

CITY OF LONGMONT
SECTION 300 – STORM DRAINAGE AND PRIVATE UNDERDRAINS
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300.00 STORM DRAINAGE CRITERIA

300.01 PURPOSE

- A. The City of Longmont Storm Drainage Criteria Manual (LSDCM) has been adopted by reference as set forth in City Code. The requirements presented herein are intended to supplement and not replace or contradict the existing LSDCM. The requirements presented herein provide requirements for the construction materials and practices for storm infrastructure. Should any requirement be in conflict with the LSDCM, the more restrictive of the criteria shall apply.
- B. All additions or modifications to the City of Longmont storm sewer system or any private storm sewer system within the city limits shall be designed in accordance with the criteria set forth in the LSDCM and this Section. Other sections of the City Standards may include additional criteria or the City Engineer may prescribe alternative criteria for the overall hydraulics of the storm sewer system, according to the circumstances of the project.
- C. In the event the LSDCM or the City Standards do not address a design methodology or calculation, Mile High Flood District (MHFD) criteria, which can be found on the MHFD website, may be used at the discretion of the City Engineer.
- D. Development projects shall, depending on the circumstances of the project, be required to provide analysis of the existing storm sewer system capacity and a condition assessment in the vicinity of the project, as requested by the City Engineer. In areas where the storm sewer system does not conform to these City Standards or meet the needs of the proposed development, the City Engineer may require off-site improvements to existing public infrastructure to bring the storm sewer system and/or appurtenances into compliance in order to adequately serve the proposed development.

300.02 ENFORCEMENT

The enforcement of Section 300 Storm Drainage shall be as provided in Section 100 of the City Standards and the LSDCM.

300.03 SEPARATION OF STORMWATER AND SANITARY FLOWS

- A. Sanitary sewage systems that overflow or bypass untreated sewage into surface streams are not permitted in Colorado. Drainage planning and design shall prevent inflow to sanitary sewers resulting from street flow and channel flooding.
- B. Illegal connections of sanitary sewers to the storm drain system or conditions where storm drains intercept flows from leaking sanitary sewers shall be corrected to protect public health.

300.04 FACILITIES MAINTENANCE AND ACCESS

All storm sewer systems shall have adequate access for maintenance activities such as removal of sediment, debris, and trash; mowing; and repair of structures. Assured long-term maintenance is essential and must be addressed during planning and design. Waterways, detention facilities, and other drainage facilities shall have access in conformance with the requirements as outlined in Section 200 of these City Standards.

300.05 SUBMITTALS

Refer to Section 100 of these City Standards and Chapter 2 of the LSDCM for submittal criteria and standards.

301.00 FLOOD RISK MANAGEMENT

301.01 COMPLIANCE

All work within the 1% annual chance (100-year) floodplain as designated by the Federal Emergency Management Administration (FEMA), City designated floodplains, master plans, or other studies within the City of Longmont, shall conform to the Floodplain Regulations in Title 20, City Code, and Chapter 4 of the LSDCM.

301.02 FLOODPLAIN DEVELOPMENT PERMITS

- A. All work within any designated 1% annual chance (100-year) floodplain requires an approved Floodplain Development Permit (FDP) from the City prior to the start of any site work.

- B. Floodplain Development Permits may require a Floodplain Impact Analysis (FIA) and applicable approval by FEMA. Reference LSDCM Appendices for Floodplain and FIA submittal items.

302.00 STORM DRAINAGE DESIGN

302.01 GENERAL

The Refer to Chapter 5 and 6 of LSDCM for Runoff and Rainfall criteria.

302.02 OPEN CHANNELS

Refer to Chapter 10 of LSDCM for Open Channel criteria.

302.03 STORM SEWER SYSTEMS

A. GENERAL

- (1) Storm sewer design shall be completed using the methodology presented in the LSDCM, Chapter 9.
- (2) All pipe material shall be of the type and materials specified herein. The use of materials other than those specified herein shall require approval from the City Engineer.
- (3) Public storm sewer shall have a minimum diameter of 18 inches.

B. ALIGNMENT

- (1) Storm sewer mains shall typically be:
 - a. Located under the asphalt.
 - b. A minimum of ten (10) feet south or east of the street centerline.
 - c. A minimum of ten (10) feet horizontally from the edge of all existing or proposed water mains or sanitary sewer mains.
 - d. A minimum of five (5) feet horizontally from the lip of gutter.
 - e. A minimum of 15 feet from any existing or proposed structures, unless approved by the City Engineer.
- (2) Storm sewer mains shall follow the requirements for Utility Line Separations and Crossings located in Section 103 of these City Standards for storm sewer clearance from other utilities.
- (3) Storm pipe alignment between manholes shall be straight. Curvilinear alignments and joint deflections shall not be allowed. Horizontal separation from other utilities shall be as specified above and in Section 100 of these City Standards.
- (4) Refer to Chapter 9 of the LSDCM for criteria on bury depth. Vertical clearance from other utilities shall be as specified in Section 100 of these City Standards.

C. ACCESS POINTS

Storm Drainage Systems shall be designed with access points at all bends, pipe junctions, or transitions in pipe size within the system and spaced no further than required in Chapter 9 of the LSDCM. Access points shall include but shall not be limited to manholes and inlets. Manholes are required at all changes in grade, alignment, pipe materials, and pipe sizes.

D. INLET DESIGN CRITERIA

- (1) Inlet design shall be completed using the methodology presented in the LSDCM Chapter 8.
- (2) Inlets within the street curb and gutter section shall be designed as a CDOT Type R inlet. Refer to Colorado Department of Transportation (CDOT) Miscellaneous Standard Plans & Project Special Drawings for Type R inlet detail. Combination Type 13 inlets may be allowed in specific circumstances where the Engineer of Record can demonstrate that a Type R inlet will not work and shall require an Exception to the City Standards.

- (3) Combination Type 13 inlet depth shall not be greater than four (4) feet from the gutter flow line to the invert of the box.
- (4) Type R Inlets shall be two (2) feet from the flowline to the lip of gutter by setting the inlet's throat six (6) inches back from the flowline of curb and gutter. The curb and gutter shall be flared by five (5) feet on both sides of the inlet to offset the inlet's throat six (6) inches. Refer to detail 200-23 "Type R (Modified) - (Chase)" for Type R installation assembly, and to detail 200-35 "Staking Detail Mountable Curb Inlet" for mountable curbs.
- (5) Other CDOT inlet types may be utilized outside of the street section with City approval.
- (6) Trench drains are not allowed within the public right-of-way.

E. MANHOLE DESIGN CRITERIA

- (1) Refer to Chapter 9 of LSDCM for Spacing and Sizing of Manholes criteria.
- (2) Drop manholes shall be evaluated and approved by the City on an individual basis. The drop shall be designed in such a way as to protect personnel entering the manhole for maintenance and operation as well as hydraulic functions.
- (3) If the manhole invert is deeper than 15 feet below finished grade or rim elevation, a structural design of the manhole base shall be required to be submitted to the City Engineer for review prior to construction.
- (4) Maintenance access shall be provided to manholes installed in areas outside of the public right-of-way in a manner that conforms to Section 200 of these City Standards.
- (5) If the manhole is located in the 100-year floodplain, or if it is otherwise required by the City Engineer, a solid manhole cover, having an integral O-ring type gasket that can be bolted closed, shall be used.
- (6) Manholes shall be located in asphalt or concrete paving when within rights-of-way. Manholes shall not be located within concrete pans, sidewalks, or gutters.
- (7) Conic section manholes shall be used where room allows. Flat top manholes shall only be used where a conic section manhole will not fit.
- (8) Manhole lids shall be placed in such a way that the manhole lid is placed above the access rung.

F. STREETS

Refer to Chapter 7 of LSDCM for Street Conveyance criteria.

G. CULVERTS AND BRIDGES

Refer to Chapter 12 of LSDCM for Culvert and Bridge Design criteria.

H. HYDRAULIC STRUCTURES

Refer to Chapter 11 of LSDCM for Hydraulic Structure Design criteria.

I. STORAGE / DETENTION

- (1) Refer to Chapter 13 and 14 of LSDCM for Storage and Detention Design criteria.
- (2) Refer to Section 100 for Retaining Wall standards. Retaining walls shall allow for access to facility.
- (3) Public Detention or Extended Detention Basin (EDB) Access Standards:
 - a. A stable access and working bench shall be provided so that equipment can remove accumulated sediment and debris from the detention basin and perform other necessary maintenance activities on all components of the facility. Unless otherwise approved by the City, the distance from the working bench to the furthest point of removal for the forebay,

bottom of the detention basin, or outlet structure shall be no more than 24 feet. The working bench and access drive shall slope no more than ten percent (10%). The access drive shall be at least 12 feet wide for a centerline radius greater than 80 feet, and at least 14 feet wide for a centerline radius between 50 and 80 feet. The minimum centerline radius shall be 50 feet. Unless otherwise approved, the working bench and access drive shall be constructed of the following materials.

- i. Below any permanent water surface: CDOT Class P concrete, at least six (6) inches thick with minimum reinforcement consisting of No. 4 reinforcing bars at 12-inches each way, centered in slab. Surface of concrete shall be provided with a grooved finish to improve traction, with grooves oriented to drain water away to one or both sides. Concrete shall be placed over at least six (6) inches of one and one-half (1.5) inch crushed rock compacted in a single lift over at least a six (6) inch layer of compacted subgrade. All base coarse and subgrade shall be compacted to 95% of Standard Proctor.
 - ii. Below the Excess Urban Runoff Volume water surface: Concrete as specified above, or Class 5 or 6 aggregate base course per CDOT Standard Specifications 703.03, or any graded crushed rock smaller than two (2) inches may be used. The granular material shall be compacted in lifts to a total 12-inch-thick section over at least six (6) inches of compacted subgrade. All base coarse and subgrade shall be compacted to 95% of Standard Proctor.
 - iii. Above the Excess Urban Runoff Volume and below the 100-year water surface: concrete as specified above, or Class 5 or 6 aggregate base course per CDOT Standard Specifications 703.03, or any graded crushed rock smaller than two (2) inches may be used. The granular material shall be compacted to provide a total eight (8) inch thick section over at least six (6) inches of compacted subgrade. All base coarse and subgrade shall be compacted to 95% of Standard Proctor.
- b. Alternative Materials: Recycled or crushed concrete shall not be used in the construction of any maintenance access areas. The use of reinforced grass pavement meeting applicable MHFD criteria, shall be considered by the City on a site-by-site basis, depending on the circumstances of the project. If used, a system of marking the edges shall be required so that the location is evident to maintenance crews. Shrubs, trees, sprinkler heads, valve boxes, and other items, shall not be located in the reinforced grass pavement.
 - c. Any retaining walls shall be laid out in a manner that avoids access restrictions. Any handrails or fences shall permit vehicular access. The entrance to an access drive shall be located so that traffic safety is not compromised. When reinforced grass pavers are used for access, a letter from a geotechnical engineer stating the road base can support 75,000 pounds will be required prior to pond certification (reference Section of 100 of these City Standards).

J. RAW WATER STORAGE AND JURISDICTIONAL DAMS

Refer to Chapter 3 of LSDCM for Raw Water Storage and Jurisdictional Dams criteria.

K. WATER QUALITY TREATMENT / EROSION CONTROL

- (1) Refer to Chapter 13 and 14 of LSDCM for Water Quality Design criteria.
- (2) Refer to Chapter 16 of LSDCM for Erosion Control criteria.

303.00 STORM DRAINAGE CONSTRUCTION

303.01 MATERIALS

A. GENERAL REQUIREMENTS

- (1) The Contractor shall provide a copy of the manufacturer's installation recommendations for each type of pipe to each foreperson and City Inspector prior to construction. These installation recommendations shall be followed during construction unless otherwise allowed by the City Engineer to follow City Standard or other requirements. City Standard requirements take priority over the manufacturers' installation recommendations.
- (2) The City Engineer reserves the right to require testing of pipe and materials after delivery and to reject all pipe or materials represented by the sample which fail to comply with the specified requirements.
- (3) For a specific list of materials accepted by the City, see the Wastewater Collection Approved Materials List in the Appendices.
- (4) Storm pipe in public rights-of-way shall be reinforced concrete pipe (RCP) conforming to American Society for Testing and Materials (ASTM) Physical Testing Standards and Mechanical Testing Standards C-76, C-506, and C-507 with a diameter not less than 18 inches. Other pipe materials may be considered for use outside of public right-of-way according to the circumstances of the project as approved by the City Engineer.
- (5) Reinforced concrete pipe (RCP) with a diameter greater than or equal to 15 inches is required for private connections to public manholes.
- (6) Concrete for storm sewer structures shall be a minimum of CDOT Type B or D mix. Other concrete mix designs may be submitted for consideration by the City Engineer.
- (7) All materials shall be new and unused, except as otherwise provided herein.
- (8) All pipe sizes and references to pipe diameter on the drawings or in the specifications are intended to be the nominal inside diameter and shall be interpreted as such.

B. REINFORCED CONCRETE PIPE MATERIAL (RCP)

- (1) Reinforced concrete pipe shall be used for storm sewer under pavement surfaces within public right-of-way.
- (2) Description:
 - a. Circular reinforced concrete pipe shall meet the requirements of ASTM Physical Testing Standards and Mechanical Testing Standards C76 and the requirements located in the Wastewater Collection Section 400 of these City Standards.
 - b. Elliptical reinforced concrete pipe shall meet the requirements of ASTM Physical Testing Standards and Mechanical Testing Standards C507 and the requirements contained herein.
- (3) All RCP pipes shall be constructed with Type II modified cement. The absorption of the concrete pipe shall not exceed five-and-one-half percent (5.5%).
- (4) Each pipe joint shall conform to ASTM C361, Section 8, with the gaskets confined in a groove cast in the pipe spigot. Pipe with collars in lieu of integral cast bells will not be accepted. The pipe joints shall be designed to withstand, without cracking, the gasket compression plus a differential load across the joint equal to 4,000 pounds per foot of inside diameter.
- (5) Each piece of reinforced concrete storm sewer pipe shall be plainly and permanently marked showing the pipe class, date of manufacture, and the manufacturer's name or mark. These markings shall be made on the outside of the pipe before curing or shall be painted on the pipe using waterproof paint.

- (6) The City Engineer shall, based on the circumstances of the project, require the submittal of reports covering joint leakage, joint shear, cement mill reports, and three edge bearings on each size and class of pipe for review before any pipe is installed in the field. The tests for joint leakage, joint shear, and three-edge bearing are for proof of design only. Reports covering tests made on other pipe of the same size, class, and design as specified herein, and manufactured from materials of equivalent type and quality, are generally acceptable.
- (7) The City Engineer shall, based on the circumstances of the project, require the submittal of drawings, specifications, and other data showing complete details of the design, fabrication, and construction of the reinforced concrete pipe for review. These submittals shall include data on all materials proposed to be used in the pipe, the size and location of each cage of the reinforcement, joint details including reinforcement, gasket details, and test results on materials, joints, and pipe.
- (8) Length: Pipe laying lengths shall be a minimum of seven foot six inches (7'-6"). The class of pipe shall be as indicated on the approved plans.
- (9) Pipe Classification: The class of pipe shall be determined to withstand loading requirements with Class III being the minimum class utilized. Bedding for concrete pipe shall be a minimum of six (6) inches below the pipe to the springline or the midpoint of the pipe.
- (10) Joints: Gaskets shall be rubber O-ring type per ASTM C361 and ASTM C443. Gaskets will be used in a bell and spigot joint. A Type 4-G Gasket is an acceptable substitute for an O-ring joint.

C. POLYVINYL CHLORIDE PIPE MATERIAL (PVC)

- (1) Polyvinyl Chloride (PVC) Pipe can be used on storm sewer projects which are not under the pavement within public right-of-way and do not routinely flow under pressure.
- (2) Polyvinyl chloride pipe shall be in accordance with the PVC material requirements located in the Wastewater Collection Section 400 of these City Standards. All sizes of PVC pipes shall be SDR 35 or stronger and shall have the ASTM specification, nominal diameter, and name or trademark of the manufacturer imprinted on the outside of the pipe.

D. CORRUGATED DOUBLE-WALLED HIGH DENSITY POLYETHYLENE PIPE (HDPE)

- (1) HDPE may be used on storm sewer projects which are not under the pavement within public right-of-way with approval by the City Engineer.
- (2) HDPE shall be manufactured in accordance with AASHTO M294 or MP7. Clean reworked material may be used.
- (3) Type S pipe shall be used for storm sewer projects. Type S pipe has a full circular cross section with an outer corrugated pipe wall and a smooth inner liner.
- (4) The minimum parallel plate stiffness values when tested in accordance with ASTM D2412 shall be as shown in table 3-1:

Table 3-1 – Minimum Parallel Plate Stiffness

| Diameter (nominal) | Pipe Stiffness (minimum) (pii) |
|--------------------|--------------------------------|
| 15" | 42 |
| 18" | 40 |
| 24" | 34 |
| 30" | 28 |
| 36" | 22 |
| 42" | 20 |
| 48" | 18 |
| 60" | 14 |

- a. Pipe and resin producers shall be certified according to the Plastic Pipe Institute/Corrugated Polyethylene Pipe Association Third Party Certification Program. All corrugated polyethylene pipe 15 inches in diameter and larger shall contain the appropriate program mark, either an official label or permanent affixation, prior to shipment.
- b. All pipe shall be clearly marked with the manufacturer’s name or trademark, the nominal size, AASHTO specification designation, plant designation code, and the date of manufacture or code, at intervals no larger than ten (10) feet.

E. JOINT TYPE

Watertight joints shall meet a laboratory test pressure of 10.8 psi per ASTM D3212 and shall have a bell and spigot or bell-bell design with an elastomeric gasket meeting the requirements of ASTM F477.

F. STORM SEWER INLETS AND STRUCTURES

- (1) Inlet grates in streets, alleys, and areas with bicyclists or pedestrians shall be of a of a close mesh inlet grate per CDOT Miscellaneous Standard Plans & Project Special Drawings Type C inlet.
- (2) Structures, including inlets and detention outlets, shall be reinforced as per the approved plans. All structures shall have steel rebar reinforcement to prevent shrinkage.
- (3) Use of a Type 13 combination or valley inlet shall be subject to the Exception process outlined in Section 100 of these City Standards.
- (4) Access covers and steps shall be provided for all inlets. Access covers shall have the words "Storm Sewer, Confined Space, Entry Permit Required" cast on the cover. Access covers shall be sized for 24 inch diameter openings, shall be one (1) inch thick, and shall be designed for traffic loading. Access covers shall be located above the pipelines so the City's jetting equipment can access the pipelines. See Section 300 details for additional information regarding location of the access cover.

G. REINFORCED CONCRETE BOX CULVERTS

- (1) Reinforced concrete box culverts may be used on storm sewer projects under the pavement within public right-of-way.
- (2) Reinforced concrete box culverts shall conform to the requirements of ASTM C789 or C850, depending on the cover over the concrete box culvert.
- (3) All concrete and steel reinforcing work shall be in accordance with the CDOT Standard Specifications for Road and Bridge Construction, Sections 601 and 602, except as modified by Section 200 of these City Standards. Additives for concrete, other than those specified in the mix design, shall not be used without prior approval of the City Engineer. When approved for use,

chemical admixtures or additives shall comply with applicable ASTM or AASHTO standards. Calcium chloride or admixtures containing chloride shall not be allowed in reinforced concrete. All concrete, unless otherwise specified on the plans, shall be Type II CDOT Class B concrete unless approved by the City Engineer. Metal reinforcement shall be deformed steel bars sized according to their application by the Engineer of Record, subject to the approval of the City. All steel reinforcement shall conform to ASTM A615, Grade 60.

H. END SECTION AND OUTFALL MATERIAL

- (1) All concrete, unless otherwise specified on approved plans, shall be Class B, per CDOT Standard Specifications for Road and Bridge Construction, unless approved by City Engineer. Metal reinforcement shall be deformed steel bars sized according to their application by the Engineer of Record subject to the approval of the City. All steel reinforcement shall conform to ASTM A615, Grade 60.
- (2) All storm sewer end sections and outfalls shall have a cast-in-place reinforced concrete headwall or a pre-manufactured flared end section, as approved by the City Engineer. Pre-manufactured end sections shall be manufactured of the same materials as the pipe to which they are connected and shall meet the minimum material specifications applying to the pipe. Reference City details 300-07A "Standard Flared End Section" and 300-07B "Elliptical Flared End Section".
- (3) All upstream storm sewer openings that are 18 inches or larger, or subject to unauthorized entrance or trash accumulation, shall have a trash rack with a galvanized coating. Reference the following City details for specific installation information: Details 300-07C "Flared End Section Trash Rack (Circular Pipe)", 300-07D "Trash Rack Mounting Detail (Circular Flared End Section)", 300-07E "Flared End Section Trash Rack (Elliptical Pipe)" and 300-07F "Trash Rack Mounting Detail (Elliptical Flared End Section)".

I. MANHOLES

- (1) All manholes shall be constructed using precast concrete sections fabricated from Type II cement and otherwise conforming to ASTM C478.
- (2) Manhole steps shall be polypropylene meeting the following requirements: Grade 60 steel-reinforced, corrosion-resistant polypropylene plastic that conforms to ASTM C478. In addition, they shall be fabricated with positive-friction lock system for being hand-driven by hammer into preformed holes.
- (3) Manholes shall be all concrete, unless otherwise specified on the plans, and shall be CDOT Class B concrete unless otherwise approved by the City Engineer. Metal reinforcement shall be deformed steel bars sized according to their application by the Engineer of Record, subject to the approval of the City Engineer. All steel reinforcement shall conform to ASTM A615, Grade 60.
- (4) All precast manhole cones shall be of the eccentric type. Reference City Detail 300-02 "Standard Manhole."

J. MISCELLANEOUS MATERIALS

- (1) Mortar; non-shrink, non-metallic grout; and preformed plastic gaskets shall be in accordance with the Wastewater Collection Approved Materials List located in Appendix I-3.
- (2) All castings for manholes, covers, frames, and for other purposes shall be of rough gray iron and have a workman-like finish free from blow-holes. Manhole frames and covers shall be in accordance with the Wastewater Collection Approved Materials List located in Appendix I-3.

- (3) Manhole covers shall have the words "Storm Sewer, Confined Space, Entry Permit Required" cast on the cover. Manhole covers will be sized for 24-inch diameter openings, one (1) inch thick, and designed for traffic loading. Manhole covers will be located above the pipelines as shown in detail 300-05 Manhole Cover Location to allow for the City's jetting equipment to access pipelines.

303.02 INSTALLATION

A. GENERAL REQUIREMENTS

This section of the City Standards covers the furnishing and installation of all drainage improvements, storm sewers, storm inlets, manholes, headwalls, other appurtenances, and all related work necessary to complete the drainage improvements. Trenching and backfill shall be completed in accordance with Section 109 "Utility Trenching" in these City Standards and as shown in Detail 300-01 "Reinforced Concrete Pipe Trench". The work covered by this section shall not be accepted until the backfill and pavement connected with the work has been completed, inspected, and approved by the City. Any section of storm sewer line that is found by the City to be defective in tests, material, alignment, grade, or joints shall be corrected as approved by the City Engineer.

B. PIPE INSTALLATION

- (1) Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in line. The end of the pipe will be plugged or capped with approved materials at the end of the work shift or if work stops temporarily. Pipe shall be installed working downstream to upstream with the bell end facing upstream. All pipe installed shall be to the required line and grade as shown on the approved plans and checked to ensure there is no variation from that line and grade. No pipe shall be laid when, in the determination of the City Engineer or City Inspector, trench conditions are unsuitable, including, but not limited to conditions such as unstable bedding, pipe subgrade, trench walls, or the presence of contaminated soil or liquids. Shoring shall be used if trench conditions warrant based on Occupational Safety and Health Administration (OSHA) standards.
- (2) Pipe shall be laid to a true line and at uniform grade as shown on the approved plans. Fine grading of the trench shall proceed ahead of pipe laying.
- (3) The Contractor shall make all pipe connections to the manholes. When connecting to existing storm drains, the Contractor shall take every precaution necessary to prevent dirt or debris from entering the storm sewer system.
- (4) Bedding material shall meet the requirements outlined in the "Utility Trenching" chapter located in Section 109 of these City Standards.

C. LOWERING OF PIPE AND ACCESSORIES INTO TRENCH

All pipe, fittings, and accessories shall be carefully lowered into the trench with suitable equipment in a manner that will prevent damage. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. Pipe and accessories shall be inspected for defects prior to being lowered into the trench. All foreign matter or dirt shall be removed from the interior of the pipe and the accessories before lowering into the trench. The pipe shall be kept clean by means approved by the City Engineer during and after installation.

D. CUTTING OF PIPE

The cutting of pipe for inserting into fittings shall be done in a neat and workmanlike manner without damage to the pipe or lining and so as to leave a smooth end with beveled edges recut to match the original pipe. Flame cutting of existing ductile iron pipe shall not be allowed. Pre-existing asbestos cement pipe

(ACP) shall not be cut. An entire section of ACP shall be removed and replaced with a non-asbestos type pipe.

E. JOINING OF PIPE

Push on and mechanical joints shall be installed in accordance with the manufacturer's recommendations.

F. JOINT DEFLECTION

Storm sewer pipes shall not have any deflections. All pipes shall be laid and maintained to the required lines and grades as shown on the approved plans. No deviation shall be made from the required line or grade except with the written consent of the City Engineer. Manholes and other necessary appurtenances shall be installed at the required locations. All pipes shall be laid to the depth shown on the approved Plans or as directed by the City Engineer in writing.

G. STORM SEWER INLETS AND STRUCTURES

- (1) All casting used shall sit flush with the surrounding concrete.
- (2) The bottom of all storm inlet structures shall be formed to drain to the outlet pipe as per the inlet details.
- (3) After completion of construction, all storm inlet structures shall be flushed with water and all debris shall be removed. The inlets are not acceptable if water remains in the invert of the structure after flushing.
- (4) The minimum diameter of the outlet pipe from the storm inlet structure shall be 18 inches.
- (5) Access covers will be located above the pipelines so the City's jetting equipment can access the pipelines as shown in City Detail 300-06 "Type R Inlet Access Location".
- (6) Storm inlets and headwalls shall be precast wherever possible, or cast in place when necessary and as approved by the City Engineer. All storm inlets and headwalls shall require structural drawings designed by a Professional Engineer.
- (7) New holes for pipeline connections to existing storm inlets or manholes shall be cored, not rough-cut via blunt force, demo saws, etc.
- (8) Storm drain inlets within the public right-of-way shall be permanently marked to discourage illicit discharges and to identify the inlet as part of the storm drain system. Markings shall be durable, highly visible, and capable of withstanding weather, traffic, and environmental exposure over time.
 - a. Markers shall be pre-manufactured, UV-resistant, adhesive-backed thermoplastic or aluminum markers, or high-durability concrete stamps, as approved by the City Engineer. All markers shall include the universal "No Dumping – Drains to River" or "Drains to Waterway" message, accompanied by the stormwater symbol (fish, water drop, or other city-approved logo). Marker background color shall be blue, with contrasting white lettering and symbol, unless otherwise approved. Markers shall be a minimum of four (4) inches in diameter for round markers, or four (4) inches by six (6) inches for rectangular markers.
 - b. Markers shall be installed directly above or adjacent to the inlet opening, in a location clearly visible from the street or sidewalk. Surface shall be cleaned of all dirt, grease, and debris prior to marker installation to ensure proper adhesion. For adhesive markers, follow manufacturer's recommendations for installation and curing times. For concrete stamping, the message and symbol shall be installed during inlet construction and finished flush with the surface. Lettering and symbols shall be clean, legible, and uniform.

H. MANHOLES

- (1) Manholes shall be constructed of concrete in accordance with the Detail 300-02 “Standard Manhole”. The materials, operations, excavation, and backfilling shall conform to the applicable sections of these City Standards.
- (2) MANHOLE BASES
 - a. Contractor must provide precast manholes wherever possible, or cast in place when necessary and as approved by the City Engineer. In case of any change in alignment or elevation of manholes, Contractor is responsible for making all changes with the approval of the City Engineer.
 - b. All precast concrete bases for manholes shall be constructed with the base and first barrel section poured monolithically, in conformance with CDOT Class B concrete, unless otherwise approved by the City Engineer. The pipe penetration gaskets shall be as specified in the Wastewater Collection Approved Materials List located in Appendix I-3. No modification of precast sections shall be permitted on the job site. All such fabrication shall be accomplished at the point of manufacture. The manufacturer shall cut openings of sufficient size to receive entering pipes, providing three-quarter (3/4) inch annular space around the pipe or as required by the manufacturer of penetration gaskets. Inverts within the precast base shall have the same requirements as the inverts for the cast-in-place manhole bases.
 - c. All cast-in-place concrete bases for manholes shall be constructed such that they are level and conform to the dimensions as shown on the standard details and approved plans. Invert channels shall be smooth and semi-circular in shape conforming to the inside of the adjacent sewer section. Storm sewer manhole invert channels shall be coordinated with the City Inspector prior to installation. Invert channels shall be formed or shaped with a trowel to suit field conditions.
 - d. Pipe size changes shall be accomplished by matching pipe crowns or having a two tenths (0.2) foot drop in inverts across the manhole and forming the channel to accommodate the pipe size differential. The floor of the manhole outside of the channels shall be smooth and shall slope toward the channels at not less than one (1) inch per foot.
- (3) PIPE CONNECTIONS
 - a. Manholes shall be thoroughly bonded to the barrel of the pipe. Provide a rubber gasket on pipe barrel for reinforced concrete pipe. All connections with pipes shall be made without projections or voids. Inlet and outlet pipes shall be flush with interior manhole diameter. Reference Detail 300-02 “Standard Manhole”.
 - b. When a storm sewer pipe is anticipated to be extended in the future the pipe shall, at a minimum, extend to the edge of the property boundary or to the edge of the right-of-way. The contractor may be required to install at least five (5) feet beyond the right-of-way or property line by the City Engineer, depending on the circumstances of the project. The stub out shall be sealed with a plug at the outer end.
- (4) MANHOLE STEPS
 - a. Manhole steps shall not be installed in the grade rings. Steps shall be positioned as shown in Detail 300-02 “Standard Manhole”.
 - b. In areas where the manhole will be exposed to groundwater, an approved waterproofing shall be applied per the manufacturer’s recommendation. The waterproofing shall only be applied to clean surfaces free of dirt, oils, greases, and foreign matters and shall not be placed on surfaces when the ambient air temperature is less than 50 degrees Fahrenheit,

unless approved by the manufacturer. See the Wastewater Collection Approved Materials List located in the Appendix I-3.

- c. Manhole covers shall be lined up with the pipeline outlet to allow the maintenance jetting equipment access to the pipelines. Coordination with the City Inspector is required on cover placement and manhole step locations over large diameter pipes. Placement shall allow for the jet nozzle of the maintenance equipment to be inserted down the manhole cover, make one 90-degree bend, and enter the upstream pipe. The jet nozzle shall be fed into the pipe to the upstream manhole and the water jet shall be turned on as the nozzle is pulled back through the pipeline. The dirt and water shall be vacuumed out of the downstream manhole into a storage tank. Reference Detail 300-05 "Storm Drainage Manhole Cover Location".

(5) MANHOLE RISERS

Manhole frames shall be raised using precast, reinforced concrete rings or cast-in-place concrete; no other material shall be allowed. The first step will be no lower than 18 inches from the final street grade. Drop-in type risers are not allowed for new construction. Drop-in type risers may be used on overlay projects, but only one riser may be used, and it shall not exceed four (4) inches in height. All risers shall have a minimum of three (3) set screws per riser. No steps are allowed on the riser section. Reference Detail 300-02 "Standard Manhole".

I. LOCATING SYSTEMS

All storm mains shall be locatable. Refer to Section 100 for requirements of tracing wire, warning tape, and electronic marker systems.

303.03 TESTING

A. GENERAL REQUIREMENTS

This section concerns the testing of storm sewer trunk lines, laterals, manholes, and appurtenances. Contractor shall clean all manholes, pipes, and structures by removing sheeting, bracing, forms, soil sediment, concrete waste, and other debris prior to all inspections. Contractor shall not discharge soil sediment or debris to drainage channels or existing storm sewer. Debris shall be properly disposed of in a waste containment site that is acceptable to the City.

B. CONSTRUCTION ACCEPTANCE REQUIREMENTS

- (1) All new storm sewer lines shall be subject to inspection by the City after installation via lamping or other visual means. All new PVC pipe may be subject to mandrel testing in accordance with the PVC Material requirements located in Section 300 of the City Standards.
- (2) All newly-constructed storm sewer lines shall be completely jetted by the Contractor to remove dirt and debris prior to Construction Acceptance. The Contractor will be responsible for removing all of the dirt and debris from the lines during the jetting operation and shall not allow any debris into any active City storm sewer system. Jetting shall be done after first lift of asphalt is completed.
- (3) Prior to Construction Acceptance the Contractor/Developer shall, at their expense, hire an independent firm to videotape the storm sewer line. A designated City employee will be assigned to observe the camera work and video tapes of the line shall be supplied to the City for further review.
- (4) Storm manholes and storm sewer lines shall be clean prior to scheduling video inspection. If rescheduling is necessary due to the fault of the Contractor, the Contractor will bear any costs of rescheduling or other costs associated with the delay.

- (5) An infiltration/exfiltration test for manholes may also be required by the City Engineer. This test will be subject to less than a one (1) inch per hour rise or fall to pass. Test shall be conducted per ASTM C969-24.
- (6) Any visible infiltration that the City Engineer considers to be detrimental to the system shall be repaired in a manner approved by the City Engineer before the work will be accepted. No manhole will be accepted that has visible infiltration.
- (7) As-built requirements shall be in accordance with these City Standards.

C. FINAL ACCEPTANCE REQUIREMENTS

- (1) Upon completion of the construction, the City Inspector will carefully inspect all drainage improvements and appurtenances. Any unsatisfactory work shall be removed and replaced in a proper manner to correspond with the approved plans or as otherwise approved by the City. The invert of the storm sewer pipes and manholes shall be left smooth, clean, and free from obstructions throughout the entire length. Manhole rings and covers shall be raised to finished grade before acceptance of the storm sewer line.
- (2) Prior to Final Acceptance, the Contractor shall completely jet the pipes to remove dirt and debris. The Contractor will be responsible for removing all of the dirt and debris from the lines during the jetting operation and shall not allow any debris into any active City storm sewer line.
- (3) Prior to the issuance of Final Acceptance, all of the installed storm sewer lines shall be videotaped by City personnel. All defects found in the lines at the time of the camera operations shall be repaired prior to the City granting Final Acceptance. This work shall be scheduled with the City by the Developer prior to final lift of asphalt paving.

304.00 UNDERDRAIN SYSTEMS

304.01 MINIMUM DESIGN AND CONSTRUCTION CRITERIA

A. GENERAL

- (1) The purpose of an underdrain system is to provide a permanent method of conveying groundwater via gravity to an acceptable discharge point in a storm sewer system or drainage channel. These criteria serve to specify and outline the minimum guidelines for the design, construction, inspection, and maintenance of an underdrain system.
 - a. Temporary underdrains shall be privately owned and maintained and shall comply with the City's MS4 permit and CDPHE regulations. Dewatering of trenches shall be done in accordance with Section 109 of these City Standards.
- (2) Underdrain systems typically include a building perimeter underdrain, an underdrain service line from each lot, an underdrain service line clean-out, an underdrain main, and underdrain access points.
- (3) Underdrain systems shall be designed and constructed in accordance with the requirements of these City Standards and in accordance with Section 15.05, City Code. Additional criteria may be outlined during plan review as determined by the City Engineer.
- (4) All area underdrains and underdrain collection systems shall have a positive gravity outlet piped to an existing underdrain collection system, to a storm sewer, or to a drainage channel. The use of any conveyance system other than a gravity system, such as a lift station, shall be subject to the Exception process outlined in Section 100 of these City Standards and Section 15.05.070, City Code.
- (5) Underdrain systems shall not discharge upstream of an orifice plate or other flow restriction. If there is a detention pond or water quality facility downstream of the developing property, the developer may be required by the City Engineer to install or retrofit offsite drainage infrastructure.
- (6) Underdrain collection systems are considered a dewatering system and shall be in compliance with CDPHE Dewatering General Permit Program.
- (7) A Professional Engineer shall design and stamp area underdrain plans, underdrain collection system plans, City Standards exception requests, and the underdrain report. The system shall be designed with consideration of any seasonal high groundwater levels anticipated at the project site.
- (8) Underdrain systems are privately owned and maintained by the property owner or Owner's Association. Specific maintenance responsibilities shall be established by means of a note on the underdrain plans.
- (9) Only groundwater may be discharged into an underdrain system. No person(s) shall connect other sources of surface runoff to an underdrain main, underdrain service line, or foundation perimeter drain. No person shall contribute or cause to be contributed, directly or indirectly, any pollutant or wastewater to an underdrain collection system.
- (10) Groundwater shall not be discharged to the sanitary sewer system.
- (11) Connection of an underdrain collection system to an existing underdrain collection system shall be allowed only with written approval from the Owner of the receiving underdrain system or if the receiving system's approved plans and/or reports allow such a connection.
- (12) The underdrain collection system shall be installed within public right-of-way or within an easement. Underdrain systems installed within public right-of-way require an Infrastructure Permit from the City of Longmont.
- (13) Underdrain systems shall be constructed of materials identified in the Wastewater Collection Approved Materials List located in the Appendix I-3.

B. UNDERDRAIN COLLECTION SYSTEM

- (1) Underdrain collection systems shall consist of an underdrain main that shall be a minimum of six (6) inch diameter, rigid-walled, non-perforated pipe.
- (2) Underdrain mains shall be white or purple gasketed SDR-35 pipe. Other types of underdrain pipe may be used upon submittal of the pipe specification and approval by the City Engineer.
- (3) Six (6) inch diameter underdrain mains shall be placed adjacent to, and in the same trench as, sanitary sewer mains if following the sanitary sewer main path. Underdrain and sanitary sewer mains shall have a minimum horizontal clearance of one (1) foot from the outside diameter of the underdrain main to the outside diameter of the sanitary sewer main and a minimum vertical clearance of one and one half (1.5) feet from the outside diameter of the underdrain main to the outside diameter of the sanitary sewer main. Reference Detail 300-08 "Sanitary Sewer and Underdrain Trench".
- (4) Underdrain collection systems that require eight (8) inch and larger diameter underdrain mains shall be placed in a separate trench from all other underground utilities and shall meet the minimum separation requirements for other utilities. Reference the "Utility Line Separation and Crossing" Section 103 of these City Standards.
- (5) The configuration of a single six (6) inch underdrain main shall be installed at a minimum of six (6) inches below the sanitary sewer manhole base and will require the installation of an underdrain clean-out upstream of the sanitary sewer manhole. Reference Details 300-09 "Underdrain Clean-out Installation" and 300-10 "Underdrain Clean-out."
- (6) Underdrain manholes are required for underdrain collection systems where three (3) or more underdrain pipes intersect, or at any change of bearing. The intersecting underdrain mains shall be deflected in advance of the underdrain manhole to provide a minimum three (3) feet of clearance from the outside diameter of the sanitary sewer manhole. The underdrain manhole shall be located downstream of the sanitary sewer manhole. Reference Detail 300-11 "Underdrain Manhole Placement" of these City Standards.
- (7) Underdrain collection systems that require six (6) inch diameter and larger underdrain mains shall have standard manholes as access points. Manholes shall be constructed in accordance with the requirements in Detail 300-02 "Standard Manhole" and these City Standards.
- (8) The outlet of the underdrain collection system shall be a gravity outfall designed to account for the possibility of backflow of the system. Erosion control is required at the outlet discharge of the system.
- (9) All underdrain mains shall be installed to the lines, grades, and depths specified in the approved plans. No deviation shall be made from the required line or grade without the written consent of the City Engineer.
- (10) Maintenance access shall be provided to all access points and discharge locations.

C. SERVICE LINES

- (1) Underdrain service lines are installed with the underdrain collection system and shall be a minimum three (3)-inch diameter solid pipe. Underdrain service lines are required to include a clean-out for maintenance access. Reference Detail 300-13 "Foundation Perimeter Underdrain and Service Line Connection."

- (2) All underdrain service lines shall be connected by gravity to the underdrain main, storm sewer, drainage channel, or other approved conveyance system. Reference Detail 300-14 "Underdrain Service."
- (3) Sump pumps may be installed as backup to the gravity collection system, with approval from the City Engineer.
- (4) The installation of a sump pump with no connection by gravity to an underdrain collection system requires an Exception per the requirements in Section 100 of these City Standards and City Code and shall require approval by the City Engineer. Reference Details 300-14A "Underdrain Service Exception A" and 300-14B "Underdrain Service Exception B" for exceptions approved by the City.
- (5) Underdrain service lines are typically installed in the same trench with the sanitary sewer service line. Underdrain service lines shall be placed adjacent to, and in the same trench as, sanitary sewer services and shall have a minimum clearance horizontally of one (1) foot from the outside diameter of the underdrain service to the outside diameter of the sanitary sewer service and a minimum vertical clearance of one and one half (1.5) feet from the outside diameter of the underdrain service to the outside of the sanitary sewer service. Reference Detail 300-08 "Sanitary Sewer and Underdrain Trench".
- (6) As-built drawings shall be provided to the City Engineer for the underdrain service lines and main.
- (7) The city shall not issue the certificate of occupancy until receipt of the professional engineer's certification and the building perimeter underdrain connection has been completed, inspected and approved by a City Engineer or Inspector.
- (8) Underdrain service lines are owned and maintained by the property owner up to the underdrain main.

D. BUILDING PERIMETER DRAIN

- (1) A building perimeter underdrain shall be installed as required by the geotechnical engineering report. All building perimeter underdrains, whether inside or outside the foundation walls, shall be connected by gravity to the underdrain main by means of an underdrain service line. Reference Detail 300-13 "Foundation Perimeter Underdrain".
- (2) All building perimeter underdrains shall be a minimum four (4)-inch diameter perforated pipe.
- (3) In accordance with City Code, a Professional Engineer shall inspect and certify to the Chief Building Official in writing, that the building perimeter underdrain was built and properly connected to the underdrain service line according to the approved plans.
- (4) Building perimeter underdrain systems are owned and maintained by the property owner.

E. AREA UNDERDRAIN

- (1) The purpose of an area underdrain is to mitigate site groundwater through a perforated perimeter underdrain.
- (2) Perforated pipe cannot be located in the ROW and requires a dedicated outlot or easement. If the area underdrain crosses the ROW, solid pipe shall be connected to the perforated pipe and extended through the width of the ROW. Pipe extending into the ROW will require an infrastructure permit.
- (3) An area underdrain is a private system owned and maintained by the property owner and/or Homeowners' Association.

F. ACCESS POINTS

Access is required for maintenance of the underdrain collection systems and shall be installed at all major changes in grade, size, and alignment. Underdrain collection systems cannot connect to, or surface in, sanitary sewer manholes for any reason.

G. CLEAN-OUTS

Reference Section 400 of these City Standards for clean-out criteria. Reference detail 300-09 "Underdrain Clean-Out Installation" and 300-10 "Underdrain Clean-Out".

H. UNDERDRAIN MANHOLES

- (1) Underdrain manholes are required for underdrain collection systems where three (3) or more underdrain mains intersect and shall be precast, reinforced concrete structures. Contractor shall provide a precast submittal to the City Engineer for review prior to installation.
- (2) For intersecting mains six (6) inches and smaller in diameter, a two (2) foot inside diameter underdrain manhole is required. Reference details 300-11 "Underdrain Manhole Installation" and 300-12 "Underdrain Manhole".
- (3) For intersecting mains eight (8) inches and larger in diameter, a four (4) foot inside diameter standard manhole is required. Reference detail 300-02 "Standard Manhole".
- (4) Underdrain manholes shall be placed a minimum of three (3) feet from the outside diameter of any sanitary sewer manholes.
- (5) Underdrain manholes shall be spaced no farther than 400 feet apart, unless otherwise approved by the City Engineer.

304.02 REPORT CRITERIA

A. GENERAL REQUIREMENTS

If an underdrain collection system is required based on recommendations made in the geotechnical engineering report for a site, then the Developer shall submit an underdrain report for review and approval to the City Engineer during DRC plan reviews.

B. UNDERDRAIN REPORT REQUIREMENTS

The purpose of the underdrain report is to identify and define solutions to groundwater problems on the site. The report shall be prepared and sealed by a Professional Engineer licensed in the State of Colorado and shall include supporting documentation such as drawings, figures, calculations, and tables. The report shall identify groundwater conditions that exist on site prior to development and expected groundwater conditions after development is complete. Underdrain reports shall include all content covered in Appendix C-8 "Underdrain Report Checklist".

C. UNDERDRAIN DETAILS

Report shall reference underdrain Details 300-08 through 300-14.

304.03 CONSTRUCTION ACCEPTANCE

In accordance with the City of Longmont Municipal Code, the City shall not issue Construction Acceptance until all of the following conditions are met:

- A. The entirety of the underdrain collection system has been inspected by dye-testing and video testing. The results of these tests shall be provided to the City as a condition of construction acceptance.
- B. The Contractor's infrastructure permit number shall be provided to the City and verified. An infrastructure permit is required at the time of the pre-construction meeting.
- C. A Professional Engineer licensed in the state of Colorado shall perform regular inspections of the underdrain collection system during construction to ensure that the system is built in accordance with the approved plans. The Professional Engineer shall be required to author, sign, stamp, and submit to the Chief Building Official a certification letter attesting to the underdrain collection system's compliance with the approved plans.
- D. Record drawings/as-builts for the underdrain collection system shall be attested to by a Professional Engineer registered in Colorado and submitted to the City. Record drawings shall include the vertical and horizontal alignment of the underdrain collection system main, underdrain service lines to each lot, the location(s) of maintenance access points (cleanouts or manholes), invert elevations, appropriate profiles, and underdrain details.