2.

4.6.8 PLACING CASTINGS

4.6.8.1 In Roadways: Top of castings shall be set parallel to finished road surface. Castings shall be fully and uniformly supported. Wedges or shims used to elevate castings shall be metal with concrete placed for uniform support. Collars around manholes shall be either a concrete collar, 9 inches wide minimum, or an asphalt hot-mix to match existing paving.

4.6.8.2 Off Roadways: All manholes shall be set to the grade shown on Approved Plans or as directed by the Engineer or Inspector.

4.6.9 STUBS

All stubs shall be plugged with watertight plugs at the end of pipes outside of the manhole.

4.6.10 OVER EXISTING SEWERS

Manholes to be built on an existing sewer shall be constructed in such a manner as will not disrupt service of the existing sewer. The manhole base, walls and invert shall be completed before the top half of the sewer pipe is cut or broken away. Rough edges of

the pipe thus exposed shall be grouted in such a manner as to produce a smooth and acceptable finish. Any portion of the existing sewer damaged shall be repaired or replaced by the Contractor.

4.6.11 PROTECTION DURING CONSTRUCTION

A plywood bottom or plugs shall be placed in manholes during construction to prevent debris from entering sewer lines.

4.6.12 DROP MANHOLES

Drop manholes will not be permitted in the District unless the Developer: (a) submits evidence of no other available option for the particular location of the proposed drop manhole; and (b) first obtains the written approval of the District Engineer for such construction, as shown on the approved plans. Drop manhole connections, as indicated on Approved Plans or as required whenever the elevation differences between the flow lines of the inflow pipe and the outflow pipe exceed 18 inches, shall conform to the Standard Detail Drawing for "Drop Manholes" or Approved Plans. All drop manholes shall be constructed with an outside drop unless specifically authorized by the District Engineer.

4.7 LATERALS

4.7.1 GENERAL

This section covers the connection of laterals to main sewer lines. Any alterations to this specification shall be approved by the District prior to connection.

4.7.2 CONNECTION REQUIREMENTS

4.7.2.1 Type of Connection:

- A. In all cases, a manhole shall be used to connect sewer lines 8 inches and larger to existing sewer mains.
- B. The connection of sewer laterals to sewer mains shall be made by installing a "wye" branch, a "saddle" fitting made specifically for lateral-sewer main connections. "Insta Tee" and similar lateral joints shall not be used in the District.

"Saddle" fittings shall be banded securely onto the pipe with stainless steel bands and encased in concrete. The hole cut into the sewer line wall shall be sized to avoid any flow restrictions between the fitting and pipe. "Wye" or "Tee" saddles shall be PVC; any other material must be approved, in writing, by the District. A District representative must be present to approve the connection, material and installation of any nose-on.

4.7.2.2 Installation: All lateral connections shall be in accordance with these Midvalley Improvement District's "Design Standards and Construction Specifications":

- A. All connections shall be left uncovered until inspected by the District Inspector.
- B. Service connections shall be bedded, backfilled and compacted as per pipe specifications or as directed by the District Inspector.
- C. All sewer lines shall remain in service while connections are made.
- D. Any damage to existing sewer manholes or lines during connections shall be corrected by the Contractor/Developer as directed by the District.
- E. The invert of all sewer laterals at the point of connection shall be at or above the springline of the sewer main.

4.7.3 LATERAL REQUIREMENTS

4.7.3.1 Installation:

- A. Material and construction requirements of laterals shall be in accordance with these "Midvalley Improvement District Standards and Construction Specifications" and the Standard Detail Drawing for "Typical Service Connection".
- B. The District shall be notified 24 hours prior to installation of the sewer lateral.
- C. 4-inch laterals shall be laid at a minimum slope of 2% and 6-inch laterals shall be laid at a minimum slope of 1%. Variations are to be reviewed by the District Inspector

4.7.3.2 Cleanouts: Cleanouts shall be installed at property lines, 50 foot intervals for 4-inch laterals and 100-foot intervals for 6-inch laterals, and at all changes in direction greater than 45 degrees. Cleanout risers shall be the same size as the lateral and shall be connected to wyes in the lateral. Concrete support blocks shall be poured around wyes for cleanouts. Cleanouts shall be in accordance with the Standard Detail Drawing for "Typical Service Connection".

4.7.3.3 Grease Traps and Sampling Manholes:

- A. In accordance with the requirements of the South Valley Water Reclamation Facility (SVWRF), whose rules and regulations are adopted by the District, grease traps shall have a minimum 800 gallon capacity and shall be of an approved precast or cast in place design. The grease trap is to be located outside of the building and shall be

accessible to the District and SVRWF at all times. All grease related wastes shall be conveyed through a separate sewer line to a grease trap and thence to a sampling manhole before entering the District's sewer line. Sanitary sewer wastes shall be conveyed through a separate independent sewer line. Past the sampling manhole, the two lines can be connected to flow to the District's sewer line.

- B. Sampling manholes shall be of an approved size and design to allow for proper sampling operations. Precast and cast in place designs are allowable upon prior review and approval.
- C. All grease traps and sampling manholes (as well as all associated plans) must be approved, and a permit issued, by the South Valley Water Reclamation Facility. Persons installing grease traps or sampling manholes shall contact the Pretreatment Department of the South Valley Water Reclamation Facility with respect to such improvements and shall comply with the rules and regulations of the South Valley Water Reclamation Facility.

4.8 ACCEPTANCE TESTS

4.8.1 GENERAL

The Developer has ultimate responsibility for work done by its Contractor. The Contractor shall perform all pipeline flushing and testing of installed pipelines except televising the installation. The Contractor shall notify the District Engineer 48 hours in advance of any proposed testing operation. After the Contractor has cleaned the lines he shall give the District 48 hours advance notice that the system is ready for televising.

Visual inspection and a leakage test shall be performed on all installed sewer lines prior to acceptance. Additional tests may be required by the District Engineer or Inspector. Defects identified by the District Engineer or Inspector shall be repaired, and subsequently inspected by the Engineer, prior to acceptance of the sewer lines.

4.8.2 VISUAL INSPECTION

4.8.2.1 Public Sewer Lines: All sections will be "mirrored" (interior of the pipe illuminated) by the District Engineer or Inspector. Each section of sewer line between manholes shall be straight and uniformly graded with no damaged pipe, misaligned or displaced joints or other defects. All sections of pipe shall be free of dirt, debris and obstructions. The Contractor shall furnish suitable assistance to the District Engineer or Inspector.

4.8.2.2 Laterals: All connections, lines and appurtenances shall be examined by the Inspector prior to backfilling. All sections of pipe shall be free of dirt, debris and obstructions.

4.8.3 AIR TESTS

4.8.3.1 Requirements: An "Air Test" shall be performed on the full length of each public sewer line installed with the following requirements:

- A. The Contractor shall give the District 48 hours notice of any test to be performed on the system.
- B. All air tests shall be observed by the Inspector, unless the air test is performed by a "Testing Firm" which the District and District Engineer approves prior to the testing.
- C. Each section tested shall be noted on an "Air Test" form to be submitted to the District. Acceptances, failures, reasons for failure and retests shall be shown on the form.
- D. All sewer pipe shall be tested after the completed backfill.
- E. All air tests are to include laterals when installed in conjunction with the sewer main.
- F. All stubs are to be air tested.
- G. All manholes shall be vacuum tested.
- H. All repairs indicated by any unsuccessful tests shall be made and the tests repeated until the successful performance of all tests is achieved.

4.8.3.2 Method of Testing: The method of "Air Testing" gravity sewer lines shall be as follows:

- A. Clean test section.
- B. Plug all pipe outlets with suitable test plugs bracing each plug securely if needed.
- C. Raise the internal pressure in the test section to 4.0 psig.
- D. After the pressure is reached, allow the pressure to stabilize. This usually takes 2 to 5 minutes, depending on the pipe size.
- E. Disconnect the air supply and allow the test pressure to decrease to no less than 3.5 psig. Starting pressure may be greater than 3.5 psig.
- F. Determine the time that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig.

- G. If the time period is less than the Minimum Test Time Required (see attached ASTM minimum test time chart, tables 1 and 2, below) locate and repair problem and retest.

4.8.4 VACUUM TESTING MANHOLES BY THE NEGATIVE AIR PRESSURE TEST:

The procedure for vacuum testing manholes by the negative air pressure test shall be as follows:

- A. All lift holes shall be plugged.
- B. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.
- C. The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.
- D. A vacuum of 10 inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 inches of mercury.
- E. The manhole shall pass if the time for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury meets or exceeds the values indicated in Table 3 below.
- F. If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained.

4.8.5 DEFLECTION TEST

All flexible and semi-rigid pipe shall be tested for deflection, joint displacement, or other obstruction by passing a rigid mandrel through the pipe by hand, not less than 30 days after completion of the trench backfill, but prior to any resurfacing. The mandrel test shall comply with the specific procedures required in Section 306-1.4.6 of the SSPWC, except for the additional provision that the mandrel shall be a full circle, solid cylinder, or a rigid, non-adjustable, odd-numbered leg (9 leg minimum) steel cylinder, approved by the Engineer as to design and manufacture.

4.8.6 TELEVISION INSPECTION

The District, at time of acceptance, final inspection or any time during the warranty period, may photograph or televise the new facilities and notify the Developer of the condition thereof. The Developer shall thereupon immediately make any repairs or corrections required by the District.

4.9 CLEANUP

All surplus materials, tools and any temporary structures shall be removed from the construction site by the Contractor. All rubbish, dirt or excess earth from the excavation shall be removed by the Contractor at the earliest possible date and the construction site left clean and acceptable to the construction Inspection.

TABLES

TABLE 1
 SPECIFICATION TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP
 FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

1 Pipe Dia. (in.)	2 Min. Time (min: sec)	3 Length for Min. Time (ft)	4 Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

TABLE 2
SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

1 Pipe Dia. (in.)	2 Min. Time (min: sec)	3 Length for Min. Time (ft)	4 Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	46:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

TABLE 3

MINIMUM TEST TIMES FOR VARIOUS MANHOLE DIAMETERS

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

**STANDARD
DETAIL
DRAWINGS**