

SOUTHWEST METROPOLITAN WATER AND SANITATION DISTRICT



SANITARY SEWER SYSTEM STANDARDS AND SPECIFICATIONS

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SOUTHWEST METROPOLITAN WATER AND SANITATION DISTRICT SANITARY SEWER SYSTEM STANDARDS AND SPECIFICATIONS

FORWARD

AUTHORITY

These Standards and Specifications are promulgated by the Board of Directors of Southwest Metropolitan Water and Sanitation District. Administration of the Standards and Specifications including interpretation, enforcement, revision, waiver, and variance is delegated by the Board of Directors to the District Manager or his appointed representative. Any variance request must be submitted in writing to the District Manager for review.

EFFECTIVE DATE

These Standards and Specifications shall be effective on October 1, 2019 and shall supersede all former Sanitary Sewer System Standards and Specifications of the Southwest Metropolitan Water and Sanitation District.

REVISIONS, AMENDMENTS OR ADDITIONS

These Standards and Specifications may be revised, amended, or added to from time to time. Such revisions, amendments or additions shall be binding and in full force and effect upon adoption by the Board of Directors of Southwest Metropolitan Water and Sanitation District.

SOUTHWEST METROPOLITAN WATER AND SANITATION DISTRICT CONTROL

These Standards and Specifications shall apply to the installation, operation, and maintenance of all sanitary sewer facilities under the ownership and/or control of Southwest Metropolitan Water and Sanitation District.

Notwithstanding any variance from these Standards and Specifications that occurred or was authorized in the past, or that may be authorized in the future, Southwest Metropolitan Water and Sanitation District shall not be restricted or limited in the exercise of its lawful powers. No action in violation of these Standards and Specifications direct or indirect, of or by any person, including any owner, operator, or agent of an owner or operator of any water facility in making any connection, disconnection, repair, or otherwise doing work with respect to any sewer facility served by the Southwest Metropolitan Water and Sanitation District system, shall continue after discovery of such violation, or the enforcement of corrective action as to such violation.

ORGANIZATION AND INTERPRETATION OF STANDARDS AND SPECIFICATIONS

These Standards and Specifications are composed of Administrative Procedures and Requirements, Technical Engineering Standards, Detail Drawings and Construction Plan Notes and Exhibits. The interpretation of any section, or of differences between sections, shall be made by the District Manager or an appointed representative, and their interpretation shall be binding and controlling in its application.

Whenever there is a conflict between these Standards and Specifications and any referenced standard, specification or code the most stringent requirement shall apply and shall mean the latest edition.

DEFINITIONS

As used in these Standards and Specifications, unless the context shall otherwise require, the words defined in this paragraph shall have the meanings herein ascribed:

- A. **Applicant for Sewer Main Extension:** Any person, association, corporation, entity, or government agency desiring sanitary sewer service for premises under their control and having entered into an agreement for extension of sewer mains with the District; often a subdivider or developer. Also referred to as Applicant.
- B. **Best Management Practice:** Any reasonable practice or procedure deemed to be necessary by the District manager and/or his/her designee to prevent, abate or remedy the consequences of the introduction of unlawful pollutants or concentrations of pollutants into the District's sanitary sewer system by an industrial or commercial user to the extent technically and economically practical.
- C. **Best Professional Judgment:** The highest quality technical opinion developed after consideration of all reasonably available and pertinent data or information.
- D. **Board:** The Board of Directors of Southwest Metropolitan Water and Sanitation District.
- E. **Collection Main:** A 12-inch or smaller diameter pipe along public streets or appropriate rights of way used for collecting wastewater from individual customers.
- F. **Contractor:** In the context of these Standards and Specifications, a Contractor employed by an Applicant for a distribution system extension.
- G. **Design Engineer:** A civil engineer licensed to practice in the State of Colorado who is employed by the Applicant to perform engineering services.
- H. **Discharger:** Any person who discharges or causes the discharge of wastewater to the sewer system of Southwest Metropolitan Water and Sanitation District.
- I. **Dissolved Solids:** The concentration of matter in the wastewater consisting of colloidal particulate matter one micron in diameter or less, and both organic and inorganic molecules and ions present in solution.
- J. **District:** The Southwest Metropolitan Water and Sanitation District.
- K. **District Engineer:** The engineering firm authorized by the Southwest Metropolitan Water and Sanitation District to provide engineering services on behalf of the District.

- L. **District Manager:** The chief executive officer of the District designated as such by the District’s Board of Directors.
- M. **Domestic (Sanitary) Wastes:** Liquid wastes: a) from the noncommercial preparation, cooking and handling of food, or b) containing human excrement and similar matter from the sanitary conveniences of dwellings, commercial buildings, industrial facilities, and institutions.
- N. **Domestic User:** Any private residential user that discharges wastes derived from ordinary living processes excluding any commercial or industrial wastes.
- O. **Fats, Oil or Grease (FOG):** Non-petroleum fats, oils, and grease derived from animal or plant sources.
- P. **Flow:** Volume of wastewater.
- Q. **Garbage:** Solid wastes from the domestic and commercial preparation, cooking and dispensing of food, and from the commercial handling, storage and sale of produce.
- R. **Grease Interceptor or Gravity Grease Interceptor (GGI)** - A plumbing appurtenance or appliance that is installed in a sanitary drainage system to intercept non-petroleum fats, oils, and greases (FOG) from a wastewater discharge and is identified by capacity volume and number of compartments.
- S. **Grease Trap or Hydromechanical Grease Interceptor (HGI)** - A plumbing appurtenance or appliance that is installed in a sanitary drainage system to intercept non-petroleum FOG from a wastewater discharge and is identified by flow rate, and separation and retention efficiency. The design may incorporate air entrainment, hydro-mechanical separation, interior baffling, and/or barriers in combination or separately.
- T. **Health Department:** Any reference in this Chapter to the “Department of Health” or the “Health Department” shall mean the Department of Health.
- U. **Holding Tank Wastewater:** Any wastewater from holding tanks such as vessels, chemical toilets, campers, trailers, septic tanks, sealed vaults, vacuum-pump trucks and holding tanks from pretreatment systems.
- V. **Inactive Gravity Grease Interceptor (GGI)** - An existing GGI that is no longer in use.
- S. **Individual (Private) Wastewater Disposal System:** A septic tank, cesspool or similar self-contained receptacle or facility which collects and/or treats or otherwise disposes of wastewater and which is not connected to the POTW.
- T. **Industrial:** Of or pertaining to industry, manufacturing, commerce, trade or business, as distinguished from domestic or residential.

- U. **Industrial Wastes:** The liquid wastes or solid wastes from industrial manufacturing processes, trades or businesses as distinct from sanitary wastewater.
- W. **Inspector:** The authorized representative of the District assigned to a job-site to perform inspection services.
- X. **Interceptor Sewer Main:** A sanitary sewer main larger than 12-inches in diameter used to collect and transport wastewater from sewer collection mains to an authorized point of discharge.
- Y. Non-domestic User - Any user that does not meet the criteria for categorization as a domestic user shall be considered a non-domestic user.
- Z. **Owner-Developer:** Any person, association, corporation, entity, or government agency desiring a sanitary sewer main extension from the District. Also referred to as Applicant.
- AA. **Pollutant:** Dredged spoil, dirt, slurry, solid waste, incinerator residue, sewage, sewage sludge, garbage, trash, chemical waste, biological nutrient, biological material, radioactive material, heat, wrecked or discarded equipment, rock, sand or any industrial, municipal or agricultural waste.
- BB. **Pollution:** The manmade or man-induced alteration of the chemical, physical, biological and radiological integrity of water.
- CC. **Publicly Owned Treatment Works (POTW):** A publicly owned treatment works includes any devices or systems used in the collection, storage, treatment, recycling, and reclamation of sewage and any conveyances, which convey wastewater to a treatment plant.
- DD. **Sanitary Sewer:** A public sanitary sewer collection or interceptor main which carries sewage and to which storm, surface, and groundwaters are not intentionally admitted, included the pipe or conduit system and appurtenances, for the collection, transportation, pumping and treatment of sewage. This definition shall also include the terms “public sewer”, “sewer system”, “sewer” and “collection line”.
- EE. **Sanitary Sewer System or Wastewater System:** Any devices, facilities, structures, equipment or works owned or used by the District for the purpose of the transmission, storage, treatment, recycling and reclamation of industrial and domestic wastes from within or without the District, including intercepting sewers, outfall sewers, collection lines, pumping, power and other equipment and their appurtenances, but excluding service lines.
- FF. **Sewer Main Extensions:** Extensions to the Sanitary Sewer Collections System owned and controlled by Southwest Metropolitan Water and Sanitation District.

- GG. **Sewer Service Line:** All pipe, fittings, and appurtenances of the customer, including the connection to the District's Sewer Collection System, used for conveying wastewater from the owners property or premises to District owned sanitary sewer mains.
- HH. **Sewage:** See definition of Wastewater (Sewage).
- JJ. **Storm Sewer:** A sewer that is intended to carry only storm, surface and groundwater drainage.
- KK. **Storm Water:** Any flow occurring during or following any form of natural precipitation and resulting therefrom.
- LL. **Stub-in:** An authorized connection made to a District owned sanitary sewer main and the sewer service pipe located between said connection and the owners property line. Stub-ins are allowed for the purpose of installing sewer service pipes within street rights-of-way prior to paving.
- MM. **Tap or Sewer Tap:** a physical connection to a District sewer main which, together with appropriate permits, effects sewer service to individual customers.
- NN. **Tap Fee:** The charge assessed against new users of the sanitary sewer system.
- OO. **Unpolluted Water:** Water of quality equal to or better than the state or Federal effluent criteria in effect, or water that would not cause violation of receiving water quality standards and would be not benefited by discharge to the POTW.
- PP. **User:** Any person who contributes, causes or permits the contribution of wastewater into the sanitary sewer system.
- QQ. **Waste Grease Bin (WGB)** - Any receptacle used to store used FOG collected from Fryers, grills, and other similar devices.
- RR. **Wastewater (Sewage):** The combination of the liquid and water carried wastes from residences, commercial buildings, industrial plants and institutions, including polluted cooling water.

Combined Wastewater: Wastewater including sanitary and industrial wastewater, storm water, infiltration and inflow carried to the POTW.

Industrial Wastewater: A combination of liquid and water carried waste, discharged from any industrial establishment and resulting from any trade process carried on in that establishment, including the wastewater from pretreatment facilities and polluted cooling water.

Sanitary Wastewater: The combination of liquid and water carried wastes discharged from toilets and other sanitary plumbing facilities.

ABBREVIATIONS

A.	<u>AASHTO:</u>	American Association Of State Highway And Transportation Officials
B.	<u>AC:</u>	Asbestos Cement
C.	<u>ANSI:</u>	American National Standard Institute, Inc.
D.	<u>ANSI:</u>	American National Standard Institute, Inc.
E.	<u>ASTM:</u>	American Society Of Testing And Materials
F.	<u>ASTM:</u>	American Society Of Testing And Materials
G.	<u>BAT:</u>	Best available technologies
H.	<u>BMP:</u>	Best management practices
I.	<u>BOD:</u>	Biochemical oxygen demand
J.	<u>BPJ:</u>	Best professional judgment
K.	<u>CFR:</u>	Code of federal regulations
L.	<u>CI:</u>	Cast Iron
M.	<u>COD</u>	Chemical oxygen demand
N.	<u>CWA:</u>	Clean water act (33 USC 1251 et seq.), as amended
O.	<u>DI:</u>	Ductile Iron
P.	<u>ESMT:</u>	Easement
Q.	<u>EPA:</u>	Environmental protection agency
R.	<u>FOG:</u>	Fats, oils and grease
S.	<u>GGI:</u>	Gravity grease interceptor
T.	<u>GPCD:</u>	Gallons per capita per day
U.	<u>HGI:</u>	Hydromechanical grease interceptor
V.	<u>ID:</u>	Inside Diameter

W.	<u>IPC:</u>	International Plumbing Code
X.	<u>L:</u>	Liter
Y.	<u>MG:</u>	Milligrams
Z.	<u>MG/L:</u>	Milligrams per liter
AA.	<u>MH:</u>	Manhole
BB.	<u>NCPS:</u>	National Categorical Pretreatment Standards
CC.	<u>NPDES:</u>	National Pollutant Discharge Elimination System
DD.	<u>O&M:</u>	Operation and maintenance
EE.	<u>OD:</u>	Outside Diameter
FF.	<u>OSHA:</u>	Occupational Safety And Health Administration
GG.	<u>PL:</u>	Property Line
HH.	<u>POTW:</u>	Publicly owned treatment works
II.	<u>PUD/PBG:</u>	Planned Unit Development/Planned Building Group
JJ.	<u>PVC:</u>	Polyvinyl Chloride
KK.	<u>SC:</u>	Surcharge
LL.	<u>SIC:</u>	Standard industrial classification
MM.	<u>SWDA:</u>	Solid Waste Disposal Act, 42 USC 6901 et seq.
NN.	<u>TSS:</u>	Total Suspended solids
OO.	<u>UPC:</u>	Uniform Plumbing Code
PP.	<u>USC:</u>	United States Code
QQ.	<u>WGI:</u>	Waste grease bin

CHAPTER 1



SANITARY SEWER SYSTEM ADMINISTRATIVE STANDARDS

A.1 SANITARY SEWER SYSTEM PLAN SUBMITTAL PROCEDURES AND GENERAL REQUIREMENTS

All plans for sewer main extensions, improvements and modifications shall be submitted to the Southwest Metropolitan Water and Sanitation District for review and approval before any construction may occur. All plans must be approved by the District manager, District engineer, and the City of Littleton prior to initiation of construction. Plans shall be submitted and reviewed in accordance with the following procedures and requirements.

A.1.1 Submittals

In order to initiate construction plan review the following items must be submitted to the District.

1. Construction Plans

Three sets of sanitary sewer system construction plans stamped and signed by a professional engineer licensed to practice in the State of Colorado. All plans and specifications submitted shall be in strict compliance with the Standards and Specifications contained herein and shall meet any special conditions that may be reasonably required. The design and installation of all facilities shall ensure development of an integrated sewer system. No work shall commence on any facilities until the plans and specifications are approved in writing by Southwest Metropolitan Water and Sanitation District and the City of Littleton. Plans and specifications should not be submitted for work that will not be installed within six months of the approval date.

- a. Three sets of detailed plans and specifications for system extensions shall be submitted to the District for approval. The copies shall meet the requirements stated below:
 1. Cover sheet containing the following information:
 - a. Vicinity map.
 - b. Index of drawings.
 - c. List of quantities of facilities to be installed.
 - d. List of agencies including contact name, firm name and telephone number for surveyor, soils engineer, design engineer, District engineer, District representative, City of Littleton and other permit agencies.
 - e. General notes (see Chapter 5, Exhibit E).

2. Sanitary sewer main in plan view (24" x 36") showing:
 - a. Location and dimensions of dedicated streets, easements and rights-of-way including street names.
 - b. Lots to be served, including lot and block numbers.
 - c. All existing or proposed curb and gutter.
 - d. The proposed alignment of the sanitary sewer main and the location of all proposed sanitary sewer facilities such as manholes.
 - e. A profile of all proposed sanitary sewer mains, existing ground elevations and proposed ground elevations.
 - f. All existing or proposed utilities, including water mains and appurtenances and storm sewers.
 - g. All existing or proposed obstructions such as vaults, catch basins, traffic islands etc.
 - h. Title block on each sheet.
 - i. Bench mark including U.S.G.S. datum, location, elevation, and monument type.
 - j. Match lines and sheet references called out in plan and profile.
 - k. Center line of drainage channels.
 - l. 100 year flood plain boundaries.
 - m. Detention pond boundaries and elevations (topography).
3. Typical street cross-sections showing:
 - a. Property lines or easement lines.
 - b. Street curb and gutter, and existing or proposed utilities complete with dimensions to the property lines or easement lines.
4. Centerline profile of the streets showing:
 - a. Official street grades and horizontal curve data.

- b. Existing ground line and proposed ground line.
 - c. Any proposed or existing utility crossing the proposed sanitary sewer main.
 - d. Street cross-pans and traffic island.
5. A detail sheet showing all relevant detail drawings such as: manholes, tapping details, manhole bases, ring and covers, etc.
6. Additionally, all plans shall:
 - a. Be made from actual field surveys by a land surveyor registered in the State of Colorado, referenced to land corners or other official survey control points and be of sufficient accuracy so that the facilities can be accurately staked for installation and can be readily located after installation for maintenance, tapping and control.
 - b. Show sufficient adjacent area to identify the relationship between proposed new facilities and existing facilities.
 - c. Contain the signature and stamp of the Professional Engineer registered in the State of Colorado responsible for the design of the system extension.
7. The Specifications shall:
 - a. State that the trench shall be excavated and the pipe exposed for inspection at any location on the project if so ordered by the District.
 - b. State that all sewer mains shall be observed by the District and that the sewer testing shall be observed and approved by the District.
8. Submittals for planned development complexes shall additionally show all existing and proposed structures, driveways, and parking facilities, on the combined utility plan.

2. Applications and Agreements for Sewer Main Extensions

Four copies of the District's Application and Agreement for Sewer Main Extensions. All copies must be signed as originals by individuals authorized to sign on behalf of

the Applicant. See Exhibit F in Chapter 5 for a copy of the District's Application and Agreement for Sewer Main Extensions.

3. Agreement for Installation of Underdrain

Two signed copies of the District's standard Underdrain Agreement if an underdrain pipe is proposed to be installed within the sanitary sewer trench. See Exhibit D in Chapter 5 for a copy of the Underdrain Agreement.

4. Payment of Plan Review and Construction Inspection Fees

Payment of applicable District plan review and construction observation fees. A fee schedule is available from the District upon request. Fees are subject to change without notice.

5. Subdivision Plat

One sepia mylar of the recorded subdivision plat. If the plat has not been recorded, two blue line copies of the most current preliminary plat shall be submitted. A sepia mylar of the recorded plat must be furnished as soon as it becomes available.

6. Easement Checklist

Two copies of the District's easement checklist together with all supplemental information specified in Section A.2. This information is required for all facilities to be constructed outside of dedicated public rights of way.

7. Geotechnical Information

A geotechnical report is required to be submitted with the construction plans. The report will also include a Utility Section that identifies geologic hazards and recommendations for over excavation and suitable backfill materials for these areas.

8. County Approvals

A written statement from a representative of the appropriate county planning department stating that none of the proposed facilities lie within or impact a Flood Plain Overlay Zone or Geo-Hazard Area. In the event facilities do lie within, or impact, a Flood Plain Overlay Zone District or Geo-Hazard Area, proof that the Applicant has applied for a Flood Plain Development Permit or Geo-Hazard Development Permit will be required. In addition, the Applicant must furnish a statement from the appropriate county approving the design of the facilities impacting the Flood Plain or Geo-Hazard Area.

A.1.2 Engineering

All plans and specifications submitted to the District for review, comment, and approval of a sanitary sewer system extension or modification shall be prepared by, or under the direct supervision of a professional engineer registered by the State of Colorado. Said professional engineer shall be responsible for preparation of the design plans, determining the material specifications and conducting the field survey. All submitted plans specifications feasibility and sanitary studies, shall include the professional engineer's seal prior to approval for construction.

All sanitary sewer line design and construction shall adhere to the latest version of Southwest Metropolitan Water and Sanitation District Sanitary Sewer System Standards and Specifications, City of Littleton and City and County of Denver Department of Public Works:

1. Sanitary Sewer Design Technical Criteria Manual
2. Sanitary Sewer Construction Details and Technical Specifications

Southwest Metropolitan details apply in all circumstances. (Unless noted otherwise.)

The applicant, contractor, and professional engineer associated with said plans shall be responsible for the adequacy and satisfactory performance of the designs and the installation of all items therein, and any failure or unsatisfactory performance of the system, so constructed, shall not be a cause for action against the District. The District does not perform engineering services for any person or entity in connection with its review of plans. Approval of plans by the District signifies only that the plans meet the minimum requirements of these Standards and Specifications based upon the information provided to the District by the professional engineer and/or owner/developer and makes no finding, representation, or warranty that the system and associated components will perform any certain function.

If the professional engineer responsible for the plans disagrees with any changes made to the submitted plans that may be required by the District as a result of the District's review of the plans, such disagreement must be brought to the attention of the District for resolution prior to construction of the project set forth in said plans. The seal of the professional engineer on plans so corrected and approved for construction will signify that he has reviewed, approved and authorized said corrected plans for construction.

A.1.3 Surveying

Line and grade for sewer mains shall be established by a professional engineer or by a surveyor licensed to practice in the State of Colorado or his authorized representative. All work shall be done in workmanlike manner.

Correct alignment and elevation of the sewer mains as shown on the approved drawings is the responsibility of the professional engineer. Observation of the staked alignment

and elevations by the District does not relieve the professional engineer in any manner from the responsibility for field errors. Sufficient pipe shall be staked to ensure continual work progress. No pipe shall be installed without line and grade stakes set by the professional engineer or land surveyor.

A.1.4 Plan Review Process

Upon receipt of all information described under section A.1.1, the District will initiate review of the construction plans and other pertinent information. The plans will be reviewed by the District and the District engineer. If modifications to the plans are required, the plans will be returned to the design engineer for revision.

Upon approval of the plans by the District, they will be submitted to the City of Littleton for review and approval. If further modifications are required, the plans will be returned by City of Littleton to the District for return to the design engineer. When revised, the plans must be returned to the District for review prior to re-submittal to the City of Littleton.

NOTE: The approval of sanitary sewer system construction plans signifies only that the plans meet the minimum requirements of the District's Standards and Specifications based on the information provided by the design engineer, Applicant, and contractor. Approval is not a representation or warranty that the system and associated components will perform any certain function.

Approved plans will be stamped with the District stamp and signed by the District manager or his authorized representative and District engineer.

A.1.5 Expiration of Plan Approval

Plans and specifications are approved for a six month period only. If construction has not begun within this six month period, or if it has been halted and not restarted prior to expiration of the approval period, the plans must be resubmitted for review and approval.

A.1.6 Preconstruction Meeting

When construction plans and all other pertinent information has been approved by the District and City of Littleton, the approved plans will be retained by the District until a preconstruction meeting is held. The preconstruction meeting will be scheduled by the District upon request of the contractor, design engineer, or Applicant.

Representatives of the Applicant, contractor, design engineer, District, and/or District engineer must be in attendance at the preconstruction meeting.

A.1.7 Authorization to Proceed

Upon approval of plans by the District and the City of Littleton, payment of applicable District construction inspection fees, and completion of the preconstruction meeting.

A copy of the construction plan review and construction inspection fee schedule is available upon request. Fees are subject to change without notice.

A.2 EASEMENTS

A.2.1 General

The following procedures have been developed to provide guidelines for the timely submittal and processing of easements granted to the District and licenses granted by the District. The guidelines are designed to provide the District with accurate and uniform drawings, legal descriptions, ownership and title information and specifications. Submittals that do not follow these procedures and required submittals will not be considered.

All information referenced in the submittal section of these procedures must be presented to, and processed by the District prior to approval of construction plans. Submittals must be accompanied by the District's Easement Preparation and Submittal Procedures Checklist (Chapter 4, Exhibit A).

A.2.2 Granting an Easement to the District

When an Applicant or property owner is required to grant permanent easements to the District for the installation of water mains, the following procedures shall be followed:

A. Procedure: The following items shall be submitted in one complete package to the District with the initial submittal of sanitary sewer construction plans as described in Section A.1.1.

Partial submittals or those not conforming to these requirements will be returned to the submitting party with a request to complete the submittal. Construction plans will not be approved until all items have been received and processed.

1. The District's Easement Preparation and Submittal Procedures Checklist identifying the full and legal name of the property owner granting the easement and the names and titles of the persons authorized to sign the easement agreement and those who will attest the authorized signer, if applicable.
2. A metes and bounds legal description of the proposed easement parcel prepared and stamped by a registered Colorado land surveyor. The legal description must meet the following conditions.
 - a. Tie: All parcels shall have a direct tie, or one with a maximum of two courses, to the nearest available recognized land corner (i.e., section corner, quarter section corner, range point). If the easement is located within a plotted subdivision, a tie shall be made to a lot corner, tract corner, or subdivision corner of that subdivision.

- b. All distances referenced in the legal description shall be to the nearest hundredth of a foot.
3. A survey drawing of the easement legal description stamped by a land surveyor registered in the State of Colorado. The drawing must meet the following requirements.

Drawings that do not comply with these requirements are not acceptable.

- a. Size: Overall 8½ x 11 inches as shown on Drawing Detail of the Sanitary Sewer Detail Drawings (Chapter 3).
- b. Title Block: Dimensions and lettering as shown on Drawing Detail of the Sanitary Sewer Detail Drawings (Chapter 3). The initials of the person who prepared the drawing shall be entered in the area marked “DRN.”
- c. Scale: The drawing shall be to an appropriate recognized civil engineering scale. The scale used shall be large enough so that all dimensions are clearly shown. Whenever possible, the entire easement should be on one sheet. Break lines, except in the land corner, ties, are not acceptable.
- d. Tie: All parcels shall have a direct tie, or one with a maximum of two courses, to the nearest available recognized land corner (i.e., section corner, quarter section corner, range point). If the easement is located within a platted subdivision, a tie shall be made to a lot corner, tract corner, or subdivision corner of that subdivision.

Basis of bearings shall be established using NAD83 State Plane Coordinates, with the State Plane Coordinate information clearly identified on the AutoCAD drawing.

- e. All distances shown on the drawing shall be to the nearest hundredth of a foot.
 - f. A description of the monuments set at the ends of the line, which is the basis of the bearing, shall be supplied in the drawing or the bearing basis note.
4. A Commitment for Title Insurance covering the sanitary sewer line easement indicating the “Southwest Metropolitan Water and Sanitation District” as the proposed insured shall be submitted. The following items shall be included:

- a. Legible copies of all documents referred to in the B-2 (Exceptions) portion of the Commitment for Title Insurance. Documents must be submitted in the order identified on the title commitment. Documents shall be numbered to coincide with the number indicated on the title commitment.
 - b. A drawing or map depicting the sanitary sewer line easement and all of the exceptions that can be plotted. Exceptions on the drawing or map shall be numbered correlative to the number of the exception on the Commitment for Title Insurance.
 - c. The District will determine the amount of title insurance to be acquired. All expenses incurred in obtaining title insurance shall be paid by the grantor of the easement.
5. A copy of an overall site plan, which accurately shows the relationship of the following:
- a. The proposed sanitary sewer main, easement, and dedicated rights-of-way.
 - b. All existing and proposed utilities on the site.
 - c. Proposed structures, landscaping, and roadways on the site.
 - d. Cross-sections of private roadways which are coincidental with sanitary sewer line easements and cross sections of public rights-of-way within which a sanitary sewer main is to be installed.
 - e. The perimeter distances and bearings or angles of the site and its relationship to the tie corner of the easement.
6. A copy of a recorded or preliminary subdivision plat or development plan for the area or subdivision within which the sanitary sewer line easement is located, or any subdivision plat or a Planned Unit Development plan that directly relates to the easement(s) and depicts property boundaries.

B. Document Preparation: The District will prepare the easement agreement on a standard District form and return the document to the grantor for signatures.

C. Construction: The construction of the sanitary sewer main shall not be authorized to commence until the easement is accepted by the District and the easement agreement has been recorded.

A.2.3 Obtaining a License to Use or Cross District Property or District Easements

When requesting permission to use or cross District property, an Applicant shall request a revocable license for routine right angle utility crossings of strip properties and easements, or for temporary uses. The following procedures shall be followed:

A. Procedure: A letter requesting the District's permission to use or cross its property shall be submitted to the District. The letter of request shall contain the exact name of the company, corporation, partnership, etc., that will own, operate, and maintain the proposed facilities, the names and titles of the persons authorized to sign the agreement, and include the following enclosures:

1. A legal description and survey drawing meeting the following requirements. Drawings that do not comply with these requirements are not acceptable:
 - a. Size: Overall 8½ x 11 inches as shown on Drawing Detail of the Sanitary Sewer Detail Drawings (Chapter 3).
 - b. Title Block: Dimensions and lettering as shown on Drawing Detail of the Sanitary Sewer Detail Drawings (Chapter 3). The initials of the person who prepared the drawing shall be entered in the area marked "DRN."
 - c. Scale: The drawings shall be to an appropriate recognized engineering scale. The scale used must be large enough so that all dimensions are clearly shown. Whenever possible, the entire crossing should be on one drawing. Break lines, except in the land corner ties are not acceptable.
 - d. Tie: All crossings shall have a direct tie, or one with a maximum of two courses, to the nearest available recognized land corner (i.e., section corner, quarter section corner, range point, or the nearest available intersection of two dedicated public road right-of-way lines).

Basis of bearings shall be established using NAD83 State Plane Coordinates, with the State Plane Coordinate information clearly identified on the drawing.
 - e. All distances shown on the drawing shall be to the nearest hundredth of a foot.
 - f. All drawings shall have a typical profile of the crossing as shown on the specimens.
2. A check payable to Southwest Metropolitan Water and Sanitation District for the applicable license preparation fee shall accompany the letter of request. If the request for the License Agreement, after the District's review, is denied,

one-half of the applicable, then-current licensing fee will be returned. The remaining half will be retained to cover associated review and administrative costs.

3. Requests should include prints of the plans of the overall job in the area of the crossing, when available, and prints of new or proposed subdivisions whenever this information would clarify or identify the location of the request.

B. Document Preparation: The District will prepare the License Agreement on a standard District License Agreement form and return the document to the Licensee for signatures. A copy of the completed Licensed Agreement shall be kept at the job site at all times.

A.3 SANITARY SEWER SYSTEM CONSTRUCTION PROCEDURES AND GENERAL REQUIREMENTS

Construction may commence pending approval of sanitary sewer system construction plans and completion of the preconstruction meeting. The District requires a minimum of 48 hours notice prior to initiation of construction.

A.3.1 Preconstruction Meeting Minutes

Minutes of the preconstruction meeting will be sent to all parties in attendance and other interested parties. The Applicant shall ensure compliance with all provisions and requirements stipulated in the minutes. Any questions or disagreements with the minutes must be brought to the attention of the District inspector in writing. The terms and conditions outlined in the preconstruction meeting minutes will be final unless modified in writing by the District.

A.3.2 Placing Survey Line

Hubs, stakes, or appropriate approved survey control markers shall be set on an offset line to mark the location of the centerline of the sewer main. Centerline hubs and stakes may be used in addition to the offset hubs and stakes; however, they may not be set in place of the offset hubs and stakes. Normal practice is to set the offset hubs and stakes 5 to 10 feet off the centerline of the sewer main.

Survey points shall be set a maximum distance of 100 feet apart. All manholes must be staked for location and grade. All stakes shall be flagged to increase their visibility.

Stakes shall be positioned so that the survey hub is between the stake and the sewer main. The side of the stake facing the sewer main shall be marked to show the point being referenced and the distance from the hub to the centerline of the sewer main. The back side of the stake shall be stationered. Grade stakes shall be set at each hub and shall state the vertical distance from the top of the hub to the top of the pipe.

A.3.3 Observations

Installation of all new sanitary sewer facilities within the District shall be observed by the District .

Problems which may require sound field judgment, in lieu of strict interpretation of the specifications, shall be resolved by the Design Engineer and the Contractor to the satisfaction of the District.

All appropriate permits shall be on the job-site and shall be available for inspection by the District inspector before starting and during construction.

The District shall not supervise nor set out work or give line and grade stakes.

All materials used shall be subject to the inspection and acceptance of the District at all times. Failure or neglect on the part of the District to condemn or reject work materials not in accordance with these Standards and Specifications shall not be construed to imply acceptance should their inferiority become evident at any time.

After receipt of approved plans from the District, the contractor shall give **at least 48 hours** notice to the District prior to starting construction.

During construction, no work is allowed to be backfilled, including bedding material above the spring line of the pipe, until the construction has been observed and accepted by the District Observer.

Observation should in no way be considered a guarantee of the contractor's work. Construction observation does not relieve the contractor of his obligation to construct facilities in accordance with these Standards and Specifications, and the approved construction plans.

The Applicant is responsible for reimbursement of all costs related to the District's construction observation..

If construction work is halted for more than three (3) workings days, 24 hour notice must be given to the District prior to restarting construction.

A.3.4 Contractors

The District reserves the right to pre-qualify all contractors working on facilities owned by the District of facilities that are to be conveyed to the District.

No work shall commence until a preconstruction meeting has been conducted and the contractor has an approved set of plans and specifications in his possession. All work shall be performed in strict compliance with the approved plans and specifications and shall be inspected by the District. Any modifications, field changes, etc., to the approved plans must be approved by the District prior to proceeding with the work.

Contractors performing all work for both main extensions and private pipe extensions shall be competent, licensed firms with adequate manpower and equipment to accomplish the work in accordance with these specifications. A representative of the contractor shall be present at the job-site whenever work is being conducted by subcontractors.

If construction work is halted for more than three (3) working days, 24 hours notice must be given to the District's inspector prior to restarting construction. This requirement may be waived at the discretion of the District inspector.

A.3.5 Phasing of Construction

Unless designated on the approved construction plans or approved in the preconstruction meeting minutes, phasing of a construction project will generally not be allowed. A desire to obtain acceptance and release for sewer taps on only a portion of a construction project designated on the approved plans requires the written approval of the District. A request for said approval must be submitted in writing and should include a description and drawing of the exact limits of the phased construction.

A.3.6 Acceptance of Construction

Applicants are cautioned that all construction is undertaken at their risk. Approval of construction plans does not constitute a guarantee that construction will be accepted nor a guarantee that facilities will be conveyed to the District. Nor does approval of construction plans and inspection of construction guarantee that a project will meet any intended purposes or obligations.

Only acceptance of construction and initiation of probationary maintenance as designated by the District's execution of the Application and Agreement for Sewer Main Extensions shall constitute acceptance by the District of the constructed facilities.

A.4 SANITARY SEWER SYSTEM CONSTRUCTION ACCEPTANCE PROCEDURES AND GENERAL REQUIREMENTS

Pending completion of construction, the District will accept the facilities for probationary maintenance in accordance with the following procedures and requirements.

A.4.1 Conditions for Acceptance of Construction

The following conditions must be met and information submitted and approved by the District prior to approval of construction and release of any sewer main for service.

1. The sewer main(s) and all appurtenances have been installed to the satisfaction of the District Observer, all notes and field measurements have been made, and two full size blue line prints and two full size reproducible mylar prints of the as-built drawings have been supplied to, and approved by, the District .
2. The sewer mains have been successfully tested to the requirements designated in the technical specification section of this publication.
3. All compaction test results required by the District have been submitted and accepted.
4. All easements have been accepted and recorded by the District.
5. The Applicant has submitted a letter to the District documenting the construction costs for the project.
6. The District's Easement Certification form including drawings identifying the "as constructed" location of sewer mains and appurtenances within the boundaries of recorded easements has been submitted and accepted by the District inspector. Certification drawings must be signed and stamped by a registered Land surveyor licensed to practice in the State of Colorado. The drawings are in addition to the full size "record drawing" drawings described in paragraph 1 above.

Examples of easement certification submittals are available upon request.

7. One full size bond copy, and PDF of the recorded subdivision plat has been provided.
8. All plan review and construction observation fees have been paid.
9. A maintenance bond or letter of credit as specified in the Application and Agreement for Sewer Main Extensions has been submitted to, and approved by, the District.

10. A recorded copy of the subdivision's homeowners association covenants and/or bylaws have been submitted to the District (if applicable).
11. The Applications and Agreements for Sewer Main Extensions have been signed by the District manager for construction approval and initiation of probationary maintenance.

A.4.2 Execution of Application and Agreement for Sanitary Sewer Main Extensions

Upon District approval of all items listed in section A.4.1 above, the Applications and Agreements for Sewer Main Extensions will be dated and signed by the District manager. Execution of the Applications shall constitute District acceptance of the facilities for probationary maintenance and initiation of the warranty period.

The probationary maintenance and warranty period shall be as designated in the Applications and Agreements for Sewer Main Extensions. The Applicant guarantees all facilities against failure for a minimum period of two years from the date of acceptance. In addition, the condition of all manholes and other appurtenances remains the Applicant's responsibility until streets are paved and all facilities inspected and accepted by the District.

A.4.3 Maintenance During Warranty

Maintenance performed by the District during the warranty period consists of observation and routine maintenance of the facilities. All remedial repairs and non-routine maintenance remains the responsibility of the Applicant. Failure of the Applicant to have all repairs carried out when requested by the District shall result in the District conducting the repairs at the Applicant's expense.

A.4.4 Issuance of Sewer Taps Permits

No sewer tap permits shall be issued nor sewer taps allowed until the Applications and Agreements for Sewer Main Extensions have been executed for acceptance of construction.

A.4.5 Final Acceptance

Final acceptance and conveyance of the facilities to Southwest Metropolitan shall occur as specified in the Applications and Agreements for Sewer Main Extensions, but no sooner than two year after probationary acceptance or after street paving, whichever is later. Final acceptance shall be subject to re-observation of all facilities by the District and correction of any deficiencies by the Applicant.

After proper notice, failure of the Applicant to correct deficiencies found during final observations shall be cause for the District to correct the deficiencies at Applicant's expense.

A.5 RESPONSIBILITY OF THE APPLICANT, DESIGN ENGINEER, AND CONTRACTOR

The following summarizes the responsibilities of the Applicant, design engineer and contractor.

A.5.1 Responsibility for Design

The Applicant is responsible for ensuring that the sanitary sewer construction plans are designed to accommodate the sewer service requirements of the planned development. The District reviews construction plans in order to promote compliance with the minimum standards of the District and does not guarantee the adequacy of the plans to perform any certain function nor to protect against any specific condition applicable to the proposed construction site.

The District is not performing engineering services for the Applicant. It is the responsibility of the Applicant, his engineer and contractor to prepare the design and plans, determine the material specifications and soil conditions, and construct the project in accordance with the specifications of the Southwest Metropolitan Water and Sanitation District and City of Littleton.

A.5.2 Preconstruction Meeting

The contractor shall be responsible for arranging a preconstruction meeting prior to the start of any construction. Representatives of the District, District engineer, Applicant, design engineer, and contractor must be represented at this meeting.

A.5.3 Notice of Initiation of Construction

The contractor is responsible for notifying the District at least 48 hours prior to the start of any construction. If work is suspended for any period of time after initial start-up, the contractor must notify the District 24 hours prior to re-starting construction, unless waived by the District .

A.5.4 Construction in Accordance with Approved Plans

The contractor is responsible for performing construction in accordance with District standards and specifications and the construction plans approved by the District. The contractor must notify the District of any modifications to the approved plans prior to accomplishing construction contemplated by the modifications. Failure of the District to approve proposed changes in writing will require that construction be completed in accordance with the approved plans.

A.5.5 Verifying Location of Existing Facilities

At all points of connection of new sanitary sewer mains to existing District facilities, the contractor will be responsible for excavating and verifying the location of such facilities prior to the installation of new facilities.

A.5.6 Termination of Service and Submittal of Plan for Bypass Pumping

If it is necessary to shut down any portion of the existing sewer system and thereby terminate service to existing customers, the contractor must notify the District at least 48 hours prior to the need to terminate service and submit a plan for bypass pumping to avoid a disruption in service to District customers. The contractor shall be fully responsible for carrying out all bypass pumping measures prescribed by the District.

A.5.7. Observations

No pipe or appurtenance shall be backfilled, nor covered with bedding material, above the spring line of the pipe prior to observation and acceptance by the District. It is the sole responsibility of the contractor to ensure that all construction is observed before backfilling. Any pipe covered prior to observation and acceptance shall be excavated by the contractor to allow for observation. This shall be accomplished at no expense to the District.

A.5.8 Repairs During Warranty Period

The Applicant shall be responsible for providing repair services to all portions of the construction project during the warranty period. The District reserves the right to perform any cleaning, repairs, or other maintenance, during the warranty period at the expense of the Applicant.

The Applicant shall be responsible for the correct alignment and cleanliness of all sewer pipe and manholes during the warranty period or until the street is paved, whichever is longer. Written notification of deficiencies discovered during this period will be provided by the District. If the deficiencies are not corrected during the prescribed time limits, the corrections shall be completed by the District at the expense of the Applicant.

A.5.9 Payment of Plan Review and Construction Inspection Fees

The Applicant is responsible for payment of all fees associated with the District's and City of Littleton's plan review and construction observation services prior to commencement of construction plan review. Fee schedules are available from the District upon request. Fees are subject to change without notice.

A.5.10 Variance to District Specifications

The Applicant may request a variance to materials specifications in writing. Such requests will be reviewed by the District Engineer and the District Representative on a case by case manner.

A.6 RELOCATION OF DISTRICT FACILITIES

The following provisions shall apply to requests to relocate existing District facilities.

A.6.1 Responsibility for Relocation Costs.

The cost to relocate any existing District owned facility or facilities shall be the responsibility of, and paid by, the entity engaging in the activity that necessitates the relocation, including, but not limited to, any county, city, town, special district, regulated public entity or private party.

A.6.2 Definition.

“Cost of relocation” includes all costs and expenses properly attributable to the requested relocation, including, but not limited to, costs for survey, right-of-way acquisition, design engineering, observation, materials, construction, permits and licenses, transportation, administrative overhead, and any reasonable costs necessarily incurred to modify or repair any other District facility where such repair or modification is made necessary by the relocation.

A.6.3 Increased Capacity.

Nothing herein contained shall prevent the District from requiring an increase in the capacity of or the over-sizing of the relocated facility; provided, however, that should the same occur, the District will be responsible for paying that share of the relocation cost attributable to said increase in capacity or over-sizing.

A.6.4 Performance of the Work.

The District shall have the right to design and construct, or cause to be designed and constructed, the facility or facilities to be relocated, all costs to be paid by the party requesting relocation in accordance with this policy statement. The District, at its option, may allow the party requesting relocation to design and construct the relocation of any District facility, provided the same is done pursuant to a written agreement entered into between the District and the relocating party, which is approved by the District’s Board of Directors, and which allocates the cost of relocation in accordance with this policy statement.

A.6.5 Determination of the Extent and Necessity for Relocation.

In all cases, the necessity and extent of any relocation of District facilities shall be made by the District.

A.6.6 Policy Considerations.

The allocation of relocation costs is intended to be fair and equitable to all parties and promote sound public policy by distributing said costs to the beneficiaries of the new project rather than adding them to the costs previously assumed by the District's taxpayers and customers. In addition, by imposing relocation costs upon the entity that seeks to disturb the status quo, the District seeks to:

1. Deter over-zealous and needless project planning by creating an economic incentive to avoid unnecessary utility relocations;
2. Recognize and promote the District's legitimate monetary and budgetary expectations with regard to the construction of its facilities and the useful life thereof;
3. Recognize the physical, legal and practical limitations and constraints on the District to defray the cost of relocations required by other entities; and
4. Reduce waste and the allocation of scarce resources.

A.6.7 Procedure for Requesting Relocation.

The following procedures shall apply to all requests to relocate sanitary sewer mains and appurtenances owned by the Southwest Metropolitan Water and Sanitation District. In all cases the necessity and extent of the relocation of facilities shall be determined by the District.

1. A written request for relocation of a District owned sanitary sewer main or appurtenance shall be submitted to the District manager. The letter shall contain at least the following information.
 - a. Name, address, telephone number and contact person for the party requesting relocation.
 - b. Description of facility to be relocated.
 - c. Location of existing facility.
 - d. Proposed location and description of relocated facility, if known.
 - e. Reason for proposing relocation.
 - f. Requested time schedule for accomplishing the relocation.

- g. Ownership of property where existing facility is located and ownership of property proposed for the relocated facility.
 - h. Disposition of existing facility (abandoned in place or removed).
2. If the District determines that it may be possible to accommodate the relocation request a meeting will be scheduled between the District and the requesting party to discuss specific details regarding the proposed relocation.
 3. Following the meeting between the requesting party and District representatives, the District will decide at its sole discretion whether it is in the best interest of the District to design and relocate the facility or if the party requesting relocation will be allowed to design and relocate the facility. However, regardless of who designs and relocates District facilities, all costs associated with the relocation including, but not limited to, administrative, engineering, legal, construction materials, and labor costs shall be the responsibility of the party requesting said relocation.
 4. At the discretion of the District a Utility Relocation Agreement defining the rights, duties, and obligations of the District and the party requesting relocation shall be prepared by the District's attorney.
 5. The relocation will proceed in accordance with the Utility Relocation Agreement.

CHAPTER 2



SANITARY SEWER SYSTEM TECHNICAL STANDARDS AND SPECIFICATIONS

T.1 SANITARY SEWER SYSTEM DESIGN AND LAYOUT

T.1.1 Size and Slope of Sewer Mains and Appurtenances

All public sanitary sewer mains shall be a minimum of eight inches (8”) in diameter. Sizing shall be determined by the design engineer and approved by the District Engineer and the City of Littleton. The sewer’s hydraulic capacity shall be such that the sewer is flowing at no more the 50% of the full depth at the calculated future peak flow rate. All sewer mains shall be sized large enough to provide for all wastewater flows from all areas specified by the District. The District reserves the right to size sewer mains to provide service for future needs.

In addition to the City and County of Denver Department of Public Works Sanitary Sewer Design and Technical Criteria Manual for Sanitary Sewer Study Requirements, latest revision, flow monitoring may be required to establish the proper sizing for outfall lines.

Where conditions require a heavier strength pipe, it shall be designed on a case to case basis by the applicant engineer.

The minimum and maximum slopes for sanitary sewer mains shall be as specified in Table I below. The slope between manholes must be uniform.

<u>Size of Sewer (Inches)</u>	<u>Minimum Slope Feet per Hundred</u>	<u>Maximum Slope Feet per Hundred</u>
4	2.0	25.0
6	0.6	20.0
8	0.6	15.0
10	0.35	12.0
12	0.30	11.0
15	0.25	8.5
18	0.15	6.5
21	0.10	2.0

NOTE: Where it is necessary to design or install sewers with greater slope than the maximum indicated in Table I, special provisions shall be made to protect against pipe displacement and erosion. Prior approval must be obtained from the District engineer in any case involving such slopes. Larger sizes require approval of the District Engineer.

Manholes shall be a minimum of 48-inches in diameter for sewer mains. See the following information:

Manhole ID = 4' For sewer main diameters < 15"

Manhole ID = 5' For sewer main diameters 15"-36"

Manhole ID = 6' For sewer main diameters 42"-48"

Whenever more than a two-way manhole of maximum pipe is required, the manhole shall be increased to the larger diameter size.

See Drawing Details for additional information.

Sanitary sewers that are designed to carry an average design flow less than 0.10 CFS shall not be installed at a slope of less than .80%.

T.1.2 Layout of the Sanitary Sewer Collection System

A. General:

All District sanitary sewer mains shall be installed in dedicated city or county rights of way or within easements granted to the District. The minimum width of such rights of way or easements shall be 30 feet. Rights of way greater than 30 feet width may be required when, in the sole opinion of the District, such additional width rights of way are needed for the installation, maintenance, repair or rehabilitation of the sewer mains.

B. Alignment:

Generally, sanitary sewer mains shall be installed on the south or west side of the right of way five to ten feet from centerline. In all cases where sewer mains are installed within public or private roadways, the mains shall be installed between the limits of the curb and gutter pan, roadside drainage ways, or other roadway limits except as specifically authorized by the District.

Sewer mains and manholes shall not be installed closer than three feet (3') clear to the lip of a concrete curb and/or gutter.

Curvilinear sewers are not permitted.

Manholes shall be installed at all changes in grade and alignment. The distance between manholes shall not exceed 400 feet.

C. Sewer Services:

Sewer services shall be located a minimum of ten feet (10') from water service pipes and will generally be located on the downhill side of the water service.

Sewer services shall be installed in a continuous straight line perpendicular to the sewer main and shall cross the property line a minimum distance of five feet (5') from the nearest lot corner. The sewer main to be tapped must extend a minimum distance of fifteen feet (15') along the front lot line of the property to be served.

For lots at the terminus of cul-de-sac streets, the sewer service pipe between the sewer main and the property line shall be in a continuous straight line and shall enter the property a minimum distance of five feet (5') from the nearest lot corner.

The minimum distance between sewer service taps shall be three feet (3'). The minimum distance from either direction from the start of the bell shall be three feet (3'). The minimum distance from the outside edge of a manhole to a service tap shall be three feet (3') or to the start of WYE. A maximum of four (4) sewer taps shall be allowed per 20-feet (20') length of sanitary sewer pipe.

Generally, a 4" sewer services will not be allowed to connect to manholes. At a Cul-de-Sac, sanitary sewer services shall connect to the main down stream of a end manhole.

Sewer service connections shall be a minimum of 4-inches (4") in diameter.

6" AND 8" Sanitary Sewer Service will require a manhole for the connection to a main.

The sewer service pipe and fittings (wye or tapping saddle) through which a property receives sewer service from the facilities of the District shall be owned, installed, and maintained at the expense of the property owner. The property owner shall maintain all privately owned piping, including the sanitary sewer service pipe and all fittings.

New sanitary sewer service shall be electronically located in accordance with Colorado Revised Statue, CRS 9-1.0-102 and 103, a 10 GA trace wire, UF rated shall be used from the connection point at the existing main to a test station box where the service enters the building.

T.2 SANITARY SEWER SYSTEM MATERIALS

T.2.1 Materials and Testing

All sanitary sewer system materials furnished shall be new and undamaged. Everything necessary to complete installations in accordance with the Standards and Specifications of the District shall be furnished and installed whether shown on approved drawings or not; and installations shall be completed as fully operable, functioning parts of the District's sanitary sewer system.

Where sewer mains are extended by Applicants, it shall be their responsibility to provide all materials necessary for the installation. No materials will be supplied to the Applicant by the District.

Acceptance of materials, or the waiving of observation thereof, shall in no way relieve the Applicant of the responsibility for furnishing materials meeting the requirements of the District.

New sewer industry products or materials will be tested if it is the opinion of the District engineer that the product or material has some merit. The District will establish the criteria for testing and evaluating the product. The District reserves the right to accept or reject any product or material regardless of the test results.

T.2.2 Size of Sewer Mains

The size of mains shall be in accordance with T.1.1.

A. (PVC) Pipe

1 Material - All pipe shall be polyvinyl chloride (PVC) and shall meet the requirements of ASTM D1784 "Rigid Polyvinyl Chloride and Chlorinated Polyvinyl Chloride Compounds" and ASTM D3034 SDR 35, "Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings" latest revision. Where conditions require heavier strength pipe it shall meet the requirements of the ASTM D3034 SDR26 or AWWA Standard C-900-07 "Polyvinyl Chloride (PVC) Pressure Pipe, for Water Class 235". The pipe shall be green in color. Suitable bedding shall be specified by the Design Engineer. Pipe and fitting markings shall include the appropriate ASTM and cell classification number (12454-B or 12454-C or other approved classifications). Pipe and fittings not so marked will be rejected.

2 Straightness - Maximum allowable ordinate as measured from the concave side of the pipe shall not exceed 1/16" per foot of length.

3 Internal Diameter - Pipe shall be so constructed that the initial internal vertical diameter does not decrease by more than 5 percent in order to provide the complete hydraulic carrying capacity conceived by the design engineer. Contractor's attention is called particularly to other sections of this specification "Pipe Installation and Field Testing" and "Final Acceptance".

4 Pipe Installation and Field Testing - Pipe shall be installed in full compliance with the recommended practice for "Underground Installation of Flexible Thermoplastic Sewer Pipe", ASTM D-2321.

In addition to the construction and testing procedures outlined in other sections of these specifications, the Contractor shall be required to install the pipe in such a manner that the diametric deflection of the pipe shall not exceed 5 percent and the materials surrounding the pipe shall be compacted to the required standard proctor densities outlined in ASTM D-2321.

If after back filling and compaction, videoing and review of the cleaned sanitary sewer line, the District observes a diametric deflection of the pipe section, a 5% mandrel-deflection test will be required. Any No-Go conditions will be repaired by the Contractor at no expense to the District.

The sanitary sewer system shall be watertight. Infiltration-exfiltration amounts shall be reviewed and evaluated by the District.

- B.** Fiberglass sewer pipe, centrifugally cast fiberglass reinforced polymer mortar pipe (CCFRPM), shall be specified by the Design Engineer with prior review and approval by the District for large diameter pipe requirements. All the pipe in this category shall meet the requirements of the ASTM D3262- standard specification for "Fiberglass" (glass-fiber-reinforced thermosetting-resin) sewer pipe.

T.2.4 Manholes

A. General

1. All manholes shall be watertight or waterproof, wet precast concrete sections of minimum 28-day concrete strength of 4000 PSI, using Type 2 cement and shall comply with ASTM C478. The base of the manhole shall be a minimum 8" thick. Manholes will require an exterior coating of bituminous waterproofing or approved equal. Manhole structures shall be designed for H-20 traffic loading in accordance with AASHTO Specifications. Cast-in-Place manhole bases are allowed only when practicable by construction such as the installation to connect to an existing pipeline with the new manhole. Manholes shall be in accordance with the Drawings Details.

2. Manholes shall be a minimum of 48 inch in diameter. The top section shall be an eccentric cone. Concrete adjustment rings shall be used to match final pavement elevations.
3. Manholes shall have a minimum 0.2-foot drop between inverts and shall not have intersecting lines at angles less than 90 degrees. A camera must be able to pass through a manhole channel.
4. Manholes shall be installed at distances not greater than 400 feet.
5. Where manholes must be extended to finished grade, concrete adjustments or riser rings shall be used, must not exceed 12" and shall be composed of the largest height combination of rings. No multiple 2" and 3" height rings. If greater than 12" is necessary, additional barrel sections must be added. All adjustment rings shall be embedded in butyl sealant strips and be watertight. Interior joints shall be grouted..

B. Precast Manholes

1. All pipe to manhole connections shall be watertight flexible connections made in cored drilled or cast in place holes with NPC Kor-N-Seal rubber boots, manufactured by Trelleborg Pipe Seals Milford, Inc. or approved equal, meeting all ASTM C923 requirements. For connections to remain flexible., grouting shall follow the manufacturer's recommendations. Prior to installing pipe connection boots, all exposed reinforcing shall be coated with coal tar or epoxy paint. Any lifting attachment areas, damaged coating areas, or uncoated area shall be field coated.
2. Manhole steps shall be copolymer polypropylene plastic with Grade 60 reinforcement or approved equal and aligned straight, not staggered and centered over a concrete bench.
3. Precast barrel joints shall be watertight and constructed with butyl sealant strip equaling in three-quarter inch by three-quarter inch ($\frac{3}{4}$ " x $\frac{3}{4}$ ") and continuously placed with no gaps or separations. A 12" wide exterior wrap shall be applied to all joints. The interior joints shall be grouted.

C. Cast-In-Place Manhole Bases

1. Manhole base shall be poured-in-place on a minimum 12" thick bed of $\frac{3}{4}$ " to 1 $\frac{1}{2}$ " crusted rock. The base of the MH shall be a minimum of 8" below the bottom of the lowest pipe and be steel reinforced per the detail. The minimum 28-day concrete strength shall be 4000 psi using Type 2 cement.
2. All inlet and outlet pipes in the base shall have installed on them an approved water stop rubber gasket prior to the concrete pour.
3. The channel depth of the bench shall be a minimum of the full depth diameter of the largest pipe.

C. Drop Manhole

1. Drop manhole base shall be constructed large enough to form a base for a cradle, supporting lower pipe entering the bottom of the manhole. The bottom entering pipe shall be supported with concrete up to the spring line.
2. The maximum amount of vertical drop shall be 6'. All drop manholes exceeding the limit will be reviewed by the District prior to design.
3. All drop manholes shall be constructed in accordance with the Drawing Detail and approved by the District prior to the final design and submittal.
3. All drop manholes must be completely lined with a Spectra Shield sprayed liner or approved equal.

D. Other Manhole Criteria

1. All manholes shall be plumb within one-eighth (1/8") per one foot (1").
2. The contractor shall give special emphasis to the backfilling and compaction directly against and around manholes (12" horizontal Contact Zone), appurtenances and structures.
3. Manholes shall have a 24-inch cast iron ring (frame) and cover with the word "SEWER" and with a pick hole lifting notch. The standard depth for the ring is 8-inches. Manhole ring and cover shall be three hundred and thirty-eight (338) pounds or greater, confirming to ASTM A48 Class 35B and meet H-20-wheel loading.
4. Platform: All manholes in excess of eighteen feet (18') in depth as measured from the cover to the invert, shall have an intermediate platform located 10' clear from the invert. The intermediate platform shall have grating over the manway, be aligned with the top opening and shall be in accordance with the District standard manhole details.

D. Service Connection to Manholes

In general, sewer service lines will not be allowed to connect to manholes. However, the District may, at its sole discretion, allow one service line to connect to a manhole located on the end of a sewer main in a cul-de-sac. The service line must be installed prior to placing the manhole base. No sewer service shall connect to the main line closer than 3-feet from the outside of manholes.

T.2.5 Cleanouts

Cleanouts shall not be used in public streets, unless so directed by the District. The District strongly recommends that cleanouts be installed on private sewer services under the following guidelines:

- A.** Not more than 100-feet of continuous sewer line be installed without at least one clean-out.
- B.** Cleanouts be located such that all portions of the line can be cleaned.

T.2.6 Sanitary Sewer Services

A. Wyes - PVC gasketed Wyes shall be used to make the connection on the District's sewer mains for new construction. Wyes shall be installed during the construction of the sewer main in compliance with Section T.4.8. The location of all sewer wyes shall be shown on the "as constructed" sewer main plans.

Wherever wyes are not used, connections shall be made by mechanical tap using a PVC service saddle.

B. Approved Pipe - PVC SDR35 (green) sewer services are acceptable if they conform to these specifications. Clay pipe services are not permitted. PVC pipe shall be used in all instances unless otherwise reviewed by the District prior to submittal. All joints for services shall be bell and spigot type with the appropriate gasket included. Solvent weld joints are acceptable. All methods of joining a sewer service to the existing wye or tee at the sewer line, or to an existing stub-in must be reviewed by the District prior to connection. In all cases where existing wyes or tees cannot be met, or available, mechanical methods must be used to tap the sewer line.

C. Fittings - Sewer fittings shall be PVC, gasketed joint and shall meet material requirements established in these Specifications.

D. Tapping Saddles - Tapping saddles shall be fabricated to insure that no protrusions of the saddle will extend into the sewer being tapped and shall fit the contour of the sewer. The saddles shall be molded PVC. Stainless steel clamp bands shall be used to secure the saddle to the main. Gasket type saddles shall not be installed.

F. Sewer Service Connections to Interceptor Sewers

In general, service line connections to interceptor sewers will not be allowed. The District may grant a variance to this specification if, in the opinion of the District, this connection is the most practical way of serve a building. If a variance is granted, a

manhole will be required to be constructed at the point of connection. An interceptor sewer, for the purpose of this specification, is described as a sewer main, usually 12-inches (12") in diameter or larger, that conveys sewage only from in-tract mains.

T.3 EARTHWORK AND EXCAVATION

T.3.1 Earthwork Defined

Earthwork shall include clearing, grubbing, grading, excavation, fill, backfill, excess excavation, bedding and pipe zone material, borrow material, and surface restoration that may be required to complete the work.

T.3.2 Exploratory Excavation

All underground utilities and structures shall be located by potholing in advance of the design to permit evaluation.

T.3.3 Excavation To Line And Grade

A. General - Excavations shall be made to the lines and grades as established by the approved plans. Pipe trenches shall be excavated to a minimum depth of 6-inches below the bottom of the pipe. Deviation from grades will be allowed when approved by the District.

B. Correction of Faulty Grades - Where excavation is inadvertently carried below subgrade and/or foundation elevations, suitable provision shall be made at the expense of the contractor for adjustment of same, as directed by the District to meet requirements incurred by the deeper excavation beneath pipe or structures.

T.3.4 Limit of Excavation

Except by expressed written permission of the District , 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, whichever is smaller. The distance is the collective length at any location, including open excavation, pipe laying and appurtenances, construction and backfill which has not been temporarily resurfaced. No trench shall be left open at any time that the contractor is not on the job site engaged in construction operations.

T.3.5 Trenching Operations

A. Trench Width - Existing asphalt or concrete surfacing shall be cut vertically in a straight line and removed from the jobsite prior to starting the trench excavation. This material shall not be used in any fill or backfill.

The trench shall be excavated so that a minimum clearance of 6-inches shall be maintained on each side of the pipe for proper placement and densification of the bedding and pipe zone or backfill material. The maximum trench width, measured at the top of the pipe shall be the outside diameter plus 16-for pipe under 12” in diameter, unless as specified by design or manufactures specifications . See Drawing Detail. .

B. Excavation Below Grade - The trench bottom shall be excavated to 6-inches below the pipe and cut smooth to obtain a undisturbed grade for the bedding.

For expansive soils as identified in the soil report, the expansive soil shall require additional excavation, bedding and be in accordance with Drawing Detail, Bedding Detail for Expansive Soil.

C. Trench Support - The trench shall be adequately supported, and the safety of workers provided for as required by OSHA, Occupational Safety and Health Administration.

T.3.6 Grading and Stockpiling

The contractor shall control grading in a manner to prevent water from running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm and wastewater can be uninterrupted in existing gutters, other surface drains or temporary drains.

T.3.7 Excavation For Structures

Except as otherwise dictated by construction conditions, the excavation shall be of such dimensions as to allow for the proper installation of the precast manhole, and to permit the construction of the necessary pipe connections.

T.3.8 Surplus Excavation Material

All surplus excavation material shall be removed from the jobsite and disposed of properly. If the surplus excavation material is disposed of on private property, written permission shall be obtained from the owner and a copy given to the District.

T.3.9 Foundation in Rock

Where rock is encountered, it shall be removed 9” below and 9” from the sides of the pipe, to accept bedding. The trench shall have no rock greater than 3” exposed in the pipe zone or in the back fill.

T.3.10 Pipe Clearance in Rocks

Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least 9-inches below the pipe and fittings.

T.3.11 Blasting

Blasting will not be allowed by the District. .

T.3.12 Dewatering

All pipe trenches or structure excavation shall be kept free from water during pipe laying and other related work. The method of dewatering shall provide for a completely dry foundation at the final lines and grades of the excavation.

If the trench bottom subgrade is stable, the use and increase in No. 67 bedding would be allowed upon District review and approval.

Dewatering shall be accomplished by the use of well points, sump pumps, rock or gravel drains placed below subgrade foundations or subsurface pipe drains. All water shall be disposed of in a suitable manner without being a menace to public health or causing public inconvenience in accordance with any required permit. No water shall be drained into other work being completed or under construction.

The dewatering operation shall continue until such time as it is safe to allow the water table to rise in the excavations. Pipe trenches shall contain enough bedding and backfill to prevent pipe flotation of the carrier or casing pipe. When pipe is laid in a casing or tunnel longer than 30 pipe diameters, the pipe inside said casing or tunnel shall be secured so flotation does not occur when the pipe is empty.

Water shall not be allowed to rise until the concrete has set a minimum of 24 hours, and the forms have been removed. Water shall not be allowed to rise unequally against unsupported structural walls.

T.3.13 Foundations on Unstable Soil

For unstable subgrade as determined by the District and the Engineer, additional excavation and placement of ¾ to 2" crushed stone, wrapped in filter fabric will be required, in accordance with the Drawing Detail.

T.3.14 Pipe Bedding and Pipe Zone Material

A. Installation of Bedding and Pipe in Standard Trench Section - After completion of the trench excavation and proper preparation of the foundation, 6-inches of bedding material shall be placed on the trench bottom for support under the pipe under normal circumstances. All pipe shall be installed in such a manner as to insure full support of the pipe barrel over its entire length. After the pipe is adjusted for line and grade, and the joint is made, the pipe zone material shall be carefully placed and tamped under the haunches of the pipe and in the previously dug bell holes.

Tamping is herein defined as the act of placing approved pipe zone material under the haunches of the pipe, paying particular attention to voids, bell hole, and sling holes. The purpose of tamping is to ensure uniform support for the pipe.

The limits of bedding and pipe zone material shall be from 6-inches below the bottom of the pipe to 12-inches above the top of the pipe. Approved backfill may then be installed to the ground line.

B. Installation of Bedding and Pipe in Expansive Soil Trench Section - After completion of the trench excavation and proper preparation of the foundation, 18-inch (18”) of No. 67 ¾-inch crushed rock shall be placed on the trench bottom for support under the pipe and to 12 inches above the top of the pipe.. All pipe shall be installed in such a manner as to insure full support of the pipe barrel over its entire length After the pipe is adjusted for line and grade, and the joint is made, the pipe zone material shall be carefully placed and tamped under the haunches of the pipe and in the previously dug bell holes.

Installation of bedding in accordance with this section shall be required for all sanitary sewer construction, as specified by the soil report for expansive soils unless noted otherwise and approved by the District. See Drawing Detail.

C. Frost - No pipe or appurtenant structure shall be installed upon frozen soil or at any time when the District deems there is danger of ice formation, or frost penetration at the bottom of the excavation. No pipe or appurtenant structure shall be installed unless backfilling can be completed before the formation of ice and frost.

D. Type of Bedding and Pipe Zone Material - The bedding and pipe zone material shall be a clean, free draining No. 67 aggregate/stone. or squeegee sand and shall conform to the following limits when tested by means of laboratory sieves:

<u>No. 67 Aggregate/Stone</u>	
<u>Sieve Size</u>	<u>Total Percent Passing by Weight</u>
1 Inch	100

3/4 inch	90-100
3/8 inch	20-55
No. 4	0-10
No. 8	0-5

<u>Squeegee Sand</u>	
<u>Sieve Size</u>	<u>Total Percent Passing by Weight</u>
3/8-inch	100
No. 200	0 - 3

T.3.15 Backfill And Compaction

A. Pipes - Backfill shall be compacted and tested in accordance with the governing agency standards and/or the street cut permit. In leu of this, all soil material shall be compacted to the specified relative compaction. Maximum dry density of all soil types encountered or used will be determined in accordance with ASSHTO T 99, ASSHTO T 180 or modification thereof. The backfill shall be compacted to a relative density of 95% for sand material as determined by ASTM D4253 and D4254 or 95% of the maximum dry density for cohesive soils as determined by ASTM D698. Tests shall be taken every 200 feet horizontally and 12 inches vertically.

It is expected that the trench excavation will provide suitable backfill material. Wet, soft, or frozen material, asphalt chunks, or other deleterious substances shall not be used for backfill. If the excavated material is not suitable for backfill, as determined by the District, suitable material shall be hauled in and utilized, and the rejected material hauled away and disposed of properly.

Backfilling shall be conducted at all times in a manner to prevent damage to the pipe or its coating and shall be kept as close to the pipe laying operation as possible. Backfilling procedures shall conform to the additional requirements, if any, of appropriate agencies or private right-of-way agreements.

B. Manholes and Structures - The Contractor shall give special emphasis to the backfilling and compaction directly against and around manholes (12” horizontal Contact Zone), appurtenances and structures. This backfill shall be placed in 6” thick

horizontal layers or depth suited for the hand compaction equipment. Compaction beyond the Contact Zone will be accomplished by mechanical equipment (vibratory and/or rolling equipment) to industry standards and soil report recommendations. 95% Modified Proctor Maximum Dry Density. As a minimum, compaction tests at the structure shall be taken every vertical foot (12”) beyond the Contact Zone, alternating each quarter side or as specified by the governing agency.

C. Compaction Tests - Compaction tests will be taken by an approved testing laboratory at locations approved by the District or other governing agency. All expenses involved in these tests will be borne by the Applicant. Copies of test results must be made available to the District. In all cases where the tests indicate compaction less than that required in these specifications, additional compaction and tests will be required until these specifications are met. Final acceptance of the sanitary lines by the District will be contingent upon satisfactory compaction results. All compaction tests must be taken, reviewed, and approved prior to testing of the sanitary line.

T.3.16 Controlled Low Strength Material (CLSM)

Permission to use CLSM commonly called “Flow Fill” shall be requested from the District for backfill in pipe zone and other backfill locations such as crossing. The request to use CLSM shall be in writing and include a mix design from a ready-mixed concrete producer. CLSM shall conform to CDOT specifications.

T.3.17 Cleanup

Upon completion of the work, all rubbish, unused materials, concrete forms and other like material shall be removed from the jobsite. All excess excavation shall be disposed of as specified and the areas shall be left in a state of order and cleanliness.

T.3.18 Surface Restoration

A. Unsurfaced Areas - All surface cuts shall be, as a minimum, restored to a condition equal to that prior to construction. All streets shall be restored in accordance with the regulations and requirements of the governing agency having control or jurisdiction over the street, roadway, or right-of-way.

B. Surfaced Areas - All surface cuts shall be, as a minimum, restored to a condition equal to that prior to construction. All gravel or paved streets shall be restored in accordance with the regulations and requirements of the governing agency having control or jurisdiction over the street, roadway, or right-of-way.

C. Easements, Cultivated or Agricultural Areas - In easements, cultivated or agricultural areas, topsoil, to a depth of 8-inches, shall be removed from the area of general disturbance and stockpiled. After installation of all pipelines, appurtenances and structures, and completion of all backfill and compaction, the stockpiled topsoil shall be redistributed evenly over all disturbed areas. Care should be taken to conform to the original ground contour or final grading plans.

T.3.19 Subgrade and Road Preparation

Prior to installation of sanitary sewer mains in dedicated streets, road construction must have progressed to at least the subgrade stage. Subgrade elevation is defined as an elevation which lies no more than 7-inches below the finished street grade. The road surface shall be smooth, clear of debris and free from deep holes, ruts, and large rocks which may hamper main installation.

Sanitary Sewer mains shall be laid where the ground surface is near its final elevation, whether it is located in a dedicated street or not.

T.3.20 Safety Precautions

All excavations shall be performed, protected and supported as required for safety and in the manner set forth in the operation rules, orders and regulations prescribed by the **Occupational Safety and Health Administration**, and all other applicable local, State, and Federal Regulations.

Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrian and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely refilled.

The District does not prescribe safety requirements and will not dictate nor recommend safety equipment, safety methods, nor the safety precautions being utilized.

It is the sole responsibility of the Contractor to take all safety precautions necessary to ensure the safety of the workers, equipment and materials.

T.4 PIPE INSTALLATION

T.4.1 Approval By the District

Any handling and installation procedures, tools, equipment, and materials require approval by the District. Approval by the District shall in no manner render the District liable for any injuries suffered, material or equipment damaged. Approval by the District is used solely as a means to insure quality control.

Safety of workers shall be provided as required by OSHA, Occupational Safety and Health Agency.

T.4.2 Handling Of Materials

Pipe, fittings, and appurtenances shall be loaded and unloaded by lifting so as to avoid shock or damage. Under no circumstances shall such material be dropped. If, however, any part of the coating or lining is damaged, the replacement or repair of the damaged pipe shall be done to the satisfaction of the District. Any pipe or materials that are not acceptable to the District shall be removed from the job site immediately. Pipe handling equipment and pipe handling methods shall be approved by the District.

T.4.3 Preparation And Observation Of Pipe And Fittings For Installation

Before placing pipe in the trench, each pipe or fitting shall be thoroughly cleaned of all foreign material, kept clean at all times thereafter, and carefully examined for cracks and other defects before installation. Bell ends and spigot ends are to be examined with particular care.

T.4.4 Pipe Joint Lubricant

Joint lubricant shall be as supplied by the pipe manufacturer, and approved by the District. Joint lubricant shall be non-toxic and water soluble.

T.4.5 Cutting And Fitting Of Pipe

Pipe shall be cut, whenever necessary, to conform to location of fittings, line, or grade. All cuts shall be straight and true, in a workmanlike manner so as to leave a smooth end without damaging the pipe. All burrs shall be removed from the ends of cut pipe, and the end lightly rasped or filed. All tools used in cutting pipe shall be approved by the District.

T.4.6 Pipe Alignment And Grade

The sanitary sewer line shall be laid and maintained to the required lines and grades as shown on the plans.

Whenever obstructions not shown on the plans are encountered during the progress of the work and interfere to such an extent that an alteration in the approved plans is required, the District shall have the authority to change the plans and order a deviation from the line and grade.

T.4.7 Pipe Installation

All pipe shall be laid without break from structure to structure, with the bell ends of the pipe upgrade. Pipe shall be laid to the line and grade shown on the approved plans and in such a manner as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the flow line. The interior of the sanitary sewer pipe shall be cleaned of all dirt and superfluous material of all descriptions as the work progresses.

At all times when pipe laying is not in progress, the open end of the pipe shall be closed with a tight fitting cap or plug to prevent the entrance of foreign matter into the pipe. These provisions shall apply during the noon hour as well as overnight. In no event shall the sanitary sewers be used as drains for removing water which has infiltrated into the trenches.

When placing sanitary sewer pipe in the ditch, the ASTM specification for installing sewer pipe shall be used. Pipe shall be laid true to line and grade as shown on plans approved by the District. Laser beam equipment must be used to provide line and grade.

All pipe shall be protected during handling against impact shocks and free fall and no pipe shall be placed in the sewer line that has been damaged while lowering into the ditch. Bell holes shall be dug under the bells of all pipe, regardless of the type of bedding used in the ditch and the entire length of barrel of all sewer shall rest firmly on the bedding material used in the ditch and the weight of the sewer pipe in no case shall be supported by the bells of the pipe.

After lowering into the ditch, both the bell and spigot shall be thoroughly cleaned and free from any foreign material.

When manufacturer's prefabricated joints are used in the laying of the sanitary sewer lines, such lines shall be joined using lubricants, primers, adhesives, solvents, etc., recommended by the manufacturers of said manufactured joints. All factory fabricated joints shall be placed, fitted, joined and adjusted in such a workmanlike manner as to obtain the degree of water tightness required and in compliance with recommended methods of manufacturer, and as approved by the District.

T.4.8 Branch – Lateral Services

Wyes, tees, fittings and saddle wyes, tees shall be PVC injection molded gasketed fittings manufactures in accordance with ASTM F1336, D3212, D1784, F477, D2321, D3034 and F679. Branches shall be installed in accordance with Drawing Details.

Tee branches shall have their axis perpendicular to the longitudinal axis of the pipe. Wye branches shall have their axis approximately 45 degrees to the longitudinal axis of the pipe.

Pipe wyes, tees and other types of branches shall be furnished and installed along with the sewer. Wyes of the size and type specified on the plans shall be installed for all sewer house connections and for future sewer house connections as shown on the plans, or specified in the detailed specifications. Installation, earthwork and bedding for branches shall conform to the applicable provisions set forth for said sewer pipe. Unless otherwise specified, the branch of wye fittings shall be inclined upward at an angle not greater than 45 degrees from a horizontal line (2 and 10 o'clock). No wye or tee for sewer house connection branch shall be placed closer than 3-feet, to the outside of any structure.

The contractor shall hand tamp the bedding under every wye branch when installed.

T.4.9 Connection to Existing Sanitary Sewer Line

In the event a connection is made to an existing public sanitary sewer main line, it shall be made in the following manner:

A hole shall be bored into the main pipeline by methods acceptable to the District. A injected molded PVC saddle wye, or PVC saddle tee, shall be utilized. Two stainless steel straps shall then be used to fasten the wye or tee saddle to the mainline, one strap being used on each side of the fitting.

The method of installation, types of stainless steel straps used shall be compatible with the materials used as per the manufacturer's recommendation.

A PVC wye fitting may be installed on an existing line by replacing and inserting a minimum of 2 feet of PVC pipe into the upstream and downstream side of the wye and connecting to the existing line with rubber couplings with a stainless steel shear ring and a concrete cradle.

T.4.10 Pipe at Manholes or Structures

Pipe shall protrude 4" minimum into the manhole through a Kor-N-Seal rubber "boot" or approved equivalent. As shown in the Drawing Detail. In a drop manhole the top pipe

shall protrude 8” and have a smooth transition to form a open top for half of the exposed section.

In cast-in-place manhole bases, pipe bells shall not be cast into manholes or structures. The pipe shall have a water stop gasket fastened with a stainless steel strap at the casting zone of the manhole base.

T.4.11 Frost

No pipe or appurtenant structure shall be installed upon a foundation into which frost has penetrated, or at any time when the District deems there is danger of ice formation, or frost penetration at the bottom of the excavation. No pipe or appurtenant structure shall be installed unless backfilling can be completed before the formation of ice and frost.

T.4.12 Perimeter Drain

Where there is not a piped underdrain system, perimeter building drains will not be allowed to drain into the sanitary sewer pipe bedding.

T.4.13 Pipe Encasement

Steel casing shall be used in lieu of concrete encasement.

Where sewer lines are at a depth too shallow to sustain traffic load or any other load, the depth may range from 0 to 3 feet \pm , depending on the loading conditions, a concrete encasement may be reviewed and approved by the District upon pre-submittal.

Concrete encasement could be reinforced in accordance with the design and shall be of a length to completely span the condition encountered. Unless so designed, encasement are for the purpose of pipeline protection and are not to be considered a structural beam. Therefore, special attention to a good soil foundation and compaction effort for the encasement must be provided.

T.4.14 Steel Pipe Casings

Steel pipe casings shall be used where bores are required under rights-of-way by the governing agency. All pipe casings shall be constructed to conform with the Drawing Detail and the requirements of any other applicable approving agency.

T.4.15 Service Connections to New Construction

New main line construction shall use PVC in-line "wye" fittings for 4-inch service connections, or manholes for 6-inch and 8-inch service connections. Construction shall be in conformance with this Section and Detail Drawing.

All in-line PVC wye fittings shall be of equal pipe class and compatible to the PVC materials used in public main line construction.

In-line wye fittings shall be installed at the location indicated on the plans. The "wye" shall be rotated to provide entrance into main line at the "ten" or "two" o'clock position. The Contractor shall record the connection invert elevation and distance from the nearest downstream manhole immediately upon installation. This information shall be shown on the record drawings.

T.4.16 Service Connection to Existing Construction

Service connections to existing sanitary sewer lines shall be made using either a PVC "tee" or "wye" saddle depending on the existing main line and service alignment. Construction shall be in conformance with this Section and Detail Drawing.

Connection to existing PVC material shall be made using a "wye" saddle with double stainless steel straps. The existing PVC sewer line shall be scored to the shape of the wye using a template approved by the saddle manufacturer. The hole shall be cut and cleanly machined by hand to remove all burrs, rough edges, and debris. All coring equipment and methods shall be approved by the District. The exterior of the main shall be wiped clean and prepared for the installation of the saddle per the manufacturers instructions.

Upon completion of the tap, the main line, tapping saddle and service line within the sanitary sewer line trench shall be bedded and hand tamped prior to backfilling.

Connection to existing concrete or clay sewer lines shall be made using a PVC tee saddle and gasket with double stainless steel straps. When connecting to an existing concrete or clay main, a long-body style PVC tee saddle shall be used. The sewer main shall be "core drilled" with a circular bit. Necessary precautions shall be taken so that the removed circular segment is not lost in the sanitary sewer main. Percussion tap is defined as breaking the existing pipe material out in a circular fashion using a hammer and chisel and this method shall not be used. A insert-a-tee shall not be used.

T.4.17 Pipe Testing Procedures After Construction

General - Post construction pipe testing shall be completed in the following sequence and as further detailed below.

- a. Flushing, video and measurement of dips or sags.
- b. Low pressure air test of PVC pipe.

- c. Air vacuum test of manholes.
- d. Deflection test may be required by the District.
- e. Deficiency "punch" list.

A. Flushing - Prior to any testing, the lines shall be thoroughly flushed and jetted to remove debris, dirt or other foreign matter. The lowest manhole (or manholes) within the project shall be plugged with a watertight plug on the downstream outlet of the manhole and all water, silt and debris shall be pumped from this manhole and disposed of properly.

After cleaning the new sanitary sewer line, the Contractor will dump clean water down the sanitary sewer line prior to the video observation. The Contractor will video and measure, with the District present, the new line with a graduated cylinder in 1/8th of an inch up to 1" marking being pulled ahead of the video camera. 3/8" dip or sag is considered unacceptable and will require District evaluation. Any infiltration in the line and the manhole must be repaired to stop infiltration by the Contractor.

B. Low Pressure Air Test - All low pressure air tests shall be done in accordance with the latest revision of ASTM F1417 which references, *UNI-BELL*, *UNI-B-6 Specification*. Each section of sanitary sewer line between two successive manholes shall be tested by plugging all pipe outlets with suitable test plugs. Air shall be slowly added until the internal pressure is raised to 4.0 psi. A continuous monitoring gauge with a minimum division of 0.10 psi and an accuracy of +/-0.40 psi shall be used. The compressor used to add air to the pipe shall have a blow-off valve set at 9 psi to assure that at no time the internal pressure in the pipe exceeds 9 psi. The internal pressure of 4 psi shall be maintained for at least two minutes to allow the air temperature to stabilize after which the air supply shall be disconnected and the pressure allowed to decrease to 3.5 psi. The time in minutes that is required for the internal air pressure to drop from 3.5 psi to 3.0 psi shall be measured and the results compared with the values listed in the ASTM table.

If the pressure drop from 3.5 psi to 3.0 psi occurs in less time tabulated or calculated values, the pipe shall be repaired and, if necessary, replaced and relayed until the joints and pipe shall hold satisfactorily under this test.

If the line being tested is in a groundwater condition, the internal air pressure valve of 4.0 psi shall be increased to include the addition of groundwater pressure on the pipe.

The additional pressure shall be calculated by adding 0.433 psi internal air pressure for each foot of water over the sealed pipes, invert, but the maximum allowable internal air pressure in the pipe shall not exceed 9.0 psi. Therefore, the low pressure air test may be used in a groundwater condition as long as the average depth of water over line does not exceed 11.5 feet. Should the average groundwater depth exceed 11.5-feet, the infiltration tests shall be performed.

C. New Air Vacuum Test – Air vacuum testing will be required in accordance with ASTM C1244 on 100% of the manholes from the top of the cone. The concrete adjustment rings are not to be tested.

D. A deflection test may be required by the District if the vertical diameter is view to have decrease or the pipe is out of round or elliptical after backfill and compaction.

T.4.18 Acceptance And Release For Taps

A sanitary sewer main shall be accepted by the District and released for taps when the following conditions have been met:

A. Installation - The main and all appurtenances have been installed to the satisfaction of the District and all pertinent notes and measurements have been made.

B. Tests - All tests specified have been passed and documented by the District.

C. As Built Drawings - One bond copy, one PDF and one computer disk of the “As-Built” plans have been submitted to and approved by the District.

D. Maintenance Guarantee - A warranty maintenance bond, letter of credit or other acceptable from of financial guarantee for the two year warranty has been approved by the District.

E. Easements - Recorded easements have been received by the District.

F. Easement Certification - The District has approved the standard form of certification that all water mains and appurtenances have been installed within the boundaries of the recorded easements signed and stamped by a Land Surveyor registered in the State of Colorado.

G. Subdivision Plat - One printable bond copy and one PDF of the recorded subdivision plat have been submitted to the District.

H. Certificate of Costs - A letter or invoice certifying the actual cost of construction of the sanitary sewer mains and appurtenances has been submitted to and approved by the District.

T.5 UNDERDRAINS

The Southwest Metropolitan Water and Sanitation District is not responsible for the installation, ownership, maintenance, repair, or replacement of underdrain systems. Plans and specifications for underdrain systems shall not be shown on the sanitary sewer system plans. Solely as an accommodation to property owners, the District may allow the installation of piped underdrains within the sanitary sewer trench subject to the following requirements.

A. Requirements

1. A Declaration of Homeowner Covenants, Conditions, and Restrictions for the area or subdivision proposed for installation of an underdrain system must be recorded by the Clerk and Recorder of the County within which the underdrains system is proposed to be installed. Said covenants, conditions and restrictions must provide the following:
 - a. That all property within the boundaries of the subdivision be held, sold, and conveyed subject to the easements, reservations, restrictions, covenants, and conditions of the recorded Declaration of Covenants, Conditions and Restriction. Further, that the Covenants, Conditions and Restrictions run with the land and be binding upon all parties, their heirs, personal representatives, successors, and assigns having any right, title, or interest in any part of the property.
 - b. Establishment of a homeowners association responsible for enforcing and carrying out the requirements of the recorded Covenants, Conditions, and Restrictions.
 - c. A condition that the common drainage portion of the underdrain system that lies beneath the public streets, common property, or utility easements whether said common drainage portion of the underdrain system located within or outside of the boundaries of the subdivision, be owned, operated, maintained, repaired and replaced by the homeowners association or individual members thereof.
 - d. A provision that permits the District to require repair, reconstruction, replacement, or relocation of the underdrain system if the District determines for any reason that its public water or sanitary sewer system is being endangered by the underdrain system.
 - e. A condition stating that any easements granted to the homeowners association for operation and maintenance of the common drainage portion of the underdrain system be subordinate to the rights granted to the District by grant of right-of-way, easement, plat dedication, or platted easement for the operation and maintenance of the District facilities.

2. A statement on the recorded plat providing that the homeowners association will be responsible for the operation, maintenance and repair of the common drainage portion of the underdrain system as defined in the Covenants, Conditions, and Restrictions.
3. Execution of an Underdrain Agreement and/or easement document acceptable to the District.
4. Submittal to two copies of engineering design plans for the underdrain system. Said plans must be submitted prior to, or at the time of, submittal of sanitary sewer design plans. The District will not approve, nor be responsible in any way for the adequacy of the design for the underdrain system. Further, the District will not guarantee that the underdrain system is constructed in accordance with any design plans nor that the underdrain system will serve any intended use.
5. Submittal of two bond copies of prints and PDF of the "as constructed" drawing of the underdrain system upon completion of its construction. The prints must be stamped by a civil engineer registered and licensed in the State of Colorado.
6. In expansive soils per the submitted soils report, the piped underdrain system shall meet the minimum strength requirements of solid polyvinyl chloride (PVC) C-900, Class 200, SDR-14 pipe. The District's minimum pipe requirements is only for the protection of the sanitary sewer system and is in no way a determination of the adequacy of any piping materials to perform any function or purpose required by the developer/owner. All underdrain piping installed within the sanitary sewer trench shall be solid wall (non-perforated) pipe.

B. Underdrain System Maintenance - The common drainage portion of the underdrain system that lies beneath the streets or roadways of this Planned Community, the Common area, or the Utility Easements, whether such common drainage portion is located within or outside of the boundaries of the Planned Community, shall be owned, operated, maintained, repaired or replaced by the Association. There shall be an easement granted to the Association, its agent or contractor upon, across, over, in and under each Lot and the Common Area in accordance with Section 6.3 of this Declaration, as is reasonably necessary, for the performance of such maintenance, repair or replacement of such underdrain system, provided that, any such easement shall be subordinate to the rights granted to the Southwest Metropolitan Water and Sanitation District, (the "District") by grant of right-of-way, easement, plat, dedication, or platted easement for the operation and maintenance of the District facilities.

The District may require the repair, reconstruction, replacement or relocation of such underdrain system if the District determines in its reasonable commercial discretion that its public water or sanitary sewer system is being endangered by the underdrain system.

T.6 FATS, OILS, AND GREASE (FOG) CONTROL STANDARDS

T.6.1 Purpose

The purpose of these standards for control of animal/vegetable fats, oils and grease is to minimize the loading of animal/vegetable fats, oils and grease (FOG) from entering the District's wastewater collection system and the Littleton/Englewood Wastewater Treatment Plant. FOG can contribute to sewer blockages causing sanitary sewer overflows and backups, and can interfere with equipment of the wastewater treatment plant. Refer to the District's Fats, Oils & Grease (FOG) Policy for more information.

T.6.2 Scope and Applicability

A. Scope

These standards shall encompass and be enforced within the entire service area of the District, including those areas outside of the District's legal boundaries, but which discharge wastewater into the District's wastewater collection system by agreement.

B. Applicability

Refer to the District's Fats, Oils & Grease (FOG) Policy for more details on the applicability of this policy. General information is provided below.

1. Non-domestic Users

This policy applies to any non-domestic user in the District's service area where preparation, manufacturing, or processing of food occurs including but not limited to restaurants, cafes, fast food outlets, pizza outlets, delicatessens, sandwich shops, coffee shops, schools, nursing homes, and other facilities that prepare, service, or otherwise make foodstuff available for consumption. These users shall install and maintain a gravity grease interceptor (GGI) and implement best management practices (BMP) as directed by the District. These BMPs are set forth in the District's Fats, Oils & Grease (FOG) Policy.

2. Domestic Users

These standards do not apply to domestic users. However, the best management practices (BMPs) set forth in the District's Fats, Oils and Grease Policy are recommended for domestic users to assist in keeping the District's collection system and private sewer lines flowing freely.

T.6.3 Requirements

Users to which these standards apply, as identified in Section T.6.2, shall comply with all requirements listed herein. Users shall permit observations by the District with or without notice for the purpose of determining applicability and/or compliance with these standards.

T.6.3.1 Plan Reviews

The user and owner of the property, business, or industry or an authorized representative of the user must contact the District for the purpose of obtaining a plan review. The plan review shall determine the need, size, location, and other requirements of the GGI required to control discharges. Written approval from the District must be obtained prior to installation of the GGI. The review of such plans and operating procedures shall in no way relieve the user from the responsibility of modifying such facilities as necessary to produce a discharge acceptable to the District in accordance with the District's Fats, Oils & Grease Policy and the Engineering Standards of the District.

Plans are required to be submitted for approval prior to any of the following:

- Sale or transfer of ownership of the business,
- Construction of a new building
- Change in the trade name under which the business is operated,
- Change in the nature of the services provided that affect the potential to discharge FOG, and/or
- Remodeling of the facility that may result in an increase in flow or FOG loading or that otherwise requires the facility to submit plans or specifications for approval through a building or zoning department, or any other formal approval process of a city, county, or other jurisdiction.

All plans submitted to the District must show the location of the GGI, clearly identify plumbing and plumbing fixtures that connect to the GGI, identify plumbing and plumbing fixture sizes, and a table or schedule identifying fixture flow (see Tables 1 and 2). Plans shall include proposed GGI size in accordance with the GGI sizing criteria provided in Section T.6.3.3(B). Plans shall include a GGI detail showing internal plumbing, dimensions, cleanouts and vent piping. Construction shall not deviate from approved plans. If a situation warrants a change from approved plans, an amended copy must be resubmitted to the District for approval.

GGI installation and associated plumbing shall be inspected and approved by the District prior to backfilling.

T.6.3.3 Gravity Grease Interceptor Criteria (GGI)

A. GGI Plumbing and Structural Requirements

All sinks, floor drains, floor sinks, mop sinks, disposals, dishwashers and other plumbing fixtures in kitchens, bars, bussing stations, and other food service areas into which wastewater containing FOG may be introduced must be connected to the GGI. Water closets, urinals, and other plumbing fixtures conveying human waste shall not drain into or through the GGI.

Each business establishment for which a GGI is required shall have a GGI serving only that establishment. Common or shared GGIs are only allowed under limited circumstances determined by the District on a case-by-case basis. If a GGI is used by more than one business, the property owner or property manager will be required to ensure the GGI is maintained in accordance with District requirements.

All GGIs and associated plumbing shall be installed by a licensed plumber or contractor. GGIs shall be installed in an accessible exterior location, have a minimum of five hundred (500) gallons capacity, and have a minimum of two (2) compartments separated by a baffle wall. The primary compartment shall have a volume equal to two thirds of the total capacity, and the secondary compartment shall have a volume equal to one third of the total capacity. Each compartment shall be accessible by a traffic rated manhole above the inlet and outlet piping with a minimum diameter of 24 inches. Manhole covers may not be locked, or otherwise fastened in place such that access is restricted.

All plumbing shall be compatible with food service wastewater, such as PVC. A sampling T with a removable cap shall be placed at the outlet end of the GGI to allow sampling of effluent. The top of the sampling T shall be no more than one foot below grade. In order to maximize retention time in the primary chamber, the bottom of the inlet piping shall extend down 25% of the total water depth. The bottom of the outlet piping must extend down between 9 and 12 inches of the base of the GGI. Flow from the primary to secondary compartment shall be through a 90° elbow bend, or similar device equivalent in cross sectional area to the inlet piping into the GGI, and shall extend down in the primary compartment of the GGI with a height above the base between 9 and 12 inches. Support brackets are required for inlet and outlet piping. Clean outs and venting shall be PVC pipes. GGIs shall have two (2) vent pipes, one shall vent the body of the GGI and one vent pipe shall connect to the external effluent piping. Vent pipes shall remain independent to a location above finished grade, be independent of any other building venting system and shall be in accordance with local building codes. See Detail Drawing D.25S for a diagram of a GGI.

B. GGI Sizing

The sizing of the interceptor shall be determined by using Tables 1 and 2. If the GGI is being sized for a vacant shell building, Table 3 shall be used to determine the GGI size.

If the sizing calculations indicate that a grease interceptor of less than 350 gallon is required, the District may allow the user not to install a GGI upon initial review of plans. This determination will be made upon an initial review of plans and of the user’s proposed operations.

Table 1: GGI Sizing Based on Fixture Flow

Fixture Type	Quantity	Fixture Surge Flow Rate (gpm)	Averaging Multiplier	Flow (gpm) = Quantity x Fixture Surge Flow Rate
Hand Sink		5	.25	
Bar Hand Sink		5	.25	
Single/Prep Compartment Sink		20	.25	
Double Compartment Sink		25	.25	
Triple Compartment Sink		30	.25	
Mop Sink		5	.25	
Wok Range (1-5 Wok Stations)		15	.25	
Wok Range (5+ Wok Stations)		20	.25	
Dishwasher (0-30 gallons)		15	.25	
Dishwasher (30-50 gallons)		25	.25	
Dishwasher (50-100 gallons)		40	.25	
Floor Drains		N/A ₁	----	N/A ₁
Other ₂			.25	
Total Flow (gpm)				
Loading Factor (Coffee Shop - 0.5; Other Users₃ = 1.0)				
GGI Size (gallons) = Total Flow x Loading Factor x Retention Time				
GGI Inlet Pipe Size₄				
Maximum GGI Size (gallons)₅				

Notes:

- 1 Hand sinks, bar hand sinks, mop sinks, and floor drains must be counted and connected to the GGI, but due to the frequency of their typical use, their surge flow rate is not included in the calculation.
- 2 The surge flow rate for plumbing fixtures not listed shall be based on manufacturer rating or drain pipe size in Table 2. If a fixture type is listed and the listed standard surge flow rate is larger than that provided by a manufacturer, the lower surge flow rate may be used. Documentation of and manufacturer rating used in the calculation shall be provided during the plan review.
- 3 The District may apply a loading factor other than 1.0 for users if special circumstances warrant.
- 4 Enter the maximum GGI size based on the inlet pipe size from Table 3.
- 5 If the calculated GGI size is greater than the maximum GGI size, the maximum GGI size shall be used.

Table 2: Surge Flow Rates Based on Fixture Discharge Pipe Size

Fixture Discharge Pipe Size (inches)	Surge Flow Rate (gpm)
1.25	7.5
1.5	15
2.0	22
2.5	30
3.0	37.5
4.0	45

Table 3: GGI Sizing for Unfinished Building Shells and Maximum GGI Size

GGI Inlet Pipe Size (inches)	GGI Size (gallons)
2	500
3	1000
4	2000
5	3500
6	5000

C. GGI Location

Each GGI shall be so installed and connected that it shall be at all times easily accessible for observation, cleaning, pumping, and maintenance. Each GGI manhole cover shall be readily accessible and safely removable for servicing and maintaining the GGI in good working condition. The use of ladders, the removal of bulky equipment, or any other circumstances that impedes safe access in order to service or inspect GGIs shall constitute a violation of accessibility. GGIs are not permitted to be located in parking spaces or drive-thru lanes. GGIs shall not be installed in any part of a building where food is handled. Location of all GGIs shall be shown on the approved building plan.

D. Common or Shared GGIs

Common or shared GGIs are not permitted unless a variance is granted. Any common or shared GGIs must be sized appropriately for each individual restaurant and the sizes must be added together to obtain the final GGI size. Common or shared GGIs may be reevaluated for proper sizing and capacity as facilities change business operations, practices, or owners or tenants.

E. Facilities with Existing GGIs

Some facilities may already have a GGI in place. An existing GGI may be undersized for a user according to the sizing requirements of Section T.6.3.3(B). The District may approve a new user or a user who is required to submit plans for

review under Section T.6.3.1 to use the existing GGI if the District determines it can adequately protect the sanitary sewer from FOG. The existing GGI must have two chambers and be retrofitted to meet the requirements of Section T.6.3.3 and Detail Drawing D.25S if the original structure does not comply with the current sizing guidelines.

E. Determination of No GGI Required

If the District has determined that no GGI is to be installed, the user shall connect all plumbing fixtures listed in Section T.6.3.3(A) to a sanitary sewer line separate from the domestic sanitary sewer line. This separate sanitary sewer line shall have a cleanout located outside of the building to allow the District access for sampling. The separate sanitary sewer line is designed to allow representative compliance sampling and installation of a GGI should one be required. This line may be combined with the domestic sanitary sewer at a point after the cleanout. If a facility's discharge exceeds the control authority's limit for oil and grease, or contributes to an excess build-up of FOG in the sanitary sewer line, the user may be required to install an appropriately sized GGI. The user may be charged for any fees associated with sampling, including labor costs, travel time, sampling supplies, and analytical costs.

T.6.3.2 Hydromechanical Grease Interceptor (HGI)

A. Design Requirements

At the discretion of the District, certain facilities that do not have the potential to discharge excessive amounts of FOG shall be required to install an approved grease control device that meets the American Society of Mechanical Engineers (ASME) A112.14.3 Type C standard. In addition to the installation of a HGI, the user shall be required to establish a schedule of BMPs to minimize the discharge of FOG into the District's sanitary sewer system. Food service establishments that may be considered for this approach include establishments such as small sandwich shops and small bakeries that do not use flatware, do not utilize an automatic dishwasher, and do not have a garbage disposal. Sinks, plumbing fixtures in kitchens and other food service areas into which wastewater is likely to or has the potential to contain human waste shall not drain into or through the HGI.

All HGIs and associated plumbing shall be installed by a licensed plumber or contractor. All HGIs must be certified to the ASME A112.14.3 Type C standard. HGIs located outside and below-grade are required to be accessible by a traffic rated manhole cover(s). Manhole covers shall not be locked or otherwise fastened in place such that access is restricted. All plumbing shall be compatible with food service wastewater, such as PVC.

If a facility's discharge exceeds the District's limit for oil and grease or contributes to an excess build-up of FOG in the sanitary sewer line, the user may be required to install an appropriately sized GGI.

B. HGI Plan Review

Plan reviews for the installation of an approved HGI shall comply with the requirements of Section T.6.3.1. Sizing of an approved HGI shall be based on the manufacturer's recommendations and the best professional judgment of the Control Authority. The minimum allowable HGI design flow rate shall be 50 gallons per minute.

Each HGI shall be installed and connected so as to be easily accessible at all times for observing, cleaning, pumping, and maintenance. Each HGI cover shall be readily accessible and easily and safely removable for servicing, maintenance, and observation. Location of all HGIs shall be shown on the approved building plan.

T.6.3.4 GGI/HGI Management, Maintenance & Operations Requirements

Refer to the District's Fats, Oils & Grease Policy for more information on the following GGI and HGI management, maintenance and operations requirements.

- Service & maintenance
- Recordkeeping
- Non-compliance
- Closure
- Best Management Practices (BMPs)
- Spill prevention
- Variances
- Enforcement

If conflicts are found to exist between the District's Engineering Specifications and the Fats, Oils & Grease Policy, the contents of the Policy will prevail.

T.7 PETROLEUM OIL, GREASE AND SAND (POGS) CONTROL STANDARDS

T.7.1 Purpose

The purpose of these standards for control of petroleum oil, grease and sand is to minimize the loading of petroleum oil, grease and sand from being discharged into the District's wastewater collection system and the Littleton/Englewood Wastewater Treatment Plant. POGS can contribute to pass-through of pollutants into the wastewater treatment plant and natural waters and can create a volatile atmosphere within the District's collection system. Additionally, sand can cause sewer blockages and damage pumping and treatment equipment.

T.7.2 Scope and Applicability

A. Scope

These standards shall encompass and be enforced within the entire service area of the District, including those areas outside of the District's legal boundaries that are served by a wastewater service and/or wastewater transmission agreement.

B. Applicability

1. Non-domestic Users

These standards apply to any non-domestic user that discharges wastewater that has the potential to contain sand, grit, and/or petroleum by-products into a District owned sewer main. Examples of such facilities include but are not limited to: automobile or recreational vehicle service stations, fleet maintenance stations, mechanical repair shops, car or truck washes, machine shops, garden nurseries, warehouses, and parking garages. These users shall install and maintain a sand/oil interceptor (SOI) as directed by the District. Users with an elevator pit must either install a SOI or implement one of the other options outlined in Section T.7.3.4.

2. Domestic Users

This policy does not apply to domestic users. However, the best management practices (BMPs), set forth in the District's Petroleum Oil, Grease, and Sand Policy, are recommended for domestic users to assist in preventing pollutants from entering the collection system.

T.7.3 User Requirements

Users to which these standards apply, as identified in Section T.7.2 shall comply with all requirements listed herein. Users shall permit inspections by the District with or without notice for the purpose of determining applicability and/or compliance with these standards.

T.7.3.1 Plan Reviews

The user and owner of the property, business, or industry or an authorized representative of the user must contact the District for the purpose of obtaining a plan review. The plan review shall determine the need, size, location, and other requirements of the SOI required to control discharges. Written approval from the District must be obtained prior to installation of the SOI. The review of such plans and operating procedures shall in no way relieve the user from the responsibility of modifying such facilities as necessary to produce a discharge acceptable to the District in accordance with District policy and these Standards.

Plans are required to be submitted for approval prior to any of the following:

- Sale or transfer of ownership of the business,
- Change in the trade name under which the business is operated,
- Change in the nature of the services provided that affect the potential to discharge POGS, and/or
- Remodeling of the facility that may result in an increase in flow or POGS loading or that otherwise requires the facility to submit plans or specifications for approval through a building or zoning department, or any other formal approval process of a city, county, or other jurisdiction.

All plans submitted to the District must show the location of the SOI, include dimensions of the SOI and plumbing, show connections to all plumbing fixtures, and include the sizing calculation in accordance with Section T.7.3.2(B).

T.7.3.2 Sand/Oil Interceptor Criteria

A. SOI Plumbing and Structural Requirements

All drains from shop areas, storage areas, washing areas, auto storage areas, and/or potential spill areas shall be connected to a SOI. If an oil or chemical storage room is too small for all oil and chemicals to be kept at least 25 feet from any floor drain, no floor drain shall be placed in that room. Fixtures to be connected include, but are not limited to, floor drains, hand sinks, and wash areas located in areas where sand and petroleum-based liquid waste materials may enter the collection system.

Each business establishment for which a SOI is required shall have a SOI serving only that establishment. Common or shared SOIs are not permitted. The District may grant a variance for a common or shared SOI if it is pre-existing and if the resulting discharge does not exceed 200 mg/L for oil and grease.

All SOIs and associated plumbing shall be installed by a licensed plumber or contractor. All SOIs must have two compartments separated by a baffle wall. The primary compartment shall have a volume equal to two-thirds of the total capacity, and the secondary compartment shall have a volume equal to one-third of the total capacity. Each compartment shall be accessible by a traffic rated manhole above the inlet and outlet piping with a minimum diameter of 24 inches. Manhole covers may not be locked, or otherwise fastened in place, such that access is restricted.

All plumbing shall be compatible with wastewater containing POGS, such as PVC. A sampling-T with a removable cap shall be placed at the outlet end of the SOI to allow sampling of effluent. The top of the sampling-T shall be no more than one foot below grade. In order to maximize retention time in the primary chamber, the bottom of the inlet piping shall extend down no less than 50% of the total water depth. The bottom of the outlet piping must extend down within nine to twelve inches of the base of the SOI. Flow from the primary to secondary compartment shall be through a baffle pass-through (hole) or over the top of the baffle. The baffle pass-through or top of the baffle shall be no more than five inches below water line. If a pass-through is used, the cross sectional area shall be at least equivalent to the cross sectional area of the inlet piping into the SOI. Support brackets are required for inlet and outlet piping. Clean outs and venting shall be PVC pipes. Vents shall be independent of any other building venting system and shall be in accordance with local building codes. See Detail Drawing D.26S for a diagram of a SOI.

Car washes with individual wash bays shall have a catch basin located directly below the drain of each bay. The catch basin(s) shall be connected to the SOI.

B. SOI Sizing

The minimum capacity of a SOI is 500 gallons. The formula for SOI capacity is:

Process floor space (sq ft) x 7.48 gallons = capacity of SOI
Use factor from Table 1

Table 1: Use Categories

Use Factor	Use Categories ₁
3 square feet	Truck wash Heavy equipment wash Commercial automatic car wash
6 square feet	Commercial car wash (hand held spray)
8 square feet	Auxiliary wash bay
15 square feet	Automotive service garage Machine shop
100 square feet	Storage area/warehouse
1,000 square feet	Parking garage ₂

Notes:

1. If your use category is not listed, contact the District for sizing calculations.
2. Do not include the top level of the parking garage if it is exposed to storm events. Runoff from this level shall be drained to the storm water system.

Common or shared SOIs are not permitted unless a variance is granted. Any common or shared SOIs must be sized appropriately for each individual user and the sizes must be added together to obtain the final SOI size. Common or shared SOIs may be reevaluated for proper sizing and capacity as facilities change business operations, practices, or owners or tenants.

C. SOI Location

Each SOI shall be so installed and connected that it shall be at all times easily accessible for inspection, cleaning, pumping, and maintenance. Each SOI manhole cover shall be readily accessible and safely removable for servicing and maintaining the SOI in good working condition. The use of ladders, the removal of bulky equipment, or any other circumstances that impedes safe access in order to service or observe SOIs shall constitute a violation of accessibility. SOIs are not permitted to be located in parking spaces or driveways with heavy traffic. The location of all SOIs shall be shown on the approved building plan.

D. SOI Maintenance

SOIs shall be maintained, at the expense of the user, by regularly scheduled cleaning so that they will properly operate as intended to efficiently intercept POGS from the user’s wastewater and prevent the discharge of said materials into the District’s wastewater collection system.

Biological treatment or enzyme treatment shall not be a substitute for the servicing of the SOI at the frequency determined by the District. Use of enzymes to bypass the SOI is prohibited.

E. SOI Closure

The District may determine that a SOI is no longer necessary. Abandoned SOIs shall be closed by:

- Complete removal of SOI contents generally performed by a authorized service company,
- Installing of a direct pipe connection from the inlet to the outlet or capping the inlet and outlet pipe,
- Filling of the empty SOI with an appropriate fill material such as sand, and
- Securing the opening(s) to the interceptor (e.g. cement, weld, etc.)

Observation of closure activities may be required by the District.

F. Facilities with Existing SOIs

An existing SOI may be undersized for a user according to the sizing requirements of Section T.7.3.3(B). The District may approve a new user or a user who is required to submit plans for review under Section T.7.3.1 to use the existing SOI if the District determines it can adequately protect the sanitary sewer from POGS. The existing SOI must have two chambers and be retrofitted to meet the requirements of Section T.7.3.3. and Detail Drawing D.26S.

T.7.3.3 Spill Prevention

All users are required to have measures in place to control unwanted discharge to the sanitary sewer. Chemicals, petroleum-based liquids, and other liquid products must be stored 1) at least 25 feet away from drains or building access to outside or 2) within adequate secondary containment to reduce the potential of spills reaching the sanitary sewer and/or storm sewer system.

T.7.3.4 Elevator Pits

New users with elevator pits shall not have drains in those elevator pits connected directly to the sanitary sewer. Sump pumps may be installed in elevator pits. The requirement for a sump pump to be installed is to be determined by the building engineer, architect, or equivalent and/or as required by the local building authority.

In the event it is determined that a sump pump shall be installed, there are three options to manage the discharge of accumulated wastewater from the sump:

- If a SOI is already required in the facility (e.g., a parking garage, maintenance garage, or warehouse where floor drains are present), then

the sump pump outlet may be plumbed through the SOI. A SOI may not be installed for the sole purpose of draining the elevator pit, because not enough wastewater will pass through the SOI to allow it to function as designed.

- If a sump pump is to be plumbed to the sanitary sewer and a SOI is not required based on other infrastructure, an oil detector shall be installed which will shut-off the flow of wastewater and sound an alarm in the event oil is detected in the wastewater. In the event the oil detector shuts off wastewater flow and the alarm sounds, the wastewater in the elevator pit shall be handled as discussed below.
- If the sump pump is not to be plumbed directly to the sanitary sewer, it may be plumbed to a holding reservoir. The size and structure of the holding reservoir is to be determined by the building engineer, architect, or equivalent and/or as required by the local building authority. Wastewater in the holding reservoir shall be handled as discussed below.

Wastewater may be continuously discharged to the sanitary sewer via a sump pump if the required oil detector described above is installed and maintained in working order. Below are approved options for handling wastewater in elevator pits where the oil detector alarm has been activated, wastewater accumulated at the bottom of a sump where there is no pump and no discharge, or wastewater in a holding reservoir:

- If the wastewater is to be discharged to the sanitary sewer, oil on the top of the water must be skimmed off or absorbed using oil absorbent pads or equivalent and disposed of by an appropriate waste hauler. Following removal of the oil, if the wastewater is in an elevator pit, the remaining wastewater may be discharged to the sanitary sewer via the sump pump. If the wastewater is in a holding reservoir or at the bottom of a sump where there is no pump and no discharge, the wastewater may then be discharged to the sanitary sewer via appropriate means (i.e. hose, bucket transport, etc.).
- Wastewater in either the elevator pit or holding reservoir may be containerized and hauled off-site by an appropriate waste hauler.
- If the volume of wastewater that accumulates in the bottom of a sump where there is no pump and no discharge or in a holding reservoir is limited and does not require discharge to the sanitary sewer or off-site disposal, the wastewater may be allowed to evaporate.

T. 8 CURED IN PLACE PIPE REHABILITATION

T.8.1 General

T.8.1.1

- A.** Minimum requirements for the rehabilitation of sanitary sewer pipelines by the installation of Cured-In-Place Pipe (CIPP) within the existing, deteriorated pipe as shown on approved drawings. The work for rehabilitation of sanitary sewer pipelines shall include the cleaning and flushing of existing sanitary sewers prior to installation of CIPP.
- B.** The rehabilitation of sanitary sewer pipelines shall be done by the installation of a resin- impregnated flexible tube which, when cured, shall be continuous and tight-fitting throughout the entire length of the original pipe. The CIPP shall extend the full length of the original pipe and provide a structurally sound, jointless and water-tight new pipe within a pipe. The Contractor is responsible for proper, accurate and complete installation of the CIPP using the system selected by the Contractor. Ground water may be present in the existing sanitary sewer. Service connections shall be reestablished after the CIPP is cured. Refer to ASTM F1216 and additional references in Section 1.2 for mandatory design, testing, and installation performance standards.

T.8.1.2 References

- A.** American Society for Testing and Materials (ASTM):
1. D256 – Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
 2. D638 – Standard Test Method for Tensile Properties of Plastics
 3. D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
 4. D1248 – Standard Specification of Polyethylene Plastics Molding and Extrusion Materials
 5. D1693 – Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
 6. D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 7. D2122 – Determining Dimensions of Thermoplastic Pipe and Fittings
 8. D2657 – Standard Practice for Heat-Joining Polyolefin Pipe and Fittings
 9. D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
 10. D2990 – Tensile, Compressive, and Flexural Creep and Creep Rupture of Plastics
 11. D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

12. D5260 - Standard Classification for Chemical Resistance of Poly(Vinyl Chloride) (PVC) Homopolymer and Copolymer Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
13. D5813 - Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems
14. F1216 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
15. F1533 - Standard Specification for Deformed Polyethylene (PE) Liner
16. F1606 - Standard Practice for Rehabilitation of Existing Sewers and Conduits with Deformed Polyethylene (PE) Liner
17. F1743 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled- in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)
18. F1867 - Standard Practice for Installation of Folded/formed Poly(Vinyl Chloride) (PVC) Pipe Type A for Existing Sewer and Conduit Rehabilitation
19. F1871 - Standard Specification for Folded/formed Poly(Vinyl Chloride) Pipe Type A for Existing Sewer and Conduit Rehabilitation
20. F2019 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)

T.8.1.3 PRE-CONSTRUCTION SUBMITTALS

A. Shop Drawings and Product Data

1. Manufacturer
2. Sufficient data to verify compliance with the specifications and to illustrate construction and assembly of the products to include, at a minimum, the testing results outlined in Section 3.5.
3. Detailed specifications and data describing materials used.
4. Indicate liner dimensions for each pipe size to be relined.
5. Complete description of proposed wet-out procedures.

B. Manufacturer's Installation Instructions

1. Submit detailed description of liner placement and curing procedures for piping (including how water will be obtained and ultimately discharged).
2. Include description of procedures for sealing liner material at manholes and reestablishing service connections.
3. Submit manufacturer's requirements for receiving, handling, and storage of materials.

C. Bypass Pumping/Piping Plan for Mainline Bypass Activities

1. A site plan showing dimensions and layout of equipment on each site and how the facilities will be protected from public access during use.

2. Detailed description of each bypass system including connection, testing, operation, alarm and control functions, and disconnection. Contingency plans for power or equipment failure shall also be included where pumps are used. Noise mitigation may be required for any overnight work with the potential to disturb the surrounding residents.
3. Schematic map showing route of discharge, discharge locations, areas to be fenced, and where and how discharge piping will be hardened to allow traffic access.

D. Odor Control Plan

1. An odor control plan that will ensure that project specific odors will be minimized at the project site and surrounding area.

E. Manufacturer's Field Start-up Report

1. Indicate personnel present and actual test procedures that were performed by manufacturer's representative.
2. Manufacturer to submit field verification of proper assembly.

F. Contractor's procedures and materials for renewal of service laterals.

T.8.1.4 PRE-CONSTRUCTION SUBMITTALS

A. Product Testing Results (as outlined in Section 3.4).

B. Digital Video Files

1. Files shall be delivered electronically via Dropbox, USB drive, or similar method.
2. Submit video recordings of piping sections.
3. Show cured liner and reestablished service connections after relining work is complete.

T.8.1.5 COORDINATION

- A. Coordinate Work of this Section with users connected to the system.
- B. Notify home owners and businesses at least 48 hours in advance of expected disruption of sanitary service.
- C. Limit disruption of service to individual properties to one-time occurrence for maximum of eight hours.
- D. Do not disrupt customer service between hours of 5:00 P.M. and 8:00 A.M.
- E. Provide and maintain temporary facilities, including piping and pumps, to meet District requirements.

T.8.1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of piping mains and services that include CIPP liner. Indicate pipe inverts and top of pipe elevations.
- B. Identify and describe unexpected variations to subsurface conditions, presence of groundwater, or discovery of uncharted utilities.

T.8.1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum five years' documented experience in installation of liner materials and licensed or certified by manufacturer.

T.8.1.8 DELIVERY STORAGE AND HANDLING

- A. The Contractor shall be responsible for the delivery, storage, and handling of products. No products shall be shipped to the job site without the approval of the District representative.
- B. Keep products safe from damage. Promptly remove damaged products from the job site. Replace damaged products with undamaged products. Protect material from moisture.

T.8.1.9 EXISTING CONDITIONS

- A. Verify field measurements prior to fabrications.
- B. Indicate field measurements on Shop Drawings.

T.8.1.10 WARRANTY

- A. Material Warranty
 - 1. All CIPP liners shall be certified by the manufacturer for specified material properties for the repair. The manufacturer shall warranty the liner to be free from defects in raw materials for ten years from the date of installation. During the warranty period, any defects which affect the integrity, strength or water tightness of the installed pipe shall be repaired at the contractor's expense.
- B. Installation Warranty
 - 1. The Installer shall guarantee the CIPP liner against defects in installation and workmanship for the period of two (2) years commencing with the date of substantial completion of the CIPP system.

T.8.2 PRODUCTS

T.8.2.1 MANUFACTURERS

- A. CIPP Liner
- B. Granite Inliner
- C. Insituform Technologies, Inc.
- D. LMK Technologies, LLC
- E. Or accepted equal that is approved by District representative

T.8.2.2 GENERAL

- A. CIPP shall be designed in accordance with ASTM F1216 and D5813.
- B. Each CIPP shall be designed to withstand internal and/or external loads as dictated by the site and pipe conditions. The CIPP design shall assume no bonding to the original pipe wall.
- C. The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or such that the knife blade moves freely between the layers.
- D. The CIPP liner shall be constructed of materials and methods that provide a jointless and continuous structurally sound liner able to withstand all imposed static, and dynamic loads on a long-term basis.
- E. Design lining material to have sufficient structural strength to support dead loads, live loads, and groundwater load imposed, assuming existing pipe cannot share loading or contribute to structural integrity of liner.
- F. Field measurements of the existing pipe diameters, ovality and length shall be taken.
- G. Pipe liner shall be capable of installation with water in the carrier pipe and surrounding groundwater.
- H. The flexible tube shall be fabricated to a size that when installed will neatly fit (minimum 99.75%) the internal circumference of the existing sanitary sewer lines (including services). Allowance shall be made for circumferential stretching during insertion so that the final cured product is snug against the wall of the host pipe.
- I. The minimum length shall be that deemed necessary by the Contractor to effectively span the distance from the inlet to the outlet of the respective manholes unless otherwise shown or specified. The Contractor shall verify the lengths in the field before impregnation.

T.8.2.3 CURED-IN-PLACE-LINER (CIPP)

- A. Unless otherwise specified, the Contractor shall furnish a general purpose, unsaturated, polyester or thermosetting vinyl ester resin and catalyst system compatible with the reconstruction inversion process that provides cured physical strengths specified herein, and complies with ASTM D5813, F1216, F1743, and F2019.

- B. Liner material shall be manufactured with resins pre-impregnated within the liner to eliminate the possibility of air bubbles and voids. Resin shall be a corrosion-resistant polyester or vinyl ester resin and catalyst system that, when properly cured within tube composite, meets requirements of ASTM F1216, F1743, and F2019.
- C. The liner thickness shall be sized for a minimum hydrostatic load of 8.0 feet and maximum depth of earth cover as measured in the field. The hydrostatic load shall be increased to the manhole depth plus 1.0 foot for bury depths in excess of 8.0 feet.
- D. The finished pipe liner in place shall be fabricated from materials which when complete is chemically resistant to and will withstand internal exposure to domestic sewage having a pH range of 5 to 11 and temperature of 150°F.
- E. Minimum Design Criteria:
 - 1. Minimum flexural strength: 4,500 PSI
 - 2. Initial Modulus of Elasticity: 250,000 PSI
 - 3. Nominal CIPP Thickness: Per ASTM F1216, Minimum of 6mm

T.8.2.4 SOURCE QUALITY CONTROL

- A. Inspect extruded material for defects and physical properties according to ASTM D1785. Verify liner material is homogeneous and free of defects, cracks, holes, blisters, protrusions, foreign materials, or other deleterious faults.
- B. For testing purposes, mark each production lot with identical marking number.
- C. Chemical and Physical Testing: Test cured samples according to ASTM D5260.

T.8.3 EXECUTION

T.8.3.1 PREPARATION

- A. Cleaning: Clean existing sewer pipes of debris, sedimentation, and mineral deposits with high-velocity cleaner, bucket and scraper, root saws, rolling or balling units, or other appropriate means.
- B. Bypassing Sewage:
 - 1. Set up bypassing pump system as detailed in Bypass Pumping/Piping Plan to isolate each section of piping for relining.
 - 2. Maintain bypass pumping until lining is totally formed and service connections are reestablished.
- C. The interior of the pipeline shall be carefully inspected to determine the location of any condition that shall prevent proper installation, such as roots, severe offsets, and collapsed or crushed pipe sections. Experienced personnel trained in locating breaks, obstacles, and service connections by closed circuit television shall perform inspection of pipelines.

T.8.3.2 ACCESS SAFETY

- A. Prior to entering access areas such as manholes, an excavation pit, performing inspection or cleaning operations, an evaluation of the atmosphere to determine the presence of

toxic or flammable vapors or lack of oxygen shall be undertaken in accordance with local, state, or federal safety regulations.

T.8.3.3 SANITARY SEWER REHABILITATION PROCEDURES

- A. Pipe Rehabilitation (CIPP) for limits between manholes, or as shown.
- B. Where practicable, liners should be installed in continuous runs where there are two or more continuous manhole segments. This is especially desirable to connect several short manhole segments with a continuous lining.
- C. Pipe rehabilitation with cured in place thermosetting resin pipe (CIPP) methods must adhere to ASTM F1216 and F2019 for pulled in place installation.
 - 1. Work includes installation of continuous lengths of homogeneous resin impregnated flexible tube cured tight to existing pipe wall with water, pressurized steam, or in accordance with the manufacturer's recommendations. CIPP installation shall be in accordance with the applicable ASTM Standards with the following modifications:
 - a. Prior to installation and as recommended by the manufacturer remote temperature gauges or sensors shall be placed inside the host pipe to monitor the temperatures during the cure cycle. Liner and/or host pipe interface temperature shall be monitored and logged during curing of the liner.
 - b. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing heat source. Another such gauge shall be placed between the impregnated reconstruction tube and the pipe invert at the remote manhole to determine the temperatures during cure. The resin manufacturer shall recommend temperature in the line during the cure period.
 - 2. After the liner has been installed, all active, existing services shall be temporarily reinstated. This shall be done without excavation in pavement areas, and in the case of non-man-entry pipes, from the interior of the pipeline by means of a 360° (degree) television camera and a cutting device that re-establishes the service connection. When a remote cutting device is used and a cleanout is available, then a mini-camera down the service may also be used to assist the operator in cutting or trimming. All coupons shall be recovered at the downstream manhole and removed.
 - 3. Work may include point repair prior to lining where necessary and as detailed in Sections 3.5, 3.6, and 3.7. All repairs must be approved by the District prior to repair work beginning.
- D. Contractor Responsibilities Include:
 - 1. Contractor to install the specified system must be responsible for complete performances of such, including, but not limited to:
 - a. Materials
 - b. Application
 - c. Quality Control
 - 2. Contractor will supply District Engineer with documentation showing past installation experience and licensing prior to construction.
 - 3. Contractor prequalification may be required by individual product manufacturers.

4. Contractor shall inspect all surfaces and sewers prior to construction and notify District Engineer of any discrepancies or disparities that may interfere with proper preparation or installation.
5. Contractor must comply with all requirements of the manufacturer.
6. Contractor is responsible for all quality assurance testing of systems after construction.
7. Contractor is responsible for all sewage bypass equipment and traffic control.
8. Contractor is to verify all existing utilities prior to digging for replacement.

T.8.3.4 TESTING

- A. The physical properties of the installed CIPP shall be verified through field sampling and laboratory testing. Materials testing shall be performed at the Contractor's expense and by an independent third-party laboratory recommended by the manufacturer and pre-approved by the District.
- B. The wall thickness shall be measured in accordance with the applicable sections of ASTM Test Method D5813 and D3567. One test shall be taken for every 500 LF of lining completed.
- C. Flexural strength and flexural modulus of elasticity shall be determined in accordance with ASTM D-790. One test shall be taken for every 500 LF of lining completed.
- D. The laboratory results shall identify the test sample location as referenced to the nearest manhole and station.
- E. If properties tested do not meet minimum requirements, after consultation with and approval of the District, the CIPP shall be removed and replaced at no additional cost to the District.
- F. As the District's discretion, additional testing may be required to confirm the installed liner is watertight. Testing may be accomplished through mainline integrity pressure testing, focused electrode leak location, or other process as designed by the District.

T.8.3.5 FINISHED CIPP

- A. Finished Pipe Liner
 1. Shall be inner polyethylene layer and an outer polyester felt layer impregnated with a thermosetting resin to fit tightly against the existing inside pipe wall.
 2. Shall be fabricated from materials that, when cured, shall be chemically resistant to withstand internal exposure to sewage gases containing quantities of hydrogen sulfide, carbon monoxide, methane, petroleum hydrocarbons, moisture saturation, and dilute sulfuric acid.
 3. Shall be continuous over the length of pipe rehabilitated.
 4. There shall be no damage, deflection, holes, delaminating, uncured resin or other visual defects in the liner. The CIPP shall be free of dry spots, lifts, and shall be smooth with minimal wrinkling.
 5. No visible leakage through the liner or at manhole or service lateral connections will be allowed.

B. Interior Surface

1. Interior surface liner within 10 feet of manholes shall be wrinkle free. All wrinkles within this limit shall be properly removed to allow proper installation of flow restricting plugs.
2. Wrinkles in the finished lined pipe that meet one or more of the following criteria are unacceptable and shall be removed or repaired by the contractor in a method that is approved by the District at no additional cost to the District:
 - a. Cause a backwater greater than one (1) inch in depth,
 - b. Reduce the hydraulic capacity of the pipeline as determined by the District,
 - c. Have a height equal to or greater than 5% of the pipe diameter,
 - d. Cause a maintenance problem or inconvenience as determined by the District,
 - e. Cause debris and solids to hang-up and accumulate, or
 - f. Reduce the structural stability of the pipe.
3. If wrinkles are detected in the installed liner, the Contractor shall provide photographs and dimensions of the wrinkle including height and direction. Methods of repair shall be proposed by the Contractor and submitted to the District for review. The District will determine on a case by case basis if removal of the wrinkle, or replacement or repair of CIPP liner is required.
4. If a void, lift, blister, or delamination between the liner and the pipe exists, the Contractor shall repair or replace that section of pipe at no additional cost to the District. Repairs shall be made by removal and replacement of the liner around the full circumference of the pipe, in the vicinity of the defect. All repairs shall be approved by the District prior to implementation and removal of defect liner and patching shall not be allowed unless approved by the District.

C. Liner Terminations at Manholes

1. The beginning and end of the CIPP shall be cut flush at the inlet and outlet points in the manhole.
2. The ends shall be permanently sealed to the rehabilitated pipeline to prevent any infiltration between the CIPP and the host pipe.
3. Ends shall be sealed with a resin mixture that is recommended by the liner manufacturer.
4. Sealing:
 - a. Shall be compatible with the liner/resin system, provide a watertight seal and is approved by the Engineer prior to start of construction.
 - b. Hydraulic cements and quick-set cement products are not acceptable.
 - c. Acceptable materials shall be an approved epoxy type product that will bond, not crack, dry up, slough off, or shrink in time, and provide a good transition in the manholes.

T.8.3.6 SERVICE LATERAL RENEWAL

- A. All sewer services connected to the main shall be reinstated after the sewer main has been lined or replaced due to defects. Service connections shall be reinstated to no more than 100% of the original area as it enters the host pipe.
- B. The exact location and number of service connections or side sewers shall be verified during the initial television inspection. It shall be the Contractor's responsibility to accurately field locate all existing service connections or side sewers and establish means for access for flow control. The Contractor shall reconnect all active service connections or side sewers to the liner pipe as determined by the District and indicated in accordance with the Contract Documents.
- C. The Contractor shall be responsible for restoring/correcting, without any delay, all missed or faulty reconnections, as well as any damage caused to property owners for not reconnecting the services soon enough or for not giving notice to the property owners.
- D. Any lateral not initially reinstated by the Contractor that proves to be active shall be reinstated by the Contractor at no additional cost to the District and the Contractor shall be responsible for any resulting property damage.
- E. All existing service connections shall be reconnected by a remote-controlled cutting device directed internally by a television camera or by internal manual cutting. Cuts shall be made by experienced operators so that no blind attempts or holes are made in the liner pipe. Locations shall be verified carefully to match earlier tapes for accurate lateral location, especially where dimples are not well defined. The District reserves the right to require service connection by excavation at the Contractor's expense at any location if the quality or workmanship of the cut is not satisfactory.
- F. A 2-pass process of using a cutter to open the lateral followed by wire brush (or similar) attachment to complete the cutting flush with the lateral walls should be used, or approved alternate. It shall be properly aligned, invert to invert, to the existing connection with no obstructions to the flow. Resin slugs shall be removed as necessary from reinstated service connections. Any mis-cuts shall be repaired at no cost to the District and shall be performed utilizing an additional thinner liner to prevent water from entering behind the liner to the full satisfaction of the District. All coupons cut from the liner for reopening of lateral connections shall be retrieved from the sewer, accounted for by the Contractor, and turned over to the District.
- G. Contractor shall provide a sound, smooth transition from laterals to the main sewer. Contractor shall submit for approval a detailed repair plan for the permanent repair of any gaps between the installed liner and the face of the lateral connections. As part of the repair plan, the District may direct the contractor to install "top-hat" or "brim" style connections at select service laterals. The fitting to be utilized for all lateral connections shall be the Lapel Liner by LMK Technologies, or approved equal, and installed in accordance with the manufacturers written instructions.

T.8.3.7 FINAL ACCEPTANCE

- A. All CIPP sample testing and repairs to the installed CIPP as applicable shall be completed, before final acceptance, meeting the requirements of these specifications and documented in written form.
- B. The Contractor shall perform a detailed closed-circuit television inspection in accordance with ASTM standards, after installation of the CIPP liner and reconnection of the side sewers. The finished liner shall be continuous over the entire length of the installation and shall be free of significant visual defects, damage, deflection, holes, leaks and other defects. Unedited digital recordings of the inspection shall be provided to the District within ten (10) working days of the liner installation.
- C. The data shall note the inspection date, manhole depths from rim to inverts, location of all reconnected side sewers, debris, defects in the liner, including but not limited to gouges, cracks, bulges, or bumps. Immediately prior to conducting the video inspection, the Contractor shall thoroughly clean the newly installed liner removing all debris and build-up that may have accumulated, at no additional cost to the District.
- D. Bypass pumping or plugging from the upstream manhole shall be utilized to minimize sewage from entering the line during the inspection. In the case of bellies in the line, the pipe shall be cleared of any standing water to provide continuous visibility during the inspection.

Upon Engineering evaluation...

- G. Mainline Integrity Pressure Testing
 - 1. After installation or during the curing/installation process, Contractor shall conduct a mainline integrity pressure test. The test must demonstrate CIPP mainline is watertight.
 - 2. The Contractor shall furnish all necessary equipment to conduct the test. An acceptable method is a low pressure air test, conducted as follows:
 - 3. Pressurize the test section to 4.0 psi and hold above 3.5 psi for not less than 2 minutes. Add air if necessary to keep the pressure above 3.5 psi. At the end of this 2 minute stabilization period, note the pressure (must be 3.5 psi minimum) and begin the timed period. If the pressure drops 0.5 psi in less than the time given in the table below, the section of pipe shall have failed the test.
 - 4. When the prevailing groundwater is above the sewer being tested, test pressure shall be increased 0.43 psi for each foot that the water table is above the invert of the sewer.

Sewer Diameter (Inches)	Minimum Test Time per 100 ft.
8	72
10	90
12	108
18	144

5. If the time for the pressure to drop 0.5 psi is 125 percent or less of the time given in the table, the line shall immediately be re-pressurized to 3.5 psi and the test repeated.
6. The pressure gage used shall be supplied by the Contractor and have minimum divisions of 0.10 psi and be oil filled.

CHAPTER 3



SANITARY SEWER DRAWING DETAILS

DRAWING	DETAIL TITLE
D.1S	Typical Street Cross Section And Street Centerline Profile
D.2S	Typical Street Cross Section Public Street
D.3S	Standard And Special Bedding Detail
D.4S	Expansive Soil Bedding Detail
D.5S	Base & Deflector Detail
D.6S	Precast Manhole Precast Base Detail
D.7S	Precast Manhole Cast-In-Place Detail
D.8S	24" Manhole Ring & Cover Detail
D.9S	Plastic Step Detail
D.10S	Outside Drop Manhole For Pipe 15" Or Smaller Detail
D.11S	Domestic Sewer Tapping Saddle Detail
D.12S	Domestic Sewer Wye Connection Detail
D.13S	Intermediate Platform Detail
D.14S	Steel Marker Post Detail
D.15S	Sewer Wye Branch Connection - Depth Less Than 12'
D.16S	Sewer Wye Branch Connection - Depth Greater Than 12'
D.17S	Pipe Casing and Spacer Detail
D.18S	Typical Precast Manhole Trace Wire Placement Detail
D.25S	Gravity Grease Interceptor
D.26S	Low & High Rate Sand and Oil Interceptor
D.27S	Low & High Commercial Grease Interceptor
D.28S	Standard Easement

CHAPTER 4

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EXHIBITS

EXHIBIT A

Southwest Metropolitan Water and Sanitation District

Easement Preparation and Submittal Procedures and Checklist

These procedures have been prepared in order to provide general guidelines for the submittal of information necessary for the preparation of water and sanitary sewer easements granted to Southwest Metropolitan Water and Sanitation District. This information generally includes legal descriptions and drawings, an overall easement drawing, and a title commitment. Information contained herein should be used in conjunction with the District's Water and Sanitary Sewer System Standards and Specifications.

All information required in the submittal section of these procedures must be presented to the District prior to the approval of and release of construction plans. Submittals must be accompanied by this form with Part A completed by the Easement Grantor or his designated representative.

All legal fees and costs associated with preparation of the easement documents will be charged to the grantor.

Submittal

The following information must be presented in two copies to the Southwest Metropolitan Water and Sanitation District.

1. A legal description and 8 ½" x 14" drawing of each proposed easement. The drawing must be prepared in either 1" = 50 feet or 1" = 60 feet scale (see attached example).

Each separate property ownership requires a separate legal description and drawing. Legal descriptions and drawings shall be numbered consecutively as parcel number 1, parcel number 2, etc.

All legal descriptions and drawings must have ties to recognized land corners and must indicate the basis of bearings.

The acreage of the proposed easements shall be indicated on the legal descriptions and drawings.

2. An overall survey drawing, stamped by a registered land surveyor, showing the boundaries of the development, the proposed easements, and all existing easements, ditches, and structures.

If off site easements are requested and not shown on the overall survey drawing, a separate overall drawing indicating the relationship of offsite easements to the proposed development

shall be submitted. Encroachments and/or encumbrances on the proposed offsite easements, such as existing easements, ditches, and structures, must be identified on the overall drawing.

3. Proof of ownership as described in Part A (below).

Easement Checklist

Part A (to be completed by Grantor)

1. On the lines provided below, please type or print the name of the Grantor for each easement exactly as the Grantor's name appears on the Deed by which the Grantor took title to the property. If the Grantor is a corporation, please list the State in which the corporation was incorporated, plus the names of all officers. If Grantor is a general partnership, a copy of the recorded trade name affidavit must be furnished along with the names of the general partners. If Grantor is a limited partnership, a certificate of limited partnership must be furnished along with the names of the partners.

Easement No.

Name, title, address and telephone number of persons who will be signing Easement Deed

_____	_____
_____	_____
_____	_____

2. Please provide the name, address, and telephone number of the party to whom the prepared documents should be forwarded for signature.

Easement No(s).

Name, address and telephone number

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

4. Please list name, address, and telephone number for the party responsible for payment of costs associated with preparation of easement documents.

Part B (To be completed by District Representative)

1. Please provide the information requested below:

Easement Parcel	Water or Sewer Easement	Exclusive or Non-Exclusive
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

2. The legal descriptions, drawings, and proposed locations of utilities have been compared and reviewed, and are recommended for acceptance by the District.

(District Representative)

(Date Approved)

Part C (To be completed by District Representative)

1. Please state any special considerations or time constraints which should be brought to the attention of the District's attorney. Include a brief background statement describing location and extent of development as well as proposed points of connection to existing mains.

2. I have reviewed the proposed easements and recommend that they be accepted by the District.

(District Representative)

(Date Approved)

Part D (To be completed by District Representative)

1. For each easement, please provide the following information.

Easement No.	Date Recorded	County	Reception No. or Book and Page No.
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

2. Copies of all easements have been mailed to (please indicate date mailed):

_____ Grantor
(Date Mailed)

_____ District Attorney (with copy of Easement checklist)
(Date Mailed)

_____ Denver Water Department (Water Easements Only)
(Date Mailed)

_____ (District Representative)

_____ (Date Approved)

EXHIBIT B

GENERAL NOTES ON SEWER PLANS

1. All sanitary sewer mains and system plans and construction shall conform with the Southwest Metropolitan Water and Sanitation District (the District) sanitary sewer standards and specifications, and be subject to construction observation by District personnel or representatives. Copies of the District standards and specifications may be obtained from the District Manager. The Owner, his Engineer or Contractor, shall schedule a preconstruction meeting with the District Manager and District Engineer at least 48 hours prior to the start of construction. Plans with the District review stamp will be distributed at the preconstruction meeting. No construction will be permitted until formal completion of easements and recordings, and prior to the preconstruction meeting.
2. Underground utilities in the area of construction have been located from Field Investigation and the best available utility records and are approximate only. The Contractor shall be responsible for the protection of all utility lines whether shown on the plans or not. The Contractor shall coordinate his activities with the affected utility companies and shall notify the Utility Notification Center of Colorado, Phone number(UNCC) 811, 48 hours prior to starting construction.
3. The length of sanitary sewer lines is the horizontal distance between center of manhole to center of manhole. Therefore, distances shown on the plans are approximate and could vary due to vertical alignment and manhole dimensions.
4. The Contractor shall have in his possession at all times one (1) signed copy of plans approved by the District.
5. Record drawings as required in the specifications are to be submitted by the Contractor prior to initial/probationary acceptance of the construction.
6. The Contractor shall be responsible for removing and replacing any existing signs, structures, fences, etc., encountered on the job and restoring them to their original condition.
7. The Contractor is responsible for:
 - A. Notifying the District 48 hours in advance of any need to shut down any portion of the existing sanitary sewer system.
 - B. Notifying the District 48 hours in advance of the work.

- C. In case of an emergency after working hours, call the District office at 979-2333 for recorded instructions.
- 8. Prior to installation of sanitary sewer mains, road construction must have progressed to at least the "sub-grade" stage. Sub-grade is defined as an elevation of no more than eight inches below the finished street grade. All manhole covers shall be adjusted to the final finished grade by the Contractor.
- 9. The Contractor shall be responsible for removing any groundwater encountered during the construction of any portion of this project. Groundwater shall be pumped, piped, removed and disposed of in a manner which does not cause flooding of existing streets nor erosion on abutting properties in order to construct the improvements shown on these plans. No concrete shall be placed where groundwater is visible or until the groundwater table has been lowered below the proposed improvements. Any unstable areas, as a result of groundwater, encountered during the construction of the proposed improvements shall be stabilized as agreed upon by the Contractor, the District, and the Design Engineer at the time of their occurrence.
- 10. It shall be the Design Engineer's responsibility to resolve construction problems with the District due to changed conditions encountered during the progress of any portion of the proposed work. If, in the opinion of the District, proposed alterations to the signed construction plans involves significant changes to the character of the work, or to the future contiguous public or private improvements, the Design Engineer shall be responsible for submitting revised plans to the District for review prior to any further construction related to that portion of the work.
- 11. The Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of the project, including safety of all persons and property; that this requirement shall apply continuously, and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold harmless from any and all liability, real or alleged, in connection with the performance of work on this project. Excepting for liability arising from the sole negligence of, the Owner, the Design Engineer, or the County.
- 12. The pipe used for sanitary sewer mains shall be in accordance with ASTM D-3034 SDR35/SDR 26, where applicable, PVC pipe in paved R-O-W's and easements, and AWWA C900-07, Class 165 in unpaved easements, AWWA C900-07, Class 235 in expansive areas. Unless noted otherwise. All pipe shall be green in color.
- 13. Probationary acceptance of the new sanitary sewer mains is contingent upon receiving copies of:
 - A. Sanitary sewer trench compaction test results, and
 - B. Record drawings

14. The sanitary sewer system will be tested in accordance with the District standards and specifications. The District will require the Contractor to conduct and submit the following:
 - A. Flushing, Video and measurement of dips or sags.
 - B. Low pressure air test 100% of the new PVC pipe system
 - C. Air vacuum test of 100% of manholes.
15. Manhole rims shall be set at an elevation relative to the pavement, in accordance with the Governing Agency standards. Whether the manhole is in a paved or unpaved grade, a minimum of one (1) and a maximum of four (4) rows concrete rings shall be used to adjust the rim elevations to final grade. The maximum acceptable vertical adjustment utilizing concrete rings is twelve (12) inches. No multiple 2" and 3" concrete rings allowed.
16. Connections to existing District lines will be permitted upon acceptance of the new sanitary sewer system. Existing pipe at the point of connection shall not be "broken out" until the new system is accepted.
17. The Contractor shall verify existing manhole inverts to be connected to prior to construction staking.
18. The Contractor shall take care to properly shape all manhole inverts and benches in accordance with District standards and specifications to promote smooth flow through the manhole. The channels must be full depth as a minimum. Inverts of lines intersecting at 90 degrees and at highly divergent or flat slopes are especially critical. A camera must be able to pass through the manhole channel. Manhole inverts shall be constructed with a smooth trowel finish, and benched finished with a light broom, non-skid, finish.
19. The District, it's representative, and/or the District Engineer, is not a guarantor of the constructing Contractors' obligations and performance of contract.
20. Observations of work in progress and on-site visits are not to be construed as a guarantee by the District or District Engineer of the Contractor's contractual commitment.
21. The District, and/or District Engineer, is not responsible for safety in, on, or about the project site, not for compliance by the appropriate party of any regulations relating thereto.

22. The Owner is responsible for all costs associated with plan review and construction observation.

EXHIBIT C

**CERTIFICATION AS TO WATER AND SEWER LINE PLACEMENT
IN EASEMENTS**

for

(Name of Project)

I, _____, a professional land surveyor registered in the State of Colorado, hereby certify to the Southwest Metropolitan Water and Sanitation District that the attached Improvement Location Certificate(s) of the following Easement Deed(s) and/or Easement Agreement(s) recorded upon the public records of Jefferson County, Colorado, to-wit:

Was (were) prepared by me on the _____ day of _____, 20____. I further certify to the Southwest Metropolitan Water and Sanitation District that, except as indicated, all water and sewer lines, including fire hydrants, installed in connection with the above-referenced project, as of _____, 20____, are located within the boundaries of said recorded easements as shown on the attached Improvement Location Certificate(s), except for lines located in dedicated public rights-of way.

(STAMP)

By: _____
(Signature)

Type or Print Signature

License Number

Date

EXHIBIT D

UNDERDRAIN AGREEMENT

THIS UNDERDRAIN AGREEMENT is entered into this _____, day of _____, 20____, by and between, **SOUTHWEST METROPOLITAN WATER AND SANITATION DISTRICT**, a quasi-municipal corporation of the State of Colorado (Hereinafter referred to as "Southwest Metropolitan"), whose address is 8739 West Coal Mine Avenue, Littleton, Colorado, 80123 and _____, whose address is _____.

WHEREAS, Developer is the owner of a tract of land commonly known as _____ (hereinafter referred to as "Property"), located in Arapahoe County, Colorado, and more particularly described on Exhibit A attached hereto and made a part hereof; and

WHEREAS, for Developer's convenience and for Developer's better enjoyment of the Property, Developer has requested permission to install and construct a private underdrain system in the same trench with Southwest Metropolitan's sanitary sewer line(s) that will serve the Property; and

WHEREAS, Southwest Metropolitan has determined that granting the Developer's request will be of benefit to the future inhabitants of Southwest Metropolitan.

NOW, THEREFORE, in consideration of the mutual promises and covenants hereinafter set forth, the parties hereto agree as follows:

1. Consent. Developer may, at Developer's expense, install Developer's underdrain (hereinafter referred to as "Underdrain") in the same trench with Southwest Metropolitan's sanitary sewer line(s) that serve the Property. If such Underdrain is installed, Developer shall, at all times, have the obligation, enforceable at the demand of Southwest Metropolitan, to operate, maintain, repair and replace said Underdrain as may be necessary or desirable from time-to-time.

Before performing any maintenance on or repair or replacements of the Underdrain, Developer agrees to give Southwest Metropolitan at least five (5) days' written notice of the time and place where any such maintenance, repair or replacement operations are to take place. All maintenance, repair or replacement operations shall be performed in a manner so as not to interfere with or endanger the physical condition or operation of Southwest Metropolitan's sewer line(s), waterline(s) or other public property.

In emergency situations, Developer need not give five (5) days' written notice before performing maintenance, repair or replacement operations; however, Developer agrees to notify the District by telephone at Area Code 303-979-2333 of emergency maintenance, repair or replacement operations and to provide the District with written notice of the same as soon as practicable thereafter.

2. Ownership and Control. It is expressly understood and agreed that Southwest Metropolitan shall not own, operate, manage or control the Underdrain contemplated herein; that Southwest Metropolitan shall have no obligation to operate, manage, control, maintain, repair or replace the Underdrain; and that said Underdrain is and shall remain at all times private property, completely separate and apart from the public sanitary sewer and waterline(s) and other public property of Southwest Metropolitan. Nothing contained herein and nothing hereafter done by Developer, its successors and assigns, shall constitute a dedication of the Underdrain to Southwest Metropolitan. Southwest Metropolitan shall under no circumstances whatsoever accept the Underdrain, or be deemed to have accepted the Underdrain, as property of Southwest Metropolitan.

2.1 Notwithstanding anything contained in this Agreement to the contrary, it is understood and agreed that if the physical condition or operation of Southwest Metropolitan's sewer line(s), waterline(s) or other public property is interfered with or endangered or constitutes a risk to the health and safety of the public as a result of Developer's Underdrain, then in that event, and only in that event, Southwest Metropolitan shall have the right, at Developer's expense, to do whatever is reasonable and necessary under the circumstances so that Southwest Metropolitan's sewer line(s), waterline(s) or other public property is no longer defective, endangered, interfered with or constitutes a risk to the health and safety of the public.

3. Record Drawings. Developer agrees to furnish Southwest Metropolitan with a sepia mylar set of as-built construction drawings for the Underdrain the Developer installs. Said drawings are to be stamped and signed by a civil engineer registered and licensed to practice in the State of Colorado.

4. Indemnification. Developer agrees to indemnify and save Southwest Metropolitan, its officers, Directors, agents and employees harmless from and against every claim, demand, liability, cost, charge, suit, judgment and expense of whatsoever kind or nature, including, but not limited to, interest, court costs and attorney's fees which Southwest Metropolitan, its officers, Directors, agents or employees may pay or incur by reason of or which in any way arise out of: (1) this Agreement, (2) the enforcement of this Agreement, or (3) the Underdrain contemplated herein.

This indemnification shall extend to claims, demands and liability of injury to persons and property and financial loss which occur off the job site as well as on, and for injury and damage to person and property and financial loss occurring after construction of the Underdrain contemplated herein, as well as for any such injury, damage or loss occurring during the construction of the Underdrain.

5. No Reliance. Developer acknowledges that Developer has not relied upon Southwest Metropolitan to determine whether the Underdrain system and its various components will perform any certain function. Developer is relying solely upon Developer's professional engineer and contractor to: (1) prepare the design and plans for the Underdrain, (2) determine the material, specifications and soil conditions with regard to the Underdrain, and (3) construct the Underdrain according to the Developer's plans and specifications.

6. Subdivision Documents. Developer agrees that the Property will be held, sold and conveyed subject to recorded covenants, conditions and restrictions that, among other things, shall expressly:

a) Refer to this Underdrain Agreement and recite the book, page and reception number at which said Agreement is recorded in the office of the Clerk and Recorder of Arapahoe County;

b) Provide for a homeowners' association as part of the plan for the development of the Property, which association shall, among other things, assume ownership of the Underdrain and become primarily responsible for the operation, maintenance, repair, replacement and relocation of the Underdrain as may be necessary or advisable from time to time;

c) Permit the District to require the repair, reconstruction, replacement or relocation of the Underdrain, or any portion thereof, if the District determines for any reason that its public water or sewer system is being endangered by the Underdrain;

d) Subordinate any easement granted to the homeowners' association for the operation and maintenance of the Underdrain to the rights granted to Southwest Metropolitan by recorded right-of-way agreement, easement deed, plat dedication or platted easement for the operation and maintenance of Southwest Metropolitan's facilities;

e) Require the homeowners' association to establish an adequate fund to cover the cost of predictable operation, maintenance, repair, replacement and relocation costs, which fund shall be maintained by the assessment of sufficient fees against members of the association to satisfy said obligations;

f) Reaffirm that Southwest Metropolitan does not own, operate, manage or control the Underdrain system, that the Underdrain system is private property and that Southwest Metropolitan shall not have any obligations for its operation, maintenance, repair, replacement or relocation.

7. Continuance of Benefits and Obligations. This Underdrain Agreement shall inure to the benefit and shall be binding upon the successors and assigns of the parties hereto, including, but not limited to, the Grantees of the Developer. It is agreed that the conditions, covenants and restrictions, together with the homeowners' association referred to in paragraph 6 above, are vehicles for facilitating the performance of Developer's obligations hereunder and shall in no way supersede this Underdrain Agreement or relieve Developer or the Grantees of Developer from any obligation hereunder.

8. Authority to Execute. The person or persons executing this Agreement on behalf of Developer personally warrant(s) and covenant to Southwest Metropolitan that he or she has full and complete authority to bind the Developer in accordance with the terms of this Agreement.

STATE OF _____)
)ss.
COUNTY OF _____)

The above and foregoing was acknowledged before me this _____ day of _____, 20____ by _____, as _____ of the _____, a _____.

Witness my hand and official seal.

My Commission expires:_____

Notary Public

EXHIBIT E

GENERAL NOTES FOR CONSTRUCTION PLANS

1. ALL SANITARY SEWER MAINS AND SYSTEM PLANS AND CONSTRUCTION CONFORM WITH THE SOUTHWEST METROPOLITAN WATER AND SANITATION DISTRICT (THE DISTRICT) SANITARY SEWER STANDARDS AND SPECIFICATIONS AND BE SUBJECT OF CONSTRUCTION OBSERVATION BY DISTRICT PERSONNEL OR REPRESENTATIVES. COPIES OF THE DISTRICT STANDARDS AND SPECIFICATIONS MAY BE OBTAINED FROM THE DISTRICT MANAGER. THE OWNER, HIS ENGINEER OR CONTRACTOR, SHALL SCHEDULE A PRECONSTRUCTION MEETING WITH THE DISTRICT MANAGER AND DISTRICT ENGINEER AT LEAST 48 HOURS PRIOR TO THE START OF CONSTRUCTION. PLANS WITH THE DISTRICT REVIEW STAMP WILL BE DISTRIBUTED AT THE PRECONSTRUCTION MEETING. NO CONSTRUCTION WILL BE PERMITTED UNTIL FORMAL COMPLETION OF EASEMENTS AND RECORDINGS, AND PRIOR TO THE PRECONSTRUCTION MEETING.
2. UNDERGROUND UTILITIES IN THE AREA OF CONSTRUCTION HAVE BEEN LOCATED FROM FIELD INVESTIGATION AND THE BEST AVAILABLE UTILITY RECORDS ARE APPROXIMATE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL UTILITY LINES WHETHER SHOWN ON THE PLANS OR NOT. THE CONTRACTOR SHALL COORDINATE HIS ACTIVITIES WITH THE AFFECTED UTILITY COMPANIES AND SHALL NOTIFY THE UTILITY NOTIFICATION CENTER OF COLORADO (UNCC), PHONE NUMBER 811, 48 HOURS PRIOR TO STARTING CONSTRUCTION.
3. THE LENGTH OF SANITARY SEWER LINES IF THE HORIZONTAL DISTRICT BETWEEN CENTER OF MANHOLE TO CENTER OF MANHOLE. THEREFORE, DISTANCES SHOWN ON THE PLANS ARE APPROXIMATE AND COULD VARY DUE TO VERTICAL ALIGNMENT AND MANHOLE DIMENSIONS.
4. THE CONTRACTOR SHALL HAVE IN HIS POSSESSION AT ALL TIMES (1) SIGNED COPY OF PLANS APPROVED BY THE DISTRICT.
5. RECORD DRAWINGS AS REQUIRED IN THE SPECIFICATIONS ARE TO BE SUBMITTED BY THE CONTRACTOR PRIOR TO INITIAL/PROBATIONARY ACCEPTANCE OF THE CONSTRUCTION.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING AND REPLACING ANY EXISTING SIGNS, STRUCTURES, FENCES, ETC., ENCOUNTERED ON THE JOB AND RESTORING THEM TO THEIR ORIGINAL CONDITION.
7. THE CONTRACTOR IS RESPONSIBLE FOR:

- A. NOTIFYING THE DISTRICT 48 HOURS IN ADVANCE OF ANY NEED TO SHUT DOWN ANY PORTION OF THE EXISTING SANITARY SEWER SYSTEM.
 - B. NOTIFYING THE DISTRICT 48 HOURS IN ADVANCE OF THE WORK.
 - C. IN CASE OF AN EMERGENCY AFTER WORKING HOURS, CALL THE DISTRICT OFFICE AT 303-979-2333 FOR RECORDED INSTRUCTIONS.
8. PRIOR TO INSTALLATION OF SANITARY SEWER MAINS, ROAD CONSTRUCTION MUST HAVE PROGRESSED TO AT LEAST "SUB-GRADE" STAGE. SUB-GRADE IS DEFINED AS AN ELEVATION OF NO MORE THAN EIGHT INCHES BELOW THE FINISHED STREET GRADE. ALL MANHOLE COVERS SHALL BE ADJUSTED TO THE FINAL FINISHED GRADE BY THE CONTRACTOR.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVING ANY GROUNDWATER ENCOUNTERED DURING THE CONSTRUCTION OF ANY PORTION OF THIS PROJECT. GROUNDWATER SHALL BE PUMPED, PIPED, REMOVED AND DISPOSED OF IN A MANNER WHICH DOES NOT CAUSE FLOODING OF EXISTING STREETS NOR EROSION ON ABUTTING PROPERTIES IN ORDER TO CONSTRUCT THE IMPROVEMENTS SHOWN ON THESE PLANS. NO CONCRETE SHALL BE PLACED WHERE GROUNDWATER IS VISIBLE OR UNTIL THE GROUNDWATER TABLE HAS BEEN LOWERED BELOW THE PROPOSED IMPROVEMENTS. ANY UNSTABLE AREAS, AS A RESULT OF GROUNDWATER, ENCOUNTERED DURING THE CONSTRUCTION OF THE PROPOSED IMPROVEMENTS SHALL BE STABILIZED AS AGREED UPON BY THE CONTRACTOR, THE DISTRICT, AND THE DESIGN ENGINEER AT THE TIME OF THEIR OCCURRENCE.
10. IT SHALL BE THE DESIGN ENGINEER'S RESPONSIBILITY TO RESOLVE PROBLEMS WITH THE DISTRICT DUE TO CHANGED CONDITIONS ENCOUNTERED DURING THE PROGRESS OF ANY PORTION OF THE PROPOSED WORK. IF, IN THE OPINION OF THE DISTRICT, PROPOSED ALTERATIONS TO THE SIGNED CONSTRUCTION PLANS INVOLVES SIGNIFICANT CHANGE TO THE CHARACTER OF THE WORK, OR TO THE FUTURE CONTIGUOUS PUBLIC OR PRIVATE IMPROVEMENTS, THE DESIGN ENGINEER SHALL BE RESPONSIBLE FOR SUBMITTING REVISED PLANS TO THE DISTRICT FOR REVIEW PRIOR TO ANY FURTHER CONSTRUCTION RELATED TO THAT PORTION OF THE WORK.
11. THE CONTRACTOR AGREES THAT HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OR THE PROJECT, INCLUDING SAFETY OF ALL PERSON AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY, AND NOT BE LIMITED TO NORMAL WORKING HOURS; AND THAT THE CONTRACTOR SHALL DEFEND, ENDEMNIFY AND HOLD HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT.

EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF, THE OWNER, THE DESIGN ENGINEER, OR THE COUNTY.

12. THE PIPE USED FOR SANITARY SEWER MAINS SHALL BE IN ACCORDANCE WITH ASTM D-3034 SDR35/SDR26, WHERE APPLICABLE, PVC PIPE IN PAVED R-O-W'S AND EASEMENTS AND AWWA C900-07 CLASS 165 IN UNPAVED EASEMENTS, AWWA 900-07 CLASS 235 IN EXPANSIVE AREAS. UNLESS NOTED OTHERWISE. ALL PIPE SHALL BE GREEN IN COLOR.
13. INITIAL/PROBATIONARY ACCEPTANCE OF THE NEW SANITARY SEWER MAINS IS CONTINGENT UPON RECEIVING COPIES OF:
 - A. SANITARY SEWER TRENCH COMNPACTION TEST RESULTS, AND
 - B. RECORD DRAWINGS.
14. THE SANITARY SEWER SYSTEM WILL BE TESTED IN ACCORDANCE WITH THE DISTRICT STANDARDS AND SPECIFICATIONS. THE DISTRICT WILL REQUIRE THE CONTRACTOR TO CONDUCT AND SUBMIT THE FOLLOWING:
 - A. FLUSHING, VIDEO AND MEASUREMENT OF DIPS OR SAGS.
 - B. LOW PRESSURE AIR TEST 100% OF THE NEW PVC PIPE SYSTEM, AND
 - C. AIR VACUUM TEST OF 100% OF MANHOLES.
15. MANHOLE RIMS SHALL BE SET AT AN ELEVATION RELATIVE TO THE PAVEMENT, IN ACCORDANCE WITH THE GOVERNING AGENCY STANDARDS. WHETHER THE MANHOLE IS IN A PAVED OR UNPAVED GRADE, A MINIMUM OF ONE (1) AND A MAXIMUM OF FOUR (4) ROWS OF CONCRETE RINGS SHALL BE USED TO ADJUST THE RIM ELEVATIONS TO FINAL GRADE. THE MAXIMUM ACCEPTABLE VERTICAL ADJUSTMENT UTILIZING CONCRETE RINGS IS TWELVE (12) INCHES. NO MULTIPLE 2" AND 3" CONCRETE RINGS ALLOWED.
16. CONNECTIONS TO EXISTING DISTRICT LINES WILL BE PERMITTED UPON ACCEPTANCE OF THE NEW SANITARY SYSTEM. EXISTING PIPE AT THE POINT OF CONNECTION SHALL NOT BE "BROKEN OUT" UNTIL THE NEW SYSTEM IS ACCEPTED.
17. THE CONTRACTOR SHALL VEWRIFY EXISTING MANHOLE INVERTS TO BE CONNECTED TO PRIOR TO CONSTRUCTION STAKING.
18. THE CONTRACTOR SHALL TAKE CARE TO PROPERLY SHAPE ALL MANHOLE INVERTS AND BENCHES IN ACCORDANCE WITH DISTRICT STANDARDS AND SPECIFICATIONS TO PROMOTE SMOOTH FLOW THROUGH THE MANHOLE. THE CHANNELS MUST BE FULL DEPTH AS A MINIMUM. INVERTS OF LINES INTERSECTING AT 90 DEGREE AND A HIGHLY DIVERGENT OR FLAT SLOPES ARE ESPECIALLY CRITICAL. A CAMERA MUST BE ABLE TO PASS THROUGH THE MANHOLE CHANNEL. MANHOLE

INVERTS SHALL BE CONSTRUCTED WITH A SMOOTH TROWEL FINISH, AND BENCHED WITH A LIGHT BROOM, NON-SKID FINISH.

19. THE DISTRICT, IT'S REPRESENTATIVE, AND/OR THE DISTRICT ENGINEER, IS NOT A GUARANTOR OF THE CONSTRUCTING CONTRACTORS' OBLIGATIONS AND PERFORMANCE OF CONTRACT.
20. OBSERVATIONS OF WORK IN PROGRESS AND ON-SITE VISITS ARE NOT TO BE CONSTRUED AS A GUARANTEE BY THE DISTRICT OR DISTRICT ENGINEER OF THE CONTRACTOR'S CONTRACTUAL COMMITMENT.
21. THE DISTRICT, AND/OR DISTRICT ENGINEER, IS NOT RESPONSIBLE FOR SAFETY IN, ON, OR ABOUT THE PROJECT SITE, NOT FOR COMPLIANCE BY THE APPROPRIATE PARTY OF ANY REGULATIONS RELATING THERETO.
22. THE OWNER IS RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH PLAN REVIEW AND CONSTRUCTION OBSERVATION.

EXHIBIT F

APPLICATION AND AGREEMENT FOR EXTENSION OF SEWER MAINS

THIS APPLICATION AND AGREEMENT (“Agreement”) is made and entered into in quadruplicate original between _____ (hereinafter referred to as “Applicant”), whose address is _____ and **SOUTHWEST METROPOLITAN WATER AND SANITATION DISTRICT, a quasi-municipal corporation of the State of Colorado** (hereinafter referred to as “District”), whose address is 8739 West Coal Mine Avenue, Littleton, Colorado 80123, and whose telephone number is (303) 979-2333.

WITNESSETH:

WHEREAS, Applicant desires to install sewer mains identified and known by the parties as the _____ **Sewer Main Extension**, and to have those mains and related appurtenances become a part of the District’s public sewer system; and

WHEREAS, Applicant may retain a contractor to install the sewer mains and related appurtenances which are the subject of this Agreement; and

WHEREAS, Applicant and District desire to execute an agreement setting forth the terms and conditions pursuant to which such sewer mains and related appurtenances will be conditionally accepted by the District and allowed to connect to the District’s public sewer system and, if finally accepted by the District, shall become a part of the District’s public sewer system for all purposes including maintenance.

NOW, THEREFORE, the parties hereto agree as follows:

1. Definitions.

1.1 The term “sewer lines” shall mean the sewer lines and related appurtenances such as manholes and other appurtenances, as shown and only as shown on Applicant’s approved plans; provided, however, the term “sewer lines” shall not under any circumstances, include private service lines under drains or storm drains.

1.2 “Approved Plans” means the set of plans and specifications approved for construction by the District’s consulting engineer as applicable, dated _____, 20____.

1.3 “Project” shall mean the sewer lines as shown on Applicant’s Approved Plans.

1.4 “Applicable Governmental Authority” shall mean the District or any governmental, municipal or quasi-municipal entity that has jurisdiction with respect to the Project.

2. Approved Plans.

Applicant covenants the Project will be constructed in accordance with the Approved Plans and any approved modifications or additions made thereto. Further, Applicant warrants that the Project will be constructed in a workmanlike manner and that, once constructed, the Project will be fit for its intended purpose.

Applicant further warrants that the Project will be constructed upon real property owned by Applicant or upon real property upon which Applicant has permission to enter for the purpose of constructing the Project and performing all of Applicant's warranty and other obligations contained herein.

3. Supervision of Work.

The District shall have no responsibility to supervise or direct construction of the Project. Applicant or Applicant's contractor will supervise and direct construction of the Project and will be responsible for the means, methods, techniques, sequences and procedures of construction.

4. Applicant's Warranty.

a) Applicant warrants and guarantees to the District that, without exception, the Project will be free from any defects (including but not limited to defects in materials and workmanship) for a period of one (1) year from the date of conditional acceptance by District or until the date the Project is finally accepted by the District, whichever period is longer. No exceptions shall be permitted to this warranty provision.

b) The Applicant additionally agrees that during the one (1) year period subsequent to the date of conditional acceptance of the Project by District, Applicant will promptly perform all work and supply all materials or cause its contractor to perform all work and supply all materials necessary to remove, replace, maintain or repair the Project constructed hereunder when said work is required by the District for any reason, notwithstanding that said work does not arise out of any negligent or willful acts or omissions of the Applicant or Applicant's contractor. In the event any of the maintenance and/or repair obligations required under this subparagraph (b) are not performed within twenty (20) days following written notice to Applicant, the District may cause said maintenance and/or repairs to be performed and charge the costs thereof to Applicant. Applicant agrees to pay all District bills for maintenance and repairs of the Project within thirty (30) days after receipt of the District invoice, together with all costs of collection, including reasonable attorney's fees and interest thereon at the rate of 1.5 percent per month on amounts that are past due.

c) Applicant agrees that any work required by the District hereunder, whether performed by Applicant or Applicant's contractor or by the District in the event of the refusal or inability of Applicant and/or Applicant's contractor to perform the work until the Project is finally accepted by the District, shall not impair or void the Applicant's warranty and guarantee under this paragraph 4 or any other obligation or liability of the Applicant imposed by law or contract.

d) Applicant further agrees that in emergency situations, the District shall have the right to perform whatever maintenance or repairs the District determines are necessary to protect the public health and safety without giving advance written notice to Applicant. Applicant agrees to pay all costs incurred by the District in performing emergency repairs and maintenance within thirty (30) days after receipt of the District's invoice thereof, together with all costs of collection, including reasonable attorney's fees and interest thereon at the rate of 1.5 percent per month on amounts that are pas due. The term "emergency" shall mean any situation where, in the District's determination, the public health or safety would be jeopardized or endangered by waiting for Applicant or Applicant's contractor to initiate and perform the needed maintenance and/or repairs.

5. Additional Security.

To induce the District to execute this Agreement and to provide additional assurance that Applicant will fully perform all of Applicant's warranty, maintenance and repair obligations contained herein, and as a precondition of the District's approval of the Project for conditional acceptance as described in paragraph 9, Applicant agrees to deliver to District as a condition precedent to the District's conditional acceptance of the Project, additional warranty security in a form and amount as described in subparagraphs 5a, 5b, or 5c below.

a) A fully executed Warranty and Maintenance Bond in the form attached hereto as Exhibit "A" issued by a surety acceptable to the District and in an amount to be determined by the District, but in no event greater than one hundred percent (100%) of the Project construction cost as determined by the District in the reasonable exercise of its discretion. Until the Project is finally accepted by the District, the performance of any warranty, maintenance or repair work upon the Project by the Applicant, Applicant's contractor or the District, shall under no circumstances, release, discharge or modify in any way Applicant's obligations under the Warranty and Maintenance Bond.

b) An Irrevocable Letter of Credit issued by an institution acceptable to the District and in an amount to be determined by the District, but in no event greater than one hundred percent (100%) of the Project construction cost as determined by the District in the reasonable exercise of its discretion. Until the Project is finally accepted by the District, the performance of any warranty, maintenance or repair work upon the Project by the Applicant, Applicant's contractor or the District, shall under no circumstances, release, discharge or modify in any way Applicant's obligations under the Letter of Credit.

c) A cash deposit in an amount to be determined by the District, but in no event greater than one hundred percent (100%) of the Project construction cost as determined by the District in the reasonable exercise of its discretion. Said sum shall be held by the District as a security deposit for the faithful performance by Applicant of all of Applicant's warranty and maintenance obligations under this Agreement. If Applicant defaults with respect to any of its warranty or maintenance obligations hereunder, including but not limited to those obligations as set forth in Paragraph 4 above, District may, (but shall not be required to) use, apply, or retain all or any part of the deposit for the payment of any amount which District may spend or become obligated to spend by reason of Applicant's default or to compensate District for any other loss or damage which District may suffer by reason of Applicant's default. District will not segregate

the cash deposit from its other funds and District shall be entitled to all interest, if any, earned on said deposit. The District shall return the security deposit less any amount or amounts thereof that had been applied to Applicant's warranty and maintenance obligations hereunder within sixty (60) days after the sewer lines and related appurtenances are finally accepted by the District.

6. Inspection.

The District and its representatives will at all times have access to the construction site and will be permitted to inspect the work, materials and any relevant documents or records necessary for the purpose of determining whether the Project is constructed in accordance with the Approved Plans. All inspections, tests, and reviews shall be conducted at the sole cost of the Applicant and shall be paid by the Applicant within thirty (30) days of invoice by the District.

7. Ownership.

Until dedicated to and conditionally accepted by the District, the Project shall be owned by Applicant and Applicant shall have full and complete responsibility for the Project including the safety conditions at the construction site. By way of explaining and not limiting the foregoing provisions of this Paragraph 7, Applicant agrees that until the District conditionally accepts the Project in accordance with the provisions of Paragraph 10 below, the District shall have no obligation pursuant to Section 9-1.5-103 C.R.S., to locate any sewer main or related appurtenance that is a part of the Project. Until conditional acceptance of the Project by District, said locate obligation, if any, shall be the sole responsibility of Applicant.

8. Tap Permits.

No sewer tap permits shall be issued or sold for connection to the Project and no such taps shall be made to the Project until the District has conditionally accepted the Project in the manner as set forth in paragraph 9 below.

9. Conditions to Conditional Acceptance.

Each of the following conditions shall be a condition precedent which must be satisfied before the District will conditionally accept the Project:

a) Approved Plans. The District, in its sole discretion, is satisfied that the Project has been constructed in accordance with the Approved Plans; and

b) Easements. The District is satisfied that all easements have been obtained for the Project and that the Project as constructed is located within said easements or other suitable public rights-of-way; and

c) Record Drawings. Receipt by the District of record drawings for the Project, certified compaction test results, and any survey certifications that the District's manager may require; and

d) Additional Security. The receipt of any security in addition to the security required by paragraph 5 b) above, that the District deems necessary for whatever reason; and

e) Disconnection of Abandoned Lines. The disconnection and removal, or in lieu thereof, the acceptance of ownership by Applicant of any existing sewer lines and related facilities to be abandoned by District in connection with the sewer mains to be installed hereunder. Any such disconnection and removal shall be in accordance with the District's standards, specifications, and requirements for disconnection; and

f) Compliance with Geotechnical Recommendations. If there are expansive soils in the area of the Project, and the District determines it is necessary, receipt by the District, at no expense to the District, of a written certification from a qualified soils engineer acceptable to the District, that the sewer mains are installed in accordance with the recommendations provided to the District by a qualified soil engineer; and

g) Contemplated Use. Without in any way being limited by the specificity of the foregoing, the District, in its sole discretion, is satisfied that there are no matters outstanding which would prohibit or unreasonably interfere with the use of the Project for its intended purpose.

10. Conditional Acceptance.

Conditional acceptance shall be accomplished only by the District's manager and/or engineer, if applicable, affixing his or their signatures to the Agreement in the space provided for on page 11. As of the date of conditional acceptance, all of Applicant's right, title and interest in and to the Project, including but not limited to, all mains, pipelines, manholes, and related parts and materials which compromise the Project, shall automatically and immediately pass to and be conveyed to the District with no additional transfer proceedings or documents being necessary; provided, however, that the Applicant's shall remain obligated to perform said Applicant's warranty, maintenance and repair obligations for a period of one (1) year from the date of conditional acceptance or until the Project is finally accepted by the District, whichever period is longer.

11. Contractor Warranties.

Applicant may cause its contractor to warrant and guarantee to District Contractor's work performed on the Project. Any such warranty by Applicant's Contractor shall be in addition to and not in lieu of Applicant's warranty and guarantee obligations to District as set forth in this Agreement.

12. Conditions to Final Acceptance.

One (1) year from the date of conditional acceptance, the District's manager and/or consulting engineer, as the case may be, will inspect the Project for final acceptance. Each of the following conditions shall be a condition precedent which must be satisfied before the District shall finally accept the Project:

a) Full Performance. Applicant has faithfully and fully performed its obligations under this Agreement.

b) No Damage. There has been no damage or destruction to the Project; and if there has been damage or destruction, the same has been repaired, and the cost of such repair has been paid by Applicant.

c) Compliance with Approved Plans. Any deviation in the construction of the Project from the Approved Plans has been corrected. Without in any way limiting the generality of the foregoing sentence, attention shall be paid to assure that all manholes and manhole covers are at finished grade and that all sewer mains flow as intended, all sewer runs are free of construction debris.

d) Contemplated Use. Without in any way being limited by the specificity of the foregoing, the District, in its sole discretion, is satisfied that there are no matters which would prohibit or unreasonably interfere with the use of the Project for its intended purpose.

13. Final Acceptance.

Final acceptance shall be accomplished only by the District's manager and/or engineer, as the case may be, affixing his or their signatures to this Agreement in the space provided on Page 11. As of the date of final acceptance, the District accepts the Project for all purposes, including maintenance and repairs and the Applicant's obligation to pay for same shall cease; provided, however, that Applicant's indemnification obligation as set forth in paragraph 15 below shall survive final acceptance.

14. Manholes.

Notwithstanding any other provision contained in the Agreement to the contrary, if the sewer lines that are subject to this Agreement are installed in private or public streets and the surface of the street is not paved by the time of final acceptance, Applicant shall remain responsible of raising the manholes to finished street grade in accordance with applicable County specifications when the street is paved. Applicant shall notify the District when the work to raise the manholes is complete so that the District may inspect the work. As part of the work on the manholes, Applicant shall insure that the manholes are clear of debris and are operational. If the Applicant does not raise the manholes as required herein, the District may perform the work at Applicant's sole cost and expense within thirty (30) days after notice to Applicant. Applicant shall make payment to the District within thirty (30) days after invoice. In the event payment is not timely made, Applicant agrees to pay all costs of collection (including reasonable attorneys fees) together with interest on the unpaid delinquent amount at the rate of 1.5 percent per month or part thereof.

15. Indemnification.

Applicant shall defend, indemnify and hold harmless the District, its officers, agents and employees, from all claims and demands or liability of whatsoever kind or nature, (including attorneys' fees) arising out of or encountered in connection with the construction of the Project or its operation or maintenance, whether such claim, demand or liability is caused in any way by Applicant, its agents or employees, or by Applicant's contractor or subcontractor, their agents or employees, or by any product or materials installed on the Project by Applicant,

its contractors or subcontractors; excepting only such injury or harm as may be caused solely and exclusively by the District's negligence.

This indemnification shall extend to all claims, demands or liabilities, (including reasonable attorney's fees) for injury to persons, property or financial loss occurring before final acceptance of the Project as well as for a period of three (3) years after the date of final acceptance of the Project.

16. No Duty No Reliance.

The District, by its review and approval of the plans for the Project, does not assume any duty of care with respect to the Applicant or the Project. It is the Applicant's sole responsibility to prepare and design the plans and select the materials for the Project in accordance with the District's specifications and all applicable District rules and regulations. It is also Applicant's sole responsibility to construct the Project in accordance with the Approved Plans.

Applicant represents that Applicant has read thoroughly the Approved Plans for the Project, examined the Project site, and ascertained all soil, geological, groundwater and other conditions to be encountered which might affect the construction, operation and maintenance of the Project. Applicant agrees that it enters into the Project relying on its own investigation and information not on any statements or representations, if any, that have been made by the District, its officers, agents or employees.

If Applicant or Applicant's professional engineers disagrees with any part or portion of the Approved Plans for specifications for the Project, such disagreement shall be brought to the attention of the District Manager for resolution prior to the construction of the Project. Nothing herein contained shall be construed to place any obligations on the District to modify, deviate or change its standards and specifications as a result of any disagreement or objection lodged by the Applicant.

17. Insurance.

The following insurance coverages, issued by insurance companies acceptable to the District, shall be obtained, paid for and kept in full force and effect by Applicant until conditional acceptance of the Project, provided, however, that if Applicant contracts for the construction of the Project, then Applicant's Contractor shall cause the following insurance coverages, issued by insurance companies acceptable to the District, to be obtained, paid for and kept in full force and effect until conditional acceptance of the Project:

a) Workmen's compensation insurance covering all workmen engaged in performance of the work on the Project in amounts not less than minimum coverage required by law, including employer liability coverage for not less than \$100,000.00;

b) Liability insurance, including automobile liability and property damage coverage on forms and written by companies that are acceptable to the District. Such policy or policies shall be written on an "occurrence" basis and maintained in minimum amounts of \$500,000.00 per occurrence, with a \$1 million general aggregate limit and a \$500,000.00

product/completed operations aggregate limit. Said policies shall contain an endorsement naming the District as an additional insured and providing that any insurance maintained by the District is excess and non-contributing with the insurance required hereunder.

c) Any policy of insurance required hereunder shall contain a contractual liability endorsement covering indemnity and defense obligations of Applicant and such other coverages as may reasonably be required by the District. Such policy will, among other things, make specific reference to this Agreement.

d) Any policy insuring against loss caused by physical damage to any portion or all of the Project, or to materials to be incorporated into the Project, or covering Applicant or Applicant's contractor's tools, supplies, machinery or equipment shall contain an endorsement providing that the insurer waives its right of subrogation against the District and any other named insured. Nothing contained in this paragraph shall give or create in any third party any claim or right of action against the District, except which may exist irrespective of this paragraph.

18. Proof of Insurance.

Prior to the commencement of any construction on the Project, Applicant or Applicant's Contractor as the case may be, shall furnish to the District certificates of insurance or copies of policies showing that such insurance required herein is in force and that the premiums due thereon have been paid and that the District is named as an additional insured. Such certification or policies shall provide that the insurance may not be cancelled, terminated or modified without fifteen (15) days advance notice thereof to the District. No policy shall contain any provisions for exclusion from liability other than the provisions for exclusion forming a part of the standard basic, unamended and unendorsed form of policy; provided, however, in no event shall any exclusions be permitted which conflict with any coverage required by this Agreement.

19. Modification.

This Agreement can be modified only by a written agreement signed by both parties hereto.

20. Interpretation of Agreement.

This Agreement and the Approved Plans are intended to supplement one another. However, in the event of a conflict, the conflict shall be brought to the attention of the District's manager, who shall have final authority to resolve any conflicts.

21. Governing Law.

This Agreement shall be construed in accordance with and governed by the laws of the State of Colorado.

22. Assignment.

Applicant may not assign this Agreement without the express written consent of the District.

APPROVALS BY THE DISTRICT

□ _____

a) Approval of Application:

Date: ____/____/____

Cynthia A. Lane P.E.
District General Manager

b) Conditional Acceptance of Project:

Date: ____/____/____

Cynthia A. Lane P.E.
District General Manager

c) Final Acceptance of Project:

Date: ____/____/____

Cynthia A. Lane P.E.
District General Manager

EXHIBIT G

SOUTHWEST METROPOLITAN WATER AND SANITATION DISTRICT

WARRANTY AND MAINTENANCE BOND

(Sewer Improvements)

KNOW ALL MEN BY THESE PRESENTS, that we _____, hereinafter called Principal, and _____, hereinafter called Surety, are held and firmly bound unto the Southwest Metropolitan Water and Sanitation District, a quasi-municipal corporation of the State of Colorado, hereinafter called "District", in the sum of _____ dollars (\$ _____), lawful money of the United States of America for the payment whereof the Principal and Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly, by these presents:

WHEREAS, Principal has applied to the District for permission to install the sewer mains and related appurtenances generally described on Exhibit "A" which is attached hereto and incorporated herein by this reference (the "Project"), for the purpose of obtaining sewer service for a development known as _____; and

WHEREAS, as a condition of the District's approval of the Project, Principal and District have entered into the Application and Agreement for Extension of Sewer Mains attached hereto as Exhibit "B" (hereinafter called the "Contract") which Contract is by this reference made a part hereof; and

WHEREAS, the Contract contains: a) Principal's warranty that the Project will be free from defects for the period beginning with the date of conditional acceptance and ending with the date the project is finally accepted by the District; and, b) Principal's promise to maintain and repair the Project until the same has been finally accepted by the District and to raise the manhole to paved street level at such time the street is finally paved, even if the same occurs after final acceptance of the Project; and

WHEREAS, the approval of the Project by the District and Principal's authorization to proceed with the construction thereof is in part conditioned upon Principal's furnishing of an adequate warranty and maintenance bond to the District guaranteeing that Principal will perform or cause to be performed all of Principal's warranty, maintenance and other obligations that arise under the Contract from and after the date the same is conditionally accepted by District.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if the Principal shall promptly, faithfully and fully perform all the undertakings, covenants, terms, conditions and agreements of said Contract arising after conditional acceptance of the Project by the District, including but not limited to Principal's maintenance, repair, warranty and manhole

raising obligations; and shall also well and truly perform all undertakings, covenants, terms, conditions and agreements, of any and all duly authorized modifications of said Contract that may hereinafter be made, notice of which modifications to the Surety being hereby waived, then this obligation shall be null and void; otherwise it shall remain in full force and effect for a period of eighteen months from the date of this Bond as set forth below.

AND THE SAID SURETY, for value received, hereby stipulates and agrees that whenever the Principal shall be, and is declared by District in default of its post-conditional acceptance obligations under said Contract, the District having performed its obligations thereunder, the Surety may promptly remedy the default or shall promptly (1) perform the Principal's post-conditional acceptance obligations in accordance with the terms and conditions of the Contract, or (2) obtain a bid or bids for submittal to the District for completing said post-conditional acceptance obligations of the Principal in accordance with the terms and provisions of the Contract and upon a determination by the District and the Surety of the lowest responsible bidder, arrange for a contract between such bidder and the District and make available as work progresses (even though there should be a default or a succession of defaults under the Contract of completion arranged under this paragraph) sufficient funds to pay the cost of completion in an amount up to but not exceeding the dollar amount of this Bond.

No right of action shall accrue on this Bond to or for the use of any person or corporation other than the District named herein or the successors and assigns of the District. Any suit under this Bond must be instituted before the expiration of two years from the date on which the Project is finally accepted by the District under the Contract.

Nothing herein contained is intended to cause the Surety to guarantee that the Project will be constructed in the first instance. Surety's obligations hereunder arise only at such time as the Project is conditionally accepted by the District.

IN WITNESS WHEREOF, the Principal and Surety have executed this Bond as of this _____ day of _____, 20__.

PRINCIPAL:

By: _____
Title:

[S E A L]

ATTEST:

[S E A L]

SURETY:

By: _____

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