# SECTION “J”

# UTILITY CONSTRUCTION

# J1 CONSTRUCTION

## J1.1 Materials:

The requirements for this section will also apply to sanitary sewers as appropriate.

All materials used for storm sewer mains will be of the approved standards as listed herein or the latest revision thereof:

- Non-Reinforced Concrete Pipe - The non-reinforced concrete pipe will conform to the Standard Specification "Non-Reinforced Concrete Sewer (**ASTM** C14)", designed for flexible rubber gasket joints to **ASTM** C443. Sulfate resistant cement will be used.

- Reinforced Concrete Pipe - Reinforced concrete pipe will conform to the Standard Specification for "Reinforced Concrete Sewer-Storm Drain and Culvert Pipe (**ASTM** C76)", designed for flexible rubber gasket joints to **ASTM** C443. Sulfate resistant cement will be used.

- Poly Vinyl Chloride (PVC) Pipe - PVC pipe will conform to the Standard Specification for "Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings (**ASTM** D3034)", CAN 3 – B182.1 and CAN 3 – B182.2 - minimum Class SDR 35, separate gasket and intergraded bell system. Joints will meet the Standard Specification “Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals (**ASTM** D3212)." Pipe may be any colour except blue.

- Ultra-Rib PVC Pipe - Will conform to **ASTM** F794 and Uni-bell B-9, and fittings will conform to **CSA** B182.4 specifications. Pipe may be any colour except blue.

- Manhole and Catchbasin Barrels, Cones & Rings - Manhole and catchbasin sections will conform to the Standard Specification for "Precast Reinforced Concrete Manhole Sections (**ASTM** C478)". All manhole barrels will be a minimum of 1200 mm inside diameter and all cones will be eccentric. Reducing rings or slabs may be used.

- Manhole Frames & Covers - Manhole frames and covers will be of cast iron conforming to Class 20, **ASTM** C48 and have at least four (4) lift holes.

- Manhole Steps - Manhole steps will be standard safety type of hot dipped 20 mm (3/4") galvanized iron spaced at 400 mm (maximum) distance.

- Manhole Bases - Manhole bases will be reinforced precast slabs, vault, or precast tees (reinforced). The concrete base is to be of a minimum of 150 mm in thickness constructed on compacted granular material or undisturbed native material. Perched manhole bases will be a minimum of 200 mm in thickness.

- Catchbasin Leads - corrugated steel pipe, 1.6 mm wall thickness conforming to CAN 3-6401 with watertight couplers with rubber gaskets conforming to **ASTM** C361M, or ultra-rib PVC pipe and fittings meeting **CSA** B182.4, **ASTM** F794 and uni-bell Uni B-9, with a minimum pipe stiffness of 320 kPa as measured in accordance with **ASTM** D2412.

**J1.2 Aggregates:**

Note: The requirements for this section will also apply to sanitary sewers, watermains, and other utility pipe installation.

- Bedding Sand - All bedding sand must be clean and meet the following requirements:

| Sieve Size Passing | % Passing, By Mass |
|---|---|
| 2500 | 100 |
| 630 | 60 ore more |
| 315 | 30 or less |
| 160 | 20 or less |

- Mortar Sand - All mortar sand will be clean, contain no deleterious material, and conform to CAN 3-AS-M, Sulphate resistant (type 50).

- Washed Rock - Washed rock must be washed and will contain no deleterious materials or other impurities and will meet the following **grading** requirements:

| Sieve Size Passing | % Passing, By Mass |
|---|---|
| 25,000 | 100 |
| 5000 | 10 |
| 80 | 2 |

- Backfill Sand & Gravel - Sand and gravel used for backfill will be well graded and approved by the **County** before use.

- Concrete - Concrete will meet the specifications outlined in Section G - 8 Transportation, and other applicable sections of these

standards. Sulfate resistant cement will be used unless otherwise approved.

- Developer's Responsibility for Material - Only approved materials are to be incorporated into the Work. The **Developer** will be responsible for all materials furnished by them and will produce certification by an independent testing authority that the materials used conform to the standards. The **Developer** will be responsible for the safe transit, delivery, and storage of all materials. Unapproved materials will be removed and replaced with acceptable materials, all at the **Developer**'s expense.

**J1.3 Excavation:** (Refer to Drawing H-02 in Appendix C)

Note: The requirements for this section will also apply to sanitary sewers, watermains, and other utility pipe installation.

- The trench will be excavated to the line and grade stipulated on the Contract drawings to a depth necessary to accommodate the bedding. The base under each bell must be hollowed sufficiently to allow bearing throughout its entire length. Where the trench has been excavated, it must be properly refilled to the corrent level with approved material, properly compacted. The **Developer** will not use blocks or any other such items to raise the pipe to the required elevation, unless concrete bedding is being used and with the approval of the **County**. The trench will be braced and drained when necessary. **Adjacent property** will be protected at all times.

- Trench walls will be vertical to 300 mm above the top of pipe.

- The maximum trench width for single pipe will be:

| Pipe Diameter | Max. Trench Width |
|---|---|
| Less than 750 mm diameter | O.D. + 450 mm |
| 750 mm diameter or larger | O.D. + 600 mm |

**J1.4 Bedding:** (Refer to Drawing H-03 in Appendix C)

Note: The requirements for this section will also apply to sanitary sewers, watermains, and other utility pipe installation.

The pipe will be laid in the class of bedding shown on the plans as specified herein.

- Class "A" - Method of bedding on which the lower part of the pipe exterior is set in concrete of suitable thickness to encase at least one quarter of the pipe diameter for the full trench width. Compacted sand will be placed to a minimum depth of 300 mm above the top of the pipe.

- Class "B" - Method of bedding in which the pipe is set in compacted sand or gravel, as specified, on a trench bottom shaped to fit the pipe. The pipe is entirely encased with sand to a minimum of 300 mm above its top in layers not exceeding 150 mm in thickness. Depth of bedding below the pipe to be a minimum of 75 mm for 675 mm diameter pipe or smaller at 100 mm for pipe 750 mm diameter or greater.

- Class "C" - Method of bedding in which the pipe is placed on an earth foundation shaped to fit the lower part of the pipe. The remainder of the pipe is encased in sand, compacted to a height of at least 150 mm above the top of pipe.

- Class "D" - Method of bedding in which the foundation is not shaped to fit the lower part of the pipe but the pipe must be evenly supported throughout its length (except for the pipe bells).

**J1.5 Pipe Laying:**

Note: The requirements for this section will also apply to sanitary sewers, watermains, and other utility pipe installation.

- Install pipe to the prescribed grade in accordance with manufacturer's standard instructions and specifications.

- Pipe will not be deflected either vertically or horizontally in excess of that recommended by the manufacturer.

- All jointing will be made between clean pipe ends.

- The trench must be kept dry during pipe laying operations and no water will be allowed to drain through the newly laid pipe for at least two hours where mortar joints have been used.

- When pipe laying is not in progress, the open ends of installed pipe will be closed by an approved plug or cap to prevent entrance of trench water and/or any foreign or other material into the line.

- Adequate backfill will be placed on the pipe to prevent floating. Any pipe which has floated will be removed from the trench and be re-

laid as directed by the **County**.

- No pipe will be laid in wet trench conditions that preclude proper bedding or on frozen trench bottom or when, in the opinion of the Engineer, the trench conditions or the weather are unsuitable for proper installation.

- Each cast iron valve, hydrant, or fitting will have a bell with an inside profile such that a seal can be made between the machined pipe end and the bell with a rubber ring. Fittings used with PVC pipe will be manufactured with a TYTON joint.

- Before laying valves, hydrants, or fittings, all lumps, blisters, and excess coating will be removed from the bell. The inside of the bell will then be wire-brushed and both the inside of the bell and the spigot end of the pipe wiped clean and dry. All surfaces to be joined will be kept clean until joints are made.

- All bell and spigot joints will be sealed with rubber rings, unless otherwise approved in writing by the **County**. All defective joints will be cut out and entirely replaced with new material.

- The cutting of pipe for closure to fittings, valves, and other reasons will be done in a neat and workmanlike manner, without damage to the pipe and so as to leave a smooth end at right angles to the axis of the pipe. Pipe cutting for valves and fittings will be done accurately so as to bring all valves and fittings to their correct positions. Cut standard pipe used with rubber gasket joints will be field machined and chamfered as required by the manufacturer's instructions.

- Upon completion, the storm sewer must be thoroughly cleaned.

**J1.6 Backfilling & Compaction:**

Note: The requirements for this section will also apply to sanitary sewers, watermains, and other utility pipe installation.

- General - Backfill material will be the soil excavated from the ditch or trench although sand or gravel may be substituted for poor existing soils. All backfill material will be subject to approval by the **County**. If possible, the excavated material will be placed back in the ditch in the vertical and horizontal order in which it was excavated. Backfill will be placed in uniform lifts not exceeding 300 mm loose depth. Where clay is used as backfill material, its

moisture content will not exceed the Plastic Limit by more than fifteen percent (15%).

Under no circumstances will backfill material within roadways contain ice, snow, straw, organic or frozen, or other deleterious material be used.

- Densities

  i) Prior to Street Construction - All excavations under proposed carriageways, sidewalks, street lights, or other similar surface structures will be backfilled and compacted to minimum density of not less than 98% of the maximum standard Proctor Density, or as otherwise approved by the **County**. Backfill will be placed in uniform lifts not exceeding 300 mm loose depth. A minimum of two density tests per 100 lineal meters of trench per 1.5 m of compacted backfill depth will be taken. Additional tests may be called for as deemed necessary. Any free water in a trench will be removed prior to placing additional lifts.

  ii) Under Existing Carriageways - All excavations under existing carriageways, sidewalks, lanes, or other similar surface structures will be backfilled to meet the following specifications:

    1. 300 mm or more below final grade - compaction in this zone will be compacted to minimum density of not less than 98% of the maximum standard Proctor Density.
    2. 0 - 300 mm below final grade - compaction in this zone will be to a minimum of 100% of the maximum standard Proctor Density and based on a minimum of two field tests per 100 lineal meters of trench of compacted backfill. Backfill will be placed in uniform lifts not exceeding 150 mm compacted depth.

- Adjacent to Existing Carriageways - All material 300 mm below the finished grade will be compacted to a density not less than 95% of the maximum density of a five point Standard Proctor Compaction Test and based on a minimum of one field test per 150 lineal meters of trench for each 1.5 meters of compacted vertical backfill.

- Sand or Gravel Backfill - Sand or gravel backfill will be compacted to meet the following density requirements:

i) 300 mm or more below grade - the minimum acceptable density will be 98% of the maximum standard Proctor Density.

ii) 0 - 300 mm below grade - all sand or gravel in this zone will compact to 100% of the maximum standard Proctor Density.

- Water Flushing - Water flushing will be permitted only under special circumstances, as approved in writing by the **County**.

- Testing - For all density tests indicating insufficient compaction, two more density tests, proportionately representative of the ditch length tested, will be taken at that depth. If the average of the three tests is below the required density, the area of deficient density will be re-excavated and re-compacted to meet the specified density. Densities greater than 100% will be deemed to be at 100% for calculating the average of the three tests.

## J2 INSPECTION

Note: The requirements for this section will also apply to sanitary sewers, watermains, and other utility pipe installation.

### J2.1 General:

All excavating, laying, joining of pipes, backfilling, and completion of all works will be subject to inspection by the **County**'s authorized representatives. Unsatisfactory conditions will be remedied at the **Developer**'s expense. All equipment, tools, and labor for testing will also be provided by the **Developer** at their expense.

### J2.2 Video Sewer Inspection:

Prior to the **Construction Completion Certificate** Inspection, televising of all storm sewers will be completed. A video tape and written report will be submitted to the **County**. A written report indicating any deficiencies and recommending repair measures will be prepared within sixty (60) calendar days from the date of issuance of a **Construction Completion Certificate**.

## J3 CULVERTS, STORM WATER POND FACILITIES & SPECIAL STRUCTURES

### J3.1 Culverts:

- Culverts will be placed so that the minimum distance from the finished grade of the roadway to the top of the pipe will be not less than one-half the diameter of the pipe or a minimum of 300 mm, whichever is greater, unless approved otherwise.

- A trench will be excavated to the required depth and grade with the bottom shaped to conform to the bottom of the pipe to afford a firm and uniform bearing over the entire length of the culvert. If the material in the bottom of the excavation is unsuitable, the trench will be dug 100 mm below the grade as ordered, and backfilled with approved granular material and thoroughly tamped, or otherwise compacted, to ensure an unyielding foundation.

- Where the trench is in solid rock or other hard material, it will be excavated to a depth of at least 100 mm below the grade established for the bottom of the pipe. This additional excavation will be backfilled with suitable material in such manner as to ensure a uniform bearing for the length of the culvert.

- Selected backfilling material, free from stones, frozen lumps, and other deleterious material, will be placed under and around the pipe and thoroughly tamped or otherwise compacted in place. The trench will be completely filled and the pipe covered to a depth of at least 300 mm with hand placed and properly compacted material before the construction of the embankment over the culvert proceeds.

- If a trench is not required, the culvert pipe will be laid true to line and grade, on a bed that is uniformly firm throughout its entire length, and the backfilling, a minimum 100 mm granular over the pipe, will be completed as specified in the preceding paragraph.

- When using corrugated pipe, the pipe will be laid in the trench with the separate sections firmly joined together and with outside laps of circumferential joints pointing upstream and with longitudinal laps on the side. Corrugated pipe will be so handled as to prevent bruising and scaling. In no case will pipe culverts be dragged on the ground.

- Where it is necessary to remove any existing culvert or structures from the grade or right-of-way, the **Developer** will carefully remove and pile or place the materials as directed by the Engineer.

- All drainage culverts will be rip-rapped at both inlet and outlet. The size and type of rip-rap will conform to good engineering practice and acceptable to the **County**.

- Minimum size of roadway culvert will be 600 mm (wall thickness 1.6 mm or as required by the loading criteria).

- Minimum size of entrance culvert will be 400 mm (wall thickness 1.6 mm or as required by the loading criteria).

**J3.2 Storm Water Pond Facilities:**

- Detention facilities will be designed as part of both the minor and the major drainage systems. They must control the peak runoff conditions for events up to the 1-in-100 year return period.

- Detention facilities become municipal **property**. The need for a specific detention facility will require the approval of the **County**. In assessing the need for specific detention facilities, the Engineer must consider the impacts of uncontrolled drainage.

- The ratio of land area for open space use around the pond will be twice the area of the water surface for the 1:100 year runoff event, unless approved otherwise.

- Soils investigations specific to the detention facility will be undertaken to determine appropriate design factors. Where the facility is sited above a shallow aquifer or high water table, the potential for groundwater contamination must be minimized.

- Wet pond detention facilities must be constructed in impervious soils to minimize water losses during dry weather periods. Intruding silt, sand, or gravel seams must be sealed off.

- Where a detention facility is to have multiple functions, its design must consider the aesthetic implications of shape, **grading**, landscape features, and use.

- An emergency overflow system will drain to a receiving watercourse, or outlet acceptable to the **County**, for storms greater than the 1:100 year event.

- The effects of the maximum pond water levels will be considered in the design of the minor system and lot **grading**. The crown elevations of the pipes in the first manhole upstream of a facility will be at or above the maximum detention pond level during the 1:5 year storm event.

- The maximum water level fluctuations for detention ponds in residential areas during the 1:100 year storm event will be 2.0 m. All inhabited building space, including basements, will be constructed above the 100 year flood level.

- In design, wet ponds (retention) will:

    i) be located at local low points or adjacent to an existing water course;

    ii) have a minimum depth of 2.4 m at normal water level;

    iii) have side slopes no steeper than 3:1 from the bottom of the pond to 1 ½ m below normal water level; from here to 5 m (horizontal) beyond the 100 year flood level the side slopes will be no steeper than 7:1 (a slope of 4:1 will be considered if appropriate slope protection is constructed);

    iv) have inorganic shoreline treatment for 1.5 m horizontal below and 3.0 m horizontal above the normal water level (the edge treatment will be compatible with adjacent land use and consider safety, **maintenance**, access, and erosion reduction);

    v) have inlets and outlets submerged below ice level and above the level of anticipated sediment accumulation (the invert will be at least 1 m below normal water level);

    vi) have provision for sediment accumulation at the points of inflow, and for the later removal of the sediment;

    vii) address all safety issues;

    viii) have no dead bay areas;

    ix) have an annual volume exchange at least twice per year;

    x) have an inspection manhole located no greater than 18 m from shore on both the inlet and outlet lines; and

xi) have a 0.3 m freeboard between the 1:100 year water level and area basements.

- In design dry ponds (detention) will:
  - i) be off-line storage areas designed to temporarily detain excess runoff and thereby reduce the peak outflow rates when a greater than 1:5 year rainfall event occurs;
  - ii) have a low flow bypass for flows from minor events and be designed to meet current Alberta Environment guidelines. The maximum depth of storage in a dry pond for a 1:100 year rainfall event will be 1.5 m;
  - iii) have a pond bottom graded to a minimum grade of 1.0% and will properly drain all areas after its operation;
  - iv) be designed to have a maximum side slope of 5:1 (vertical) unless otherwise approved by the **County**;
  - v) all inlet and outlet structures of the pond will have grates and accompanying hardware of corrosive resistant metal over their openings to preclude access by children and animals. These structures will be designed for a hydraulic capacity of twice the required capacity and address all safety and **maintenance** issues (particularly during operation);
  - vi) roadways can be considered as a temporary storage facility for major storm events as long as the ponding does not cause flooding of adjoining properties;
  - vii) the **Developer** will provide equipment and documentation as required by the **County** for the **maintenance** of the storm water ponds;
  - viii) the pond's perimeter may require fencing in a manner approved by the **County**; and
  - ix) have a 0.3 m freeboard between the 1:100 year water level and area basements.

**J3.3 Outfalls:**

- Obverts of outfall pipes will be at least 150 mm above the 1:5 year flood level in the receiving watercourse. Inverts of outfall pipes will be above the winter ice level. Otherwise, outfall pipes will be submerged below the bottom of ice level. In addition, outfalls will be located to avoid damage from moving ice during breakup.

- Drop structures, slope protection material and energy dissipaters will be used where necessary to prevent erosion.

- Facilities must be provided which will prevent entry by children and animals.

**J3.4 Receiving Waters:**

- Measures must be incorporated in new **development**s to prevent any increase in the amount of downstream erosion.

- If a **development** causes downstream erosion despite the use of on-site peak runoff rate controls, appropriate mitigating measures are to be taken in the downstream areas.

- Preservation of watercourse aesthetics and wildlife habitat must be considered in erosion and bank stability work.