TABLE OF CONTENTS

SECTION 1 - GENERAL CONDITIONS PAGE

SECTION 2 - PROJECT PROTOCOLS

SECTION 1
GENERAL CONDITIONS

1.1 PURPOSE

The Board of Directors of the South Durango Sanitation District (SDSD or the District) has adopted these Codes & Standards for the following purposes:

- To supplement the Rules and Regulations of the District. (A copy of the District's Rules & Regulations is provided in Appendix A).
- To govern the design and construction of all sanitary sewers and appurtenances within the District's service area.
- To standardize the District's plan submittal and review procedures, construction inspection, and final acceptance procedures.

The term Codes & Standards shall include Sections 1, 2 and 3; Appendices A, B, C and D; and all resolutions of the Board of Directors which relate thereto.

Developers, engineers, and contractors designing and constructing facilities that will become part of or connect to the District's infrastructure shall be familiar with and must comply with these Codes & Standards.

It shall be unlawful for any person, firm, or corporation to construct, enlarge, alter, repair, move, improve, remove, excavate, convert, or demolish any public improvements or common facilities owned and operated by the South Durango Sanitation District without abiding by the requirements of these Codes & Standards.

Any variation from these Codes & Standards will require prior written approval from the District.

1.2 EFFECTIVE DATE OF CODES & STANDARDS

These Codes & Standards shall be in effect immediately upon formal adoption by the District Board of Directors and shall supersede all former standard specifications.

1.3 REVISIONS, AMENDMENTS, OR ADDITIONS

These Codes & Standards may be revised, amended, or added to from time to time. Such revisions, amendments, and additions shall be binding and in full force immediately upon formal adoption by the District Board of Directors. All parties in possession of the SDSD Codes & Standards shall be responsible for ensuring they have the most current edition.

1.4 ALTERNATE MATERIALS AND METHODS OF CONSTRUCTION

The provisions of these Codes & Standards are not intended to prevent the use of any material or method of construction not specifically prescribed by these procedures, provided any alternate has been approved and its use authorized by the District.

1.5 MODIFICATIONS

Whenever there are practical difficulties involved in carrying out the provisions of these Codes and Standards, the District may grant modifications for individual cases, provided that the District shall first find that special unique circumstances makes these Codes & Standards impractical, that the modification is in conformity with the intent and purpose of these Codes & Standards, and that such modification does not affect the functionality of the improvements or increase the District's maintenance burden.

1.6 TESTS

Whenever there is insufficient evidence of compliance with any of the provisions of these Codes & Standards or evidence that any material or construction does not conform to the requirements herein, the District shall require that the Contractor have tests performed to demonstrate compliance. Test methods will be as specified by these Codes & Standards or by other recognized test standards. If there are no recognized test methods for the proposed alternate, the District will determine test procedures. All tests will be made by an approved agency and all costs shall be the responsibility of the Contractor. Reports of such tests shall be submitted to and retained by the District.

1.7 ENFORCEMENT AND INTERPRETATION

The District Manager is authorized and directed to enforce all provisions of these Codes & Standards, and may appoint an engineer, construction inspector, or other authorized representative to act in his/her behalf. Wherever the term District Manager is used it shall include any authorized representative of the District Manager. Whenever any work is being done contrary to the provisions of these Codes & Standards, the District Manager may order the work stopped by verbal notice, followed by a written notice which will be served on any persons engaged in the doing or causing of such work to be done, and any such persons shall forthwith stop such work until authorized by the District Manager to proceed.

The District Manager shall have the authority to interpret any Section, or any difference between Sections, when appropriate, and his/her interpretation shall be binding and controlling in its application.

1.8 LIABILITY

The District Manager, acting in good faith in the discharge of his/her duties, will not be personally liable for any damage that may occur to persons or property as a result of any act or by reason of any act or omission in the discharge of his/her duties.

1.9 FEES & FINES

As part of the implementation of these Codes & Standards, certain fees will be required and certain fines may be imposed. A current fee schedule is available at the District office. Fees may be established and changed by the Board of Directors at any time. Following is a brief description of the various fees and fines:

Codes & Standards Reproduction Fee. Fees for copies of the Codes & Standards are set to cover the cost of reproduction. The fee includes one hard copy of the Codes & Standards.

Plan Review Fee**.** This fee covers the costs of Plan Review by the District's Engineer for projects requiring Reimbursement Agreements (RA). Plan Review Fees will be determined on a case-by-case basis.

Construction Service Fee**.** This fee covers the costs of construction inspection and testing by the District for projects requiring Reimbursement Agreements. Construction Service Fees will be determined on a case-by-case basis.

Plant Investment Fee (PIF or Tap Fee). A PIF is assessed to recover a proportionate share of the capital cost of the District facilities. The PIF includes an amount for the capital cost of the existing District facilities and an amount for the capital cost of expansion of District facilities. The combination of these two components supports the District's policy that growth pays for growth. The PIF rate may be changed at any time by the Board of Directors of the District.

Tap Inspection Fee. A tap inspection fee is charged for inspecting each tap connection. The fee is paid at the time the PIF is paid.

User Fee. User fees for sewer service are collected to pay for the operation and maintenance expenses of the District. The User Fee shall be assessed the month after the PIF is paid. Fines for late payment of user fees are set forth in the Rules & Regulations.

Unauthorized Use of Infrastructure Fine. Fines for unauthorized use of District Infrastructure (e.g. making connections without a District Inspector present) will be determined on a case-by-case basis.

Infrastructure Disturbance Fine. Fines for disturbing District infrastructure will be determined on a case-by-case basis.

SECTION 2
PROJECT PROTOCOLS

2.1 GENERAL

Required project protocols are described in this Section. These protocols must be followed for all projects that plan to connect to the District's facilities. These protocols standardize:

- Submittal and review procedures for project plans and specifications
- Construction inspection requirements
- Final acceptance requirements
- Warranty requirements

The protocols are broken into the following project phases:

- Project Initiation
- Design Phase
- Construction Phase
- Final Acceptance
- Warranty Period

An overview of the entire project process is presented in the Project Flow Chart illustrated in Figure 2-1 on the following page. Checklists to track the progress of each project phase are presented in Appendix B.

2.1.1. Projects not requiring a Reimbursement Agreement.

For projects that do not require Reimbursement Agreements, such as new taps in an approved subdivision, the Owner is required to take the following steps:

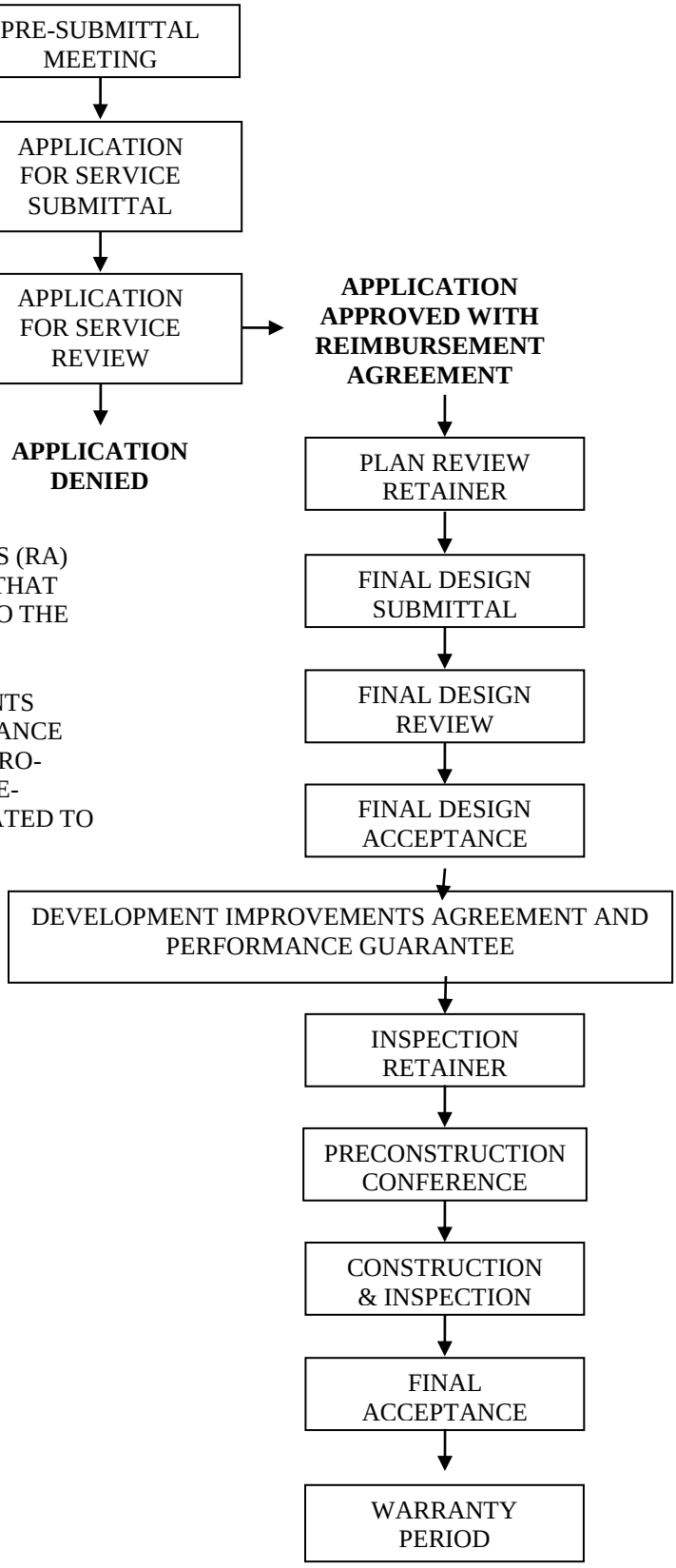
A. Prior to making the connection, complete a standard sewer tap application and pay the required PIF to the District.

B. Notify the District via fax with time and date stamp 48-hours before making the connections to the District's sewer lines so that a District representative can be present to inspect the connection as it is being made.

C. Make the connection to the system in the presence of the District's inspector.

The remaining portions of Section 2 shall not apply to such projects. For projects that do not require Reimbursement Agreements, plans and specifications are not required, however, the work must conform to the District's Codes & Standards. If plans are available for these types of projects, one copy of the plans shall be submitted to the District to be kept in the project file for future reference.

FIGURE 2-1: PROJECT FLOW CHART



NOTES:

1. REIMBURSEMENT AGREEMENTS (RA) ARE REQUIRED FOR PROJECTS THAT DEDICATE INFRASTRUCTURE TO THE DISTRICT

2. A DEVELOPMENT IMPROVEMENTS AGREEMENT WITH A PERFORMANCE GUARANTY IS REQUIRED FOR PROJECTS CONSTRUCTING IMPROVEMENTS WHICH WILL BE DEDICATED TO SDSD.

2.2 PROJECT INITIATION

2.2.1 Pre-Submittal Meeting

To commence a project, a Pre-Submittal Meeting will be held between the District, the Applicant, and, for larger projects, the Applicant's Engineer. The purpose of the meeting is to introduce the District to the project, and to introduce the Applicant to the District's Codes & Standards requirements. The Applicant should bring any preliminary project plans and location maps to the meeting. Following this meeting, the District will create a file for the project.

2.2.2 Application For Service Submittal

The next step in the process is for the Applicant to complete and submit an Application for Service. Completed applications shall be submitted to the District Manager. The purpose of this application is to provide detailed project and contact information. Preliminary plans and specifications shall be submitted with the application, along with a copy of the deed for the project property.

2.2.3 Application for Service Review

The District will review the Application for Service and will determine whether the project meets the requirements for service as set forth in the District's Codes & Standards, and whether or not a Reimbursement Agreement (RA) will be required for the project.

If the application is incomplete, the missing information shall be requested from the Applicant and the review process suspended until the additional information is submitted.

The District Manager has the authority to approve Applications for Service unless the project requires a new commitment to serve, any variation from the Codes & Standards or any other issue which the District Manager believes requires review by and approval of the Board. In such cases the application will be referred to the District Board at the next scheduled monthly board meeting. The District will inform the Owner in writing as to whether or not the Application for Service has been approved or denied.

2.2.4 Reimbursement Agreement (RA)

Reimbursement Agreements will be required for all projects that involve the construction of improvements which will be dedicated to the District or for projects that result in significant disturbance or relocation of existing District facilities. The purpose of the RA is to ensure that the District's costs for administrative, engineering, legal, and any specialized services associated with the project, such as plan review and construction inspection, are paid for by the Owner and not by the District's existing customers.

For projects in which the Owner proposes dedicating sewer improvements to a Home Owner's Association (HOA), or other similar entity, the District will make the final

determination of whether the proposed improvements should be dedicated to the HOA or the District. The District policy is to avoid situations where the Owner dedicates improvements to a HOA and later the HOA requests the District to accept improvements that may not have been constructed or maintained in accordance with the Codes & Standards.

2.3 DESIGN PHASE

Design of all improvements which will be dedicated to the District shall be performed under the direct supervision of a Professional Engineer registered in the State of Colorado.

All design information and submittals required by these Codes & Standards shall be provided to the District, even if the Owner is utilizing alternative methods of design and construction, such as design-build.

The District may request that certain improvements be oversized to provide future service to areas adjacent to the proposed project. In these instances, an agreement between the Owner and District will be developed dictating the terms of reimbursement to the Owner for the additional incremental cost of constructing the oversized improvements.

2.3.1 Plan Review Retainer

The District's costs for plan review will be estimated based on the preliminary project plans submitted with the Application for Service.

A plan review retainer will be required from the Owner that covers the estimated review costs. This retainer must be submitted prior to the start of the review. If the actual cost of plan review ends up exceeding the plan review cost estimate, the Owner shall pay for the additional review costs. Once final plans and specifications are approved, any remaining plan review retainer will be refunded to the Owner.

2.3.2 Final Design Submittal

All improvements which will be dedicated to the District shall be designed in accordance with the design criteria provided in Section 3 of these Codes & Standards. Additionally, the design shall incorporate the Standard Details provided in Appendix C and the Technical Specifications provided in Appendix D.

Any deviations from these Codes & Standards shall be clearly noted and shall require written approval from the District prior to construction.

Plans shall be drawn to scale and shall have sufficient clarity to indicate the location, nature, and extent of the work proposed and show in detail that it conforms to the provisions of these Codes & Standards and all relevant laws, ordinances, rules and regulations. The term plans shall include all drawings and technical specifications.

Plans shall be submitted on full size or half size sheets. A Plan Submittal Checklist is included in Appendix B that lists minimum requirements for drawing content. To reduce the likelihood of having to resubmit the plans, the Owner's engineer shall abide by this list when preparing the project drawings.

If requested, copies of all supporting data such as calculations, geotechnical reports, and surveys shall be submitted with the plans to assist with the review process.

Copies of all review comments from any other regulatory agencies reviewing the project shall be provided if such comments will assist with the review process.

If requested, copies of any proposed Contract Documents between the Owner and the Contractor shall be provided with the Final Design Submittal.

Four (4) complete copies of the Final Design Submittal, including all supporting data, shall be submitted to the District, one for the Project File, one for the District's Engineer, and one copy for the District's inspector.

For projects that will have several phases of construction, detailed master plan drawings of the entire project shall be submitted prior to, or with, the first phase plan set. The master plan drawings shall contain sufficient infrastructure detail to determine if the proposed design concepts for the entire site are feasible.

2.3.3 Final Design Review

The District's Engineer will review the Owner's Final Design Submittal to ensure compliance with the District's Codes & Standards. Approval by the District is not intended and shall not be interpreted as guaranteeing the design of the facilities. The District will not be responsible for any damages arising out of the design of the facilities.

A review period of 15 working days will be required on all submittals. Unusually large submittals may require additional time. At the end of the review period, or sooner if possible, written comments will be returned to the Owner. The response may be an unconditional approval, a request for additional data, or a request for revision and resubmittal. For resubmittals, an additional 15 day review period will be required from the date of the resubmittal. Plans and specifications that do not conform to the District Codes & Standards may require repeated resubmittals before the District's Engineer approves them.

2.3.4 Final Design Acceptance

Once the final design is in conformance with the requirements of these Codes & Standards, the final design will be approved in writing by the District. One copy of the Final Design Submittal with the District Engineer's signature of approval shall be returned to the Owner. The accepted plans and specifications may not be changed without authorization from the District.

No improvements to be dedicated to the District shall be constructed prior to Final Design Acceptance. Fines may be imposed for unauthorized connections.

Any project not under construction within one-year from the date that the District Engineer approves the final set of design drawings shall be subject to re-approval at the District's discretion.

2.4 CONSTRUCTION PHASE

Upon approval of the final design for RA projects, the Construction Phase of the project may commence.

2.4.1 Construction Financial Guarantee

An itemized cost estimate of the cost of constructing the improvements to be dedicated to the District shall be provided to the District. The District's Engineer shall review the cost estimate and either approve the estimate or require changes. The Owner shall submit a financial guarantee with the DIA prior to construction, in a form acceptable to the District, for 110 percent of the total approved estimated construction cost of the improvements. After the improvements have been constructed and accepted, the District may release a portion of the guarantee equal to not more than 50 percent of the estimated costs of the improvements. The remaining portion shall be kept until the end of the warranty period. The guarantee shall be available to reimburse any expenses incurred by the District to maintain or repair the facilities. The Owner will still be liable for all expenses incurred by the District that are not reimbursed through the guarantee.

2.4.2 Construction Services Retainer

The Owner shall reimburse the District for the District's construction inspection and testing services. The District shall prepare a cost estimate for construction services. A retainer shall be required from the Owner that covers the estimated costs. This retainer must be submitted prior to the start of construction. Once notification of final acceptance is issued, any remaining retainage shall be refunded to the Owner. If the actual cost of construction services ends up exceeding the cost estimate, the Owner shall be responsible for the additional costs.

2.4.3 Pre-Construction Conference

A pre-construction conference shall be required at least two weeks prior to the start of construction. The District shall be notified of this meeting at least one week prior to the date scheduled. Attendees shall include District staff, the District's Engineer, the Owner, the Owner's Engineer, the General Contractor, and any key Subcontractors. A Checklist is included in Appendix B that lists topics that should be discussed at this meeting.

2.4.4 Construction & Inspection

A. Installation Guidelines. Installation guidelines for sewer system work are provided in Section 3.

B. Schedule. The Contractor shall submit an initial project schedule at the Pre-Construction Conference. Periodic schedule updates shall be provided thereafter at intervals determined at the Pre-Construction Conference. The schedule shall identify when District infrastructure will be impacted by construction or staging operations.

C. Submittals. The Contractor shall provide a list of materials that will be used on the project at the Pre-Construction Conference. At that time, it will be determined which of the materials shall require shop drawing submittals. Six copies of all required shop drawings shall be submitted to the District for review. Three copies with review comments shall be returned to the Contractor. The District's Engineer shall review the drawings within 10-working days of receipt and provide comments back to the Contractor. The Contractor shall submit shop drawings in a timely manner so that the full review timeframe is available to the Engineer without affecting the construction schedule. Any submittals that are not in accordance with these Codes & Standards, and which are therefore subject to rejection, shall be submitted even earlier in case they need to be submitted a second time.

D. Safety. All construction work performed within the District shall conform to all applicable Federal, State, County and City rules and regulations concerning safety. The safety of the crew and public shall be considered at all times. When working within public right-of-ways, the Contractor shall conform to all applicable traffic control regulations. Contractors are expected to know the necessary safety measures and the District assumes no responsibility for the safety procedures or lack of such procedures used by the Contractor.

E. Locating and Protecting Utilities. The Contractor shall be responsible for locating and protecting all utilities at the project site. The Utility Locate Service phone number is 1-800-922-1987 for the District's service area. Three days advance notice is typically required before any excavation.

In the event of a break in any utility, the Contractor shall immediately notify the responsible official of the organization operating the interrupted utility and shall lend all possible assistance in restoring services.

F. Insurance. The Contractor shall list the District as an additional insured on all insurance coverage and shall provide the District with a Certificate of Insurance at the Pre-Construction Conference.

G. Indemnification. The Contractor hereby agrees to save and hold harmless the District, and any of its officers, employees, subcontractors or agents from all

costs, loss, damage and liability incurred by any of the above as a result of any third party claims, demands, costs or judgments which is caused by an activity, condition or event arising out of the performance or nonperformance of any provision of the construction of the project by Contractor, its agents or independent subcontractors. When any cost, damage or liability occurs as aforesaid, Contractor assumes the burden of proof that the activity, condition or event did not cause such cost, damage or liability.

H. Materials Testing. Material testing requirements and frequencies shall be as required in these Codes & Standards and shall be reviewed at the Pre-Construction Conference. The Contractor shall pay for all materials testing and shall furnish the District with copies of all test reports. The failure of any portion of the work to meet any of the testing requirements of the Codes & Standards shall be reasonable cause for the District to require the removal or correction and reconstruction of any such work. All retesting shall be at the expense of the Contractor.

I. Inspection. All work and materials that are to be dedicated to the District must be inspected by the District's inspector in accordance with the Reimbursement Agreement and the following requirements:

1. Notification: The Contractor shall notify the District a minimum of 48-hours in advance of any work that will affect the District's infrastructure. At the time of notification, the Contractor shall advise the District of the nature and the anticipated duration of the construction activities.

2. Material Inspection: All pipes, fittings, appurtenances and any other materials that will be dedicated to the District shall be carefully examined for defects before installation. Bell and spigot ends of pipes shall be examined with particular care, as these areas are most vulnerable to damage from handling. Defective materials shall be marked and removed from the work site as soon as possible.

3. Construction Inspection: The District's Inspector will check all new infrastructure for conformance to these Codes & Standards. No work may be buried until inspected. The District will not be responsible for the quality of the work performed by the Contractor nor for any defects subsequently found in the work or materials. The District's Inspector shall have the authority to halt construction, if in his opinion, these Codes & Standards and/or standard construction practices are not being followed, or the work is otherwise defective.

J. Mitigating Construction Impacts. The Contractor shall control and minimize all impacts related to the performance of the work. All possible efforts shall be made to avoid disruption and disturbance of any neighbors. If the Contractor fails to provide adequate mitigation in a timely fashion, the District reserves the right to perform the necessary mitigation work itself or through subcontractors, and to

then back charge the Contractor for all costs associated with this work. At a minimum, the following shall be provided for the duration of the project:

1. Daily Cleanup. Daily construction cleanup shall be required.

2. Mud and Earth Tracking on Public Streets. The Contractor shall conduct his operations so that equipment tracking of mud and earth onto adjacent public streets is minimized. If requested by the District's inspector, the Contractor shall be required to clean all streets affected by mud and/or earth tracked by his equipment or that of his subcontractors or suppliers.

3. Road Re-grading. Regular re-grading of gravel roads negatively impacted by construction traffic shall be required.

4. Pothole Fixing. Regular fixing of potholes along construction access roads shall be required.

5. Temporary Paving. For multiyear projects, temporary paving of impacted streets will be required prior to the onset of winter, if, in the Inspector's opinion, road damage is extensive.

6. Dust Control. Gravel roads shall be sprinkled with a water solution containing calcium or magnesium chloride as often as is necessary to control dust arising from the operations connected with the work.

7. Sanitary Facilities. Outhouses shall be provided and shall be located as far away as possible from any existing residences or businesses. Regular servicing of outhouses shall be required.

8. Working Hours. Working hours shall be restricted to 7:00 AM to 7:00 PM, Monday through Friday. Overtime work outside of regular working hours or the performance of work on Saturday, Sunday, or any legal holiday will not be allowed without prior written consent from the District.

9. Interruption of Service. District customers impacted by new connections to the existing District infrastructure shall be provided with a minimum of 48-hours notice prior to any shutdowns. No shutdowns will be allowed on weekends. Prior to all shutdowns, the Contractor shall present the proposed shutdown plan to the District's Inspector for approval.

10. Protection of Public and Private Property. The Contractor shall use every reasonable precaution to prevent the damage or destruction of public or private property such as poles, trees, shrubbery, crops, fences, and survey monuments adjacent to or interfering with the work, and all overhead structures such as wires or cables, within or outside of the right-of-way.

Where trees, hedges, shrubs or other ornamental plantings within the construction limits are not designated to be protected or saved, the Contractor shall notify the owner of the property fronting the plantings in question not less than ten days prior to removing the plantings. This notification shall include allowing the property owner the option to transplant the plantings fronting his property onto his property instead of having the Contractor remove them.

11. Traffic Disruption. The Contractor shall carry on the work in a manner that will cause the least interruption in traffic. Access rights of the public shall be considered at all times. All barricading, signage, flagmen, lights, and detours shall be the Contractor's responsibility and shall be coordinated with the appropriate entities including the City of Durango, La Plata County and the Colorado Department of Transportation and shall be in accordance with their regulations and all applicable OSHA standards. A Traffic Control Plan shall be submitted prior to beginning construction where any construction activity will involve the use of public right-of-ways. The plan shall provide project specific details for guiding and handling traffic safely through the construction work zone. The Contractor shall coordinate intersection and driveway closures with property owners and the District. If backfill has been completed to such an extent that safe access may be provided, and the street open to local traffic, the Contractor shall immediately clear the street and driveways and provide and maintain access. The Contractor shall cooperate with the various parties involved in the delivery of mail, snow removal, and the collection and removal of trash and garbage to maintain existing schedules for these services.

12. Staging and Parking Areas. Contractor Staging and Parking Areas shall be established that avoid disruption to any neighbors.

13. Explosives. The use of explosives will not be permitted without written permission from the District.

K. Emergency Work. When, in the opinion of the District, or it's assigned representatives, the Contractor has not taken sufficient precautions to ensure the safety of the public or the protection of the work to be constructed, or of adjacent structures or property which may be injured by processes of construction on account of such neglect, and an emergency may arise and immediate action is considered necessary in order to protect public or private, personal or public interest, the District, WITH OR WITHOUT NOTICE, to the Contractor or the Developer, may provide suitable protection by causing such work to be done and material to be furnished and placed as the District may consider necessary and adequate. The cost and expense of such work and material so furnished will be born by the Contractor or Developer and will be paid upon presentation of the bills. The performance of such emergency work under the direction of the District will in no way relieve the Contractor of responsibility for damages which may occur during or after such precaution has been taken.

In an emergency threatening loss of life or extensive damage to the work or to adjoining property, and where the Contractor is unable to obtain special instructions or authorization from the District after diligent attempts to obtain such special instruction or authorization in sufficient time to take the necessary action, the Contractor is hereby permitted to act at his own discretion to prevent such threatening loss or damage.

L. Startup. Startup of all facilities that will be dedicated to the District shall be closely coordinated with the District's Engineer and Inspector. All equipment that will be dedicated to the District shall first have the installation checked and certified by a manufacturer's representative. The manufacturer's representative shall also be present when the equipment is first started up.

2.5 FINAL ACCEPTANCE

2.5.1 General

At the completion of construction, the Final Acceptance requirements, as outlined in these Codes & Standards, must be met before the District will assume ownership of the project and release all or a portion of the financial guarantee.

2.5.2 Acceptance Testing

Acceptance Testing in accordance with the Technical Specifications shall be provided for all infrastructure that will be dedicated to the District. The District's Inspector shall be notified 48-hours before any testing and shall be present to witness the tests.

2.5.3 Punchlist

The Contractor shall notify the District when the work is complete to perform a walkthrough of the project for the purpose of developing a Punchlist. The Punchlist shall identify all unfinished work and completed work requiring modifications. Upon completing the Punchlist Items, the Contractor shall again setup a walkthrough with the District to inspect the work and check-off the items on the Punchlist. Until the Project is accepted, the District reserves the right to add to the Punchlist at anytime. A schedule for completing the Punchlist work shall be established. If the Contractor fails to complete the Punchlist work in a timely fashion, the District reserves the right to perform the necessary Punchlist work itself or through subcontractors and to back charge the Owner for all costs associated with this work.

2.5.4 Restoration of Prior Conditions

Upon completion of the work, the Contractor shall restore all disturbed areas and facilities to their pre-project condition or better. Restoration activities shall include, but not be limited to, streets, curbs, gutters, drainages, grading, and landscaping. Additionally, the

Contractor shall perform a final cleanup of all areas impacted by the construction to the satisfaction of the District's Inspector.

2.5.5 Record Drawings

The Contractor is responsible for maintaining record drawings during construction to show any changes from the original plans. Upon completion of the work, the Contractor shall provide the record drawings to both the Owner's Engineer and the District for comments. The Owner's Engineer shall incorporate all comments and provide final drawings in both reproducible hard copy form (Mylars) and in electronic form (Auto-CAD). The hard copy drawings shall be signed and sealed by the Owner's Engineer and shall be stamped "Record Drawings".

2.5.6 Copies of Testing Reports

The Contractor shall provide copies of all testing reports produced as part of the project.

2.5.7 O&M Manuals

The Contractor shall provide Operations & Maintenance Manuals for all equipment dedicated to the District as part of the project.

2.5.8 Training

The Contractor shall provide training by a manufacturer's representative for all equipment that will be dedicated to the District.

2.5.9 Easements & Dedications

All easements and dedications shall be officially recorded prior to final acceptance of the project by the District.

2.5.10 Ownership

The Owner shall dedicate all infrastructure to the District and shall execute such documents evidencing that dedication as may reasonably be required by the District.

2.5.11 Lien Waiver Releases

All infrastructure to be dedicated to the District shall be conveyed free and clear of all liens and encumbrances prior to final acceptance of the project by the District.

2.5.12 Initial Release of Financial Guarantee

Up to 50 percent of the Financial Guarantee may be released at the time of Final Acceptance. The remainder of the Guarantee will not be released until the end of the warranty period.

2.5.13 Notification of Final Acceptance

Upon completion of all final acceptance requirements to the satisfaction of the District, the District shall issue a Notification of Final Acceptance Letter to the Owner. Any remaining construction inspection retainage shall be returned to the Owner at this time.

2.6 WARRANTY PERIOD

2.6.1 Warranty

The Owner will be responsible for all work performed, including proper function of the work, repair of settled areas, adjustment of manholes, meter pits, valve vaults, and similar items to grade, for a period of two (2) years from the date of Notification of Final Acceptance. Any malfunction during the warranty period shall be remedied by the Owner to the satisfaction of the District at no expense to the District. If the District is required to make repairs to the improvements, the Owner shall be responsible for the costs of such repairs including engineering, legal, and administrative costs.

2.6.2 Warranty Inspection

Not more than thirty days prior to expiration of the warranty, the Owner shall contact the District to schedule a final inspection of the work. Following inspection, a list of deficiencies will be prepared. The deficiencies must be corrected within thirty days after receipt of the list. After repairs have been made, a follow-up inspection must be requested. The warranty period shall continue until the Owner requests a final inspection and all warranty repairs have been made. The warranty period for repairs shall be two (2) years.

2.6.3 Final Release of Financial Guarantee

At the end of the warranty period, after all warranty issues have been addressed, the District shall release the remainder of the financial guarantee not previously released at the time of Final Acceptance minus any expenses incurred by the District to maintain or repair the facilities during the warranty period. If significant repairs are required, at the District's discretion, a portion of the financial guarantee may be held back until the warranty period for the repairs has expired.

SECTION 3
WASTEWATER SYSTEM

3.1 GENERAL

3.1.1 Easements

Wherever feasible, the wastewater infrastructure shall be constructed in the rights-of-way of streets that the City of Durango, La Plata County, Colorado Department of Highways or some other entity has accepted or will accept for maintenance. Facilities to be constructed outside street rights-of-way shall be located in easements dedicated for the use of the District by the owner. No structures shall be placed within sewer easements. Such easements shall be dedicated and shown either on the plat or on a form of easement deed approved by the District. Copies of all recorded plats, easement deeds or descriptions and maps must be provided for District records. All sewer lines shall have minimum 20-foot easements centered on the centerline of the pipe. Lift stations shall have sufficient easements to allow for access to and maintenance of all equipment.

3.1.2 Surveys

All surveys shall be conducted by a professional land surveyor licensed in Colorado and, where practical, shall use the most recent NAD 83 City of Durango aerial datum, with scaling factors provided by the District. Control points must be tied down sufficiently to enable the District to find and use them at the time the surveys are submitted and to enable points that may be destroyed prior to construction to be reestablished. Benchmarks should be established in locations where they will not be disturbed by construction and shall be completely described in the original survey notes.

3.1.3 Geotechnical Investigations

If soil investigations are performed as part of the project, a copy of the soil investigation report shall be provided to the District. The report shall provide sufficient subsurface exploratory and sample analysis to permit an adequate assessment of any soil problems that may be encountered. The following information should be included in the report:

- The in-place relative density
- Type and extent of material to be encountered
- Moisture content in lbs per cubic foot, % by weight, and % of optimum
- Potential excavation problems
- Location and extent of excavation
- The suitability of excavated materials for use as backfill
- The compaction characteristics of the soils
- The ground water conditions

3.1.4 Access

All sewer infrastructure structures (manholes, vaults, lift station, etc.) shall be accessible by a minimum 10-foot wide all-weather access road. The access drive shall have an all-weather surface such as asphalt or concrete paving, or at a minimum, be composed of four inches of 3/4" minus ABC overlaying six inches of 3" minus ABC, which overlays suitable compacted subgrade material. The access road shall be capable of supporting HS-20 vehicle loading and shall be designed to provide adequate drainage. Refer to Standard Sewer Detail No. 21.

3.2 DESIGN CRITERIA

3.2.1 General

All sewer systems shall be designed in accordance with these Codes & Standards and applicable sections of Colorado Department of Public Health and Environment (CDPHE) Policy 96-1. Besides requiring approval from the District, all designs for sewer lines 24-inch in diameter or larger, and all designs for wastewater lift stations must be approved by CDPHE and must be submitted to CDPHE by the Owner's Engineer with the appropriate Site Application form.

3.2.2 Design Flows

The wastewater collection system shall be designed to transport average and peak flows at ultimate build-out of the project. Average day flows shall be calculated using the Equivalent Residential Tap (ERT) Schedule provided in Exhibit A of the District's Rules & Regulations and an Average Day Flow rate of 250 gallons per day per ERT. This flow rate is based on historical data and includes an infiltration component.

The table below indicates peaking factors to be used for sizing pipes:

Sewer Pipe Diameter	Peaking Factor
10-inch and smaller	4.0
12-inch to 15-inch inclusive	3.5
18-inch to 27-inch inclusive	3.0
30-inch and larger	2.5

3.2.3 Sewer Lines

Sanitary sewer lines shall be designed for gravity flow conditions and in accordance with the following criteria.

A. **Pipe Sizing**. Hydraulic characteristics shall be calculated for each reach of the sanitary sewer system using the following design criteria:

1. Sewer lines shall be designed to carry the peak flow with a flow depth of one-half of the full pipe.

2. Minimum and maximum acceptable slopes shall be as shown in the following table:

Nominal Pipe Diameter	Minimum Slope (%)	Maximum Slope (%)
4	1.0	12.0
6	1.0	12.0
8	0.5	12.0
10	0.5	12.0
12	0.4	10.0
15	0.4	8.0
18	0.4	6.0
21	0.4	5.0
24	0.4	4.0

3. No public sewer shall be smaller than eight inches in diameter.

4. Sanitary sewer system layout shall provide a system of lines that generally increase in diameter from higher to lower areas within a basin. Once a sewer line size is increased at any point in the system, it shall not be reduced in size at any downstream location, regardless of available slope.

B. **Location.** The following criteria shall apply:

1. Where possible, sewer lines shall be located under streets in the center of a driving lane.

2. Sewers should be laid deep enough to drain basements and to prevent freezing. All sewer lines shall have a minimum depth of cover of 3-feet, and a maximum depth of cover of 18-feet, measured from the top of pipe to the final surface grade.

3. Where sewer line depths are less than 4-feet and the main is located under a right-of-way, street, driveway, parking lot, or other areas where live loading is a concern, special pipe materials (such as ductile iron pipe) or other structural measures (such as concrete encasement) shall be provided.

4. All sewer lines shall be laid at a constant slope between manholes.

5. All sewer lines shall be laid in a straight alignment between manholes.

6. Sewer lines shall be designed to provide a minimum clear separation of 10 horizontal feet from any water line or appurtenance. Horizontal edge-to-edge separation with utilities other than water lines shall be 5 horizontal feet mini-

mum, and shall in all cases allow for future excavation of the sewer line without causing damage to the adjacent utility.

7. Where sewer lines are proposed to cross water lines or other utility lines, they shall be designed to cross at an angle close to 90-degrees. Minimum vertical clearance between the edge of the sewer line and the edge of the other utility line shall be 18-inches.

8. Where a minimum horizontal separation of 10-feet or a vertical separation of 18-inches cannot be maintained between sewer and water lines, the crossing must be constructed to protect the water line. Minimum protection horizontally shall consist of concrete encasement. Minimum protection vertically shall consist of concrete encased SDR-35 pipe extending 10-feet either side of the crossing. See Standard Sewer Detail No. 9 for further requirements.

9. Where sewer lines are placed in carrier pipes, the casing shall conform to the requirements of Standard Sewer Detail No.10.

C. **Materials**. The following criteria shall apply:

1. Gravity sewer pipe shall be new and shall be SDR-35 PVC pipe in accordance with Technical Specification 02595: 8”-15” PVC Pipe or Technical Specification 02596: 18”-27” PVC Pipe. All sewer pipes shall be of adequate strength to support trench and AASHTO HS-20 highway loadings.

2. Sanitary sewers under pressure shall be ductile iron pipe in accordance with Technical Specification 02565: Ductile Iron Pipe (AWWA C151), or PVC pipe in accordance with Technical Specification 02597: 4"-12" PVC Pressure Pipe, (AWWA C-900).

3. Sewer pipe shall be installed per Technical Specification 02200: Earthwork and the Standard Sewer Detail No. 8.

D. **Summary Table**. A table shall be prepared that summarizes the sewer line design. The table may be included on the drawings or submitted separately, and shall contain the following information for the downstream end of every pipe:

1. ERTs = Number of ERTs tributary to the pipe

2. D = Pipe diameter

3. M = Pipe Material

4. PF = Peaking factor

5. n = Manning’s ‘n”

6. S = Slope (ft/100 ft)

7. Q-peak = Peak flow (gpd)

8. V-peak = Peak flow velocity (fps)

9. d-peak = Peak flow depth (inches)

10. d/D peak = Ratio of peak flow depth to inside pipe diameter

11. Q-avg = Average flow (gpd)

12. V-avg = Average flow velocity (fps)

13. d-avg = Average flow depth (inches)

14. d/D avg = Ratio of average flow depth to inside pipe diameter

3.2.4 Manholes

Manholes shall be designed to promote smooth, continuous flow between adjacent reaches of sanitary sewer lines. Standard Sewer Details No. 1 through 7 and the following design criteria shall apply to manholes:

A. **Location**. The following criteria shall apply:

1. Manholes shall be required at all pipe junctions, at the upper end of each sewer line, and at all changes in slope, pipe diameter, and pipe alignment.

2. Manholes shall be required at all service connections eight inches in diameter or larger.

3. Manholes shall be required along sewer lines at distances not greater than 400-feet for all sized pipes.

4. Where possible, manholes will be located in streets in the center of a driving lane.

5. Manholes shall not be located in curbs, pans, drainage ditches, or any locations where water can collect and pool.

6. Manholes shall not be located in areas subject to flooding from floodplains, surface runoff, or ponding.

7. Direct access by maintenance vehicles shall be provided to each manhole in accordance with the provisions of Section 3.1.4.

B. **Size and Configuration**. The following criteria shall apply:

1. Manholes shall have a minimum inside diameter of 4-feet for pipes 18-inch in diameter or smaller. Manholes shall have a minimum inside diameter of 5-feet for pipes 21-inch in diameter or larger.

2. Sanitary sewer lines shall be designed so that the minimum angle between any upstream line and the downstream line is 90-degrees.

3. Manholes less than or equal to 5-feet from invert to top of cone shall have a flat-top section in lieu of a cone section.

4. Grade adjustments shall be made using precast concrete adjusting collars ranging in size from a minimum of 4-inches to a maximum of 10-inches. Total grade adjustment allowed by use of collars shall be 18-inches.

5. In open space areas, manhole rims shall be set 6-inches above grade to prevent infiltration from surface runoff.

6. U-shaped flow channels shall be required in all manholes, connecting the inverts of the upstream and downstream pipe sections. For pipes less than 15-inches in diameter, the height of the channel shall be one-half of the pipe diameter. For pipes 15-inches in diameter or larger, the height of the channel shall be three-fourths of the pipe diameter.

7. Manholes shall have a minimum drop of 0.2-feet across the manhole.

8. Where manholes are designed to collect flows from two or more incoming lines, the design "in" inverts shall be set to keep the largest incoming line lower in the manhole than the other incoming lines. The other, smaller incoming line(s) shall enter the manhole a minimum of 0.1-feet higher than the invert of the largest line. Maximum inside drop from upstream invert to downstream invert shall be 18-inches.

9. Drop manholes shall be avoided wherever possible. Where there are no available alternatives, outside drop manholes shall be required where the invert of the upstream pipe section entering the manhole is greater than 18-inches above the invert of the downstream pipe exiting the manhole. Drop manholes shall be constructed per Standard Sewer Detail No. 2 and 3.

10. Service connections directly to manholes are not permitted.

C. **Materials**. The following criteria shall apply:

1. All manholes shall be constructed of pre-cast concrete barrels and bases unless otherwise approved by the District. If approved, cast-in-place manhole bases shall extend a minimum of 8-inches below the pipe invert and the overall outside base dimensions shall be 16-inches greater than the inside diameter of the manhole barrel section. The base shall be constructed of pre-mixed concrete having a minimum 28-day compressive strength of 3,000 psi.

2. All manhole structures shall be of adequate strength to support AASHTO HS-20 highway loadings.

3. Manholes that must be located within the 100-year floodplain, or in a location where runoff may accumulate and pond, shall be installed with a watertight, bolting-type cover to prevent infiltration. The manhole ring shall be bolted to the manhole cone to prevent possible damage due to run off.

4. Manholes shall be in accordance with Technical Specification 02540: Precast Concrete Manholes and Vaults.

3.2.5 Service Lines

Service lines shall be a minimum of 4-inches in diameter and shall be placed in accordance with the minimum and maximum slope information provided previously in this section. The service line shall be joined to the sewer main with a wye fitting or an approved saddle permanently connected above the spring line of the sewer main. See Standard Sewer Detail No. 11 for further requirements on service line connections.

Service lines shall not enter at manholes.

Separate service lines shall serve each building capable of future individual ownership. Condominium or townhome service line configurations will be approved on an individual basis. Sewer service lines shall be installed per the latest version of the Uniform Plumbing Code.

Service lines are to be installed only in cases where served lots are known and likely building locations designated. Services to future locations that cannot be identified closely enough to guarantee their use by the property owner will not be installed.

Cleanouts, in accordance with Standard Sewer Detail No. 12, shall be installed on all service lines at the property line.

3.2.6 Lift Stations & Force Mains

The District will only accept lift stations and force mains after all gravity alternatives have been exhausted. If a lift station is necessary, it shall be designed in accordance with the most recent version of CDPHE regulations for Wastewater Pumping Stations (Policy

96-1) and these Codes & Standards. Concurrent with District review of the design, the Developer's Engineer shall submit the design to CDPHE for approval and shall be responsible for completing the required Site Application process. In addition to the requirements of CDPHE Policy 96-1, all lift stations shall meet the requirements of Standard Sewer Detail No. 20 and shall include the following:

A. Control panel which provides for:
   1. Automatic alternator for lead-lag operation
   2. Automatic reset
   3. Hour meter for each pump motor
   4. Low voltage protection relays
   5. Running overload and high level lights
   6. HOA switch for each pump

B. Basket strainers that are easily accessible.

C. Mercury bulb float switches

D. Auxiliary heaters and insulation in the dry well

E. Separate check and gate valves for each pump

F. Dry well sump pump or drain outlet

G. Epoxy paint coatings inside and outside for all metal surfaces

H. Remote-switched blower ventilation system

Minimum size of force mains shall be four (4) inches. Pipe shall be sized to maintain velocities between 2 and 6 feet per second. Force mains should be installed at a positive grade to a manhole where a gravity sewer line begins. Where positive grades cannot be maintained, air and vacuum release valves must be installed at all relative high points in the line. Minimum depth for force mains shall be four feet.

Valves on force mains shall be installed per Standard Sewer Detail Nos. 14 and 15 and shall meet the requirements of the following specification sections:

- Technical Specification 15200 – Valves, General
- Technical Specification 15203 – Check Valves
- Technical Specification 15206 – Gate Valves
- Technical Specification 15207 – Plug Valves
- Technical Specification 15230 – Miscellaneous Valves

Pressure cleanouts on force mains shall be installed per Standard Sewer Detail No. 13.

Thrust blocks on force mains shall be installed per Standard Sewer Detail Nos. 16 and 17.

3.2.7 Grease Interceptors

To prevent grease buildup in the wastewater collection system, grease interceptors shall be installed as required by the District's Rules and Regulations. The grease interceptor design shall be shown on the sewer plans, along with design calculations, and shall be certified by a Professional Engineer licensed by the State of Colorado. Grease interceptors shall be designed per the applicable Plumbing Code used by the City of Durango or La Plata County, and the criteria listed below. If any conflicts arise between the various criteria, the more stringent criteria shall apply.

A. Grease interceptors shall be installed and connected so that they shall be easily accessible for inspection, cleaning, and removal of the intercepted grease. The interceptor shall be located as close to the source as practical; however, it must be outside the facility served.

B. The interceptor shall only collect waste from kitchen areas, i.e. no sanitary wastes.

C. For eating establishments and restaurants of any size, the size of the interceptor shall be determined by the following formula:

$$TS = D \times GL \times HR/2 \times LF$$

where:

TS = total size of interceptor, in gallons
D = number of seats in dining room
GL = gallons of waste per meal (use 5 gallons/meal)
HR = number of hours restaurant is open
LF = loading factor
0.8 for active facility, or if open more than 8 hours/day
0.5 for light activity, or if open less than 8 hours/day

The minimum interceptor size shall be 750 gallons.

D. For establishments other than restaurants, the size of the interceptor shall be determined by the following method:

1. Determine the type of fixtures and the size of a dishwasher, if any, discharging into the interceptor.

2. Determine the dishwasher flow rate and the flow rate of the single largest of all the sinks based on trap size. Using the following table, pick the highest gpm found for either the largest trap size or the dishwasher. This is the maximum probable flow rate into the interceptor.

Drain Outlet or Fixture Trap size, inches	Max Flow, gallons per minute equivalent
1-1/2	22.5
2	30
2-1/2	35
3	45
4	60
30 gallon or less dishwasher	15
50-gallon or less dishwasher	25
100-gallon or less dishwasher	40

3. Multiply the maximum probable flow rate by 30 to calculate the minimum interceptor size in gallons. Pick the standard size with a capacity equal to or larger than the calculated size.

4. A minimum size should be chosen based on the size of the establishment as follows:

   - For small shops, such as pizza parlors, meat markets, or other similar establishments: 750-gallon capacity.

   - For larger size establishments, such as regular supermarkets: 1,000-gallon capacity.

   - For very large supermarkets and other similar establishments: 1,500-gallon capacity.

E. See Standard Sewer Detail No. 18 for additional grease interceptor design requirements.

F. Grease interceptors shall be cleaned when 50% of the wetted height contains grease or every 6 months whichever comes first.

3.2.8 Sand & Oil Interceptors

To prevent petroleum-based waste, sand, and gravel from entering the treatment system, sand and oil interceptors shall be installed as required by the District's Rules and Regulations. The sand and oil interceptor design shall be shown on the sewer plans, along with design calculations, and shall be certified by a Professional Engineer licensed by the State of Colorado. Sand and oil interceptors shall be designed per the applicable Plumbing Code used by the City of Durango or La Plata County, and the criteria listed below. If any conflicts arise between the various criteria, the more stringent criteria shall apply.

A. Sand and oil interceptors shall be installed and connected so that they shall be easily accessible for inspection, cleaning, and removal of the intercepted oil. The interceptor shall be located as close to the source as practical; however, it must be outside the facility served.

B. The interceptor shall only collect waste from washdown areas, i.e. no sanitary wastes.

C. Vehicle Servicing. When a sand and oil separator is installed in an automobile, truck, bus, or tractor garage, in a service station, or in a repair shop with facilities for motor or transmission overhauling, it must have a minimum static water depth of 24-inches below the invert of the separator outlet and a minimum static water capacity of 6 cubic feet. This applies to facilities where not more than three vehicles are serviced. For each additional vehicle up to and including 10, one cubic foot of static capacity shall be added. For each vehicle over ten, an additional 0.25 cubic foot shall be added.

D. Vehicle Storage. In motor vehicle storage facilities, a combination separator-drain shall be installed with a static water level of 1 gallon for every 100 square feet of area to be drained.

E. Vehicle Storage and Servicing. Where motor vehicles are serviced and stored, a sand and oil separator shall be installed with a static water capacity of 1 cubic foot for every 100 square feet of area to be drained. The interceptor shall have a minimum capacity of 6 cubic feet.

F. Mechanical Car Washing. In facilities designed especially for mechanical washing of motor vehicles, a sand and oil interceptor shall be installed to receive the water from all washing facilities. A minimum static water level of 2.5 feet and a minimum static water capacity of 50 cubic feet shall be maintained.

   Where motor cleaning services are rendered at mechanical car washing facilities, a sand and oil separator shall be installed in that section of the drainage system which receives water from this operation.

G. Manual Car Washing. In a one-car washing facility, a combination separator-drain shall be installed with a minimum static water capacity of 30-gallons.

H. See Standard Sewer Detail No. 19 for additional sand and oil interceptor design criteria.

3.2.9 Interceptor Maintenance Agreement

An Interceptor Maintenance Agreement is required for all grease, sand, and oil interceptors before they are brought on-line. This agreement establishes recommended cleaning frequencies and requires the Owner of the facility to send the District copies of receipts

from the interceptor cleaning company in order to provide evidence of regular interceptor maintenance.

3.3 INSTALLATION

3.3.1 General

The Contractor shall verify measurements and dimensions of the work, as an integral step of starting each installation. Where installations include manufactured products, the Contractor shall comply with the manufacturer's applicable instructions and recommendations for installation, to whatever extent the manufacturer recommendations are more explicit or stringent than applicable requirements in these Codes & Standards.

If required, dewatering shall be in accordance with Technical Specification 02140: Dewatering.

All excavation, trenching, and backfilling shall be in accordance with Technical Specification 02200: Earthwork.

3.3.2 Storage & Handling

The Contractor will be responsible for the safe storage and protection of all materials delivered to the work site. Any damaged materials shall be repaired or replaced at the Contractor's expense. All materials shall be handled with equipment and methods adequate to prevent shock or damage and in accordance with any applicable industry standards.

3.3.3 Acceptance Testing

Testing for sewer system installations shall be in accordance with Technical Specification 02622: Pipeline and Manhole Testing.

3.3.4 Materials

A. **Sewer Pipe**

1. Check for proper pipe. Should be factory-stamped "SDR-35 ASTM 3034"
2. Check for cracks at both ends – reject if necessary.
3. Check for dents or blemishes - discoloration indicates problems.
4. Check for sun exposure damage - discoloration indicates problems.
5. Check that rubber gaskets in bell ends are not weathered or cracked and are still black and pliable.

6. Should be new and cleaned out.

B. **Manholes**

1. Concrete Condition
   - Check for cracked or chipped concrete – patch if necessary

2. Poured inverts:
   - Must have long radius bends running continuously from inlet to outlet resulting from the use of a special invert form.
   - No short radius bends especially for deflections of more than 45°
   - Check for cracked concrete – patch if necessary

3. Steps
   - Check that steps are well installed and line up with the orientation of the manhole so that when assembled the steps align with the eccentric edge of the cone and/or opening for the rim and cover, and not over the channel but the shelf to allow one to step off onto the shelf at the bottom easily

4. Grade Rings
   - Check to make sure that when assembled the manhole will not require more that 18" of grade rings above the top of the cone or reducing slab (for shallow flat top manholes) to reach finished grade

5. Rim and Cover
   - Make sure they are labeled with "SEWER" and are durable cast iron with adequate lifting or opening slots or eyes

6. PSX Boots or A-Lock
   - Both acceptable
   - If A-Lock, don't grout outside because don't want to lose flexibility

C. **Pipe Zone Bedding Material**

1. Ideal material is 3/4" minus A.B.C. (aggregate base course) or CDOT Class 6 material (same thing).

2. Contractor may try to substitute some cheaper material, which may be O.K but must be approved on a case by case basis. In general the material must have:
   - No rocks bigger than ¾-inch in diameter
   - If using a gravelly material such as screened or washed rock or pea gravel (something without finer graded material mixed in), then we need filter fabric on top of pipe zone to prevent fines from the trench zone material above from filtering down into the gravel resulting in a settling trench.

- Sand, Crusher Fines, or other fine grained material shall be carefully evaluated to insure that it has a low clay content and is well graded (several different sizes of particles) and is high in sand content.

3. Proctor Test on Material - All material used shall have a proctor taken by a geotechnical testing lab (a proctor tells how dense a particular material can get i.e. in general terms a 100-percent proctor density is the most dense or compact a material can get). Without a proctor no relative compaction testing can be done. The important thing about a proctor and compaction testing is that the materials are homogeneous and consistent in characteristics. If the material changes, i.e. it looks different, or it performs different, a new proctor should be taken for the different material.

D. **Trench Zone Bedding Material**

1. Depends if there is a road above or open land

2. If road, then should be backfilled with 3" minus A.B.C. or smaller gradation A.B.C. (aggregate base course - road base material).

3. If open land, then can be back filled with "suitable" native material - "suitable" meaning not top soil or organic material or thick wet clay but material that is well graded and has some structural stability.
   - No rocks bigger than 12-inch in diameter if compaction equipment can accommodate 18" lifts. Basically largest rock size shall be 6" less than the back fill lift thickness the contractor's equipment can accommodate (check with engineer to confirm equipment's capabilities)

4. Proctor Test on Material - same as described above in 3.3.4, C-3.

3.3.5 Excavation

A. Cut trench starting from the downstream end and proceeding upstream, (opposite the direction of flow).

B. Excavate trench to the flow line grade plus 5" minimum, and to the bottom of manhole grade plus 12" minimum.

C. Get all large rocks out to create smooth even trench bottom.

D. Over-excavate soft spots or non-suitable material and replace with 3/4" minus A.B.C. compacted to 95% modified proctor density according to ASTM D 1557.

E. If groundwater is encountered, the work should stop and the contractor must submit a dewatering plan for approval by the District Engineer.

3.3.6 Bedding Below Pipe

A. Minimum of 4-inches of pipe zone bedding below pipe.

B. Compact to 95% modified proctor density according to ASTM D 1557

C. Compaction testing may be required at the inspector's discretion, if it is suspected that the compaction effort is not achieving the desired density.

3.3.7 Pipe Laying

A. Lay pipe from downstream to upstream with pipe bells pointed upstream.

B. Slope per drawings (ideally use laser device to set pipe grade and to monitor grade as the pipe is being installed, bedded, and compaction is completed).

C. Smooth, continuous bedding under pipes (no air gaps). This requires the contractor to hand dig small depressions to accommodate the bells at each joint as the pipe is being laid.

D. Full pipe lengths should be used wherever possible to minimize the number of joints and the potential for leaks.

E. A No. 12 copper wire shall be attached to all PVC force main pipe for the purpose of future location in accordance with the Standard Details and specifications. Warning tape shall be installed above all PVC gravity pipe at a depth of 18-inches below finished grade to provide adequate warning of a buried utility to persons performing excavation activities.

F. Make sure joints are not driven home completely….but close! – joints should be assembled so that as the spigot end of the pipe is being inserted into the bell, the black line on the plain end should just disappear from view. This gives a narrow gap on the inside of the pipe, while still allowing for a flexible joint. If the joint is "driven home" so that the end of the spigot makes direct contact with the taper of the bell, the joint will have limited flexibility and no thermal expansion room.

G. Check for minimum cover requirements. From top of pipe to finish grade must be a minimum of 3-feet.

H. Photos should be taken at this stage to show pipe and bedding.

3.3.8 Service Connections

A. Both service saddles and full pipe "wye" fittings are acceptable. Contractor shall submit method and product information at the pre-construction conference.

B. The service connections shall be assembled so that the opening into the main is located above spring line at approximately 2 or 10 o'clock.

C. All sewer service lines shall be a minimum 4" in diameter, and laid at a minimum slope of 1%.

D. All fittings used shall be long radius bends not exceeding 45-degrees in deflection angle, and not all glue fittings (gasketed fittings shall be installed at regular intervals to allow for flexibility).

E. The District takes no responsibility for service lines beyond the main line including any service saddle or pipe or fittings beyond the full pipe "wye" fitting.

3.3.9 Bedding on Sides of Pipe

A. Bring pipe zone bedding up to a couple of inches above centerline (springline) of pipe.

B. Prevent dirt from entering end of pipe or at service line wyes.

C. Watch carefully, as this procedure will tend to lift the pipe and bring it off of the desired design grade. Ballast material or other methods may be used to hold the pipe down, e.g. put piles of pipe zone bedding material on the nearby joints.

D. Hand haunch the back fill material with a bar or shovel handle to fill all air voids around and under the pipe.

E. Hand compact both sides of the pipe with “jumping jack” type compaction equipment to ensure pipe is well-bedded at “springline” on both sides.

F. Compact to 93% modified proctor density according to ASTM D 1557

G. Compaction testing may be required as quality assurance dictates (inspectors discretion, as you suspect the compaction effort is not getting the desired density).

H. Re-check grade after pipe is bedded

3.3.10 Bedding to 12-inches Above Pipe

A. Bring pipe zone bedding up to 12-inches above pipe

B. Compact to 95% modified proctor density according to ASTM D 1557

C. Compaction testing may be required as quality assurance dictates (inspectors discretion, as you suspect the compaction effort is not getting the desired density).

D. Lay filter fabric material as may be required.

3.3.11 Trench Zone Backfilling

A. A six inch (6") wide warning tape shall be installed above all gravity pipe at approximately 18-inches below finished grade to indicate the location of the buried pipeline.

B. Bring to within 12" of the top of the trench (or as directed by the development plan requirements) using trench zone material.

C. Compact in 18-inch or less lifts

D. Compact to 93% modified proctor density according to ASTM D 1557

E. Test compaction every 400 feet of trench, and at each branch or section of trench less than 400 feet. Testing shall be performed at the top of the trench zone and at the mid depth of the trench zone when the trench zone thickness exceeds four feet. Additional testing may be required as quality assurance dictates (inspectors discretion)

3.3.12 Surface Zone Backfilling

A. Trench shall be surfaced according to development plans and specifications.

B. In open areas or areas that will be left undeveloped, the surface zone of the trench (top 12" of the trench depth) shall backfilled with the trench zone material and all large rocks above 6" diameter shall be removed.

C. Compact to 93% modified proctor density according to ASTM D 1557.

3.3.13 Manhole Installation

A. Compact native material below manhole to 95% modified proctor density according to ASTM D 1557

B. Place a minimum 12" thick layer of 3/4" A.B.C. material as a leveling course compacted to 95% modified proctor density according to ASTM D 1557.

C. Test compaction only as quality assurance dictates (inspectors discretion)

D. Set base section level, oriented or rotated according to plan, and to the design grades using laser device and other methods as required.

E. Assemble manhole sections as per manufactures recommendations and to meet District Standard Sewer Details. Watch step placement as described above.

F. Pipes shall be inserted into manhole and grouted in place so as to match the invert of the pipe with the invert of the concrete trough of the manhole within a tolerance of 1/8" (no humps or jumps). Shimming the pipe inside the manhole to accomplish this grade is not allowed, as shims are often left in the grout and affect the grout integrity. The pipe shall be blocked from the outside of the manhole only, until the pipe is securely grouted on the inside as per District standards and specs.

3.3.14 Acceptance Testing

A. Acceptance Testing shall be in accordance with Specification 02622.

B. Test after trench is backfilled but before permanent resurfacing is placed.

C. Plug service lines or don't connect them until after testing

D. Air Pressure Test to test sewer lines for leaks

E. Check for rock points, leaks, alignment, deflections, etc.

F. Lamp Test and Mandrel Test to test sewer lines for deflection (pipes shall be cleaned immediately before Lamp and Mandrel tests)

G. CCTV inspection at the end of construction and the end of the warranty period (pipes shall be cleaned immediately before CCTV inspection)

H. Optional water-testing of manholes at Inspector's discretion – see Specification 02622.