CITY OF IQALUIT

MUNICIPAL DESIGN GUIDELINES

OCTOBER 2004

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A WATER DISTRIBUTION SYSTEM

A-1 GENERAL

These guidelines are intended as a guide only. The Design Engineer is responsible to ensure that the water system is designed and constructed according to accepted engineering practice.

These Guidelines shall not be considered as a substitute for a detailed material and construction specification prepared by the Design Engineer.

These Guidelines only apply in areas where underground water servicing is specified.

A-2 ORGANIZATIONS ISSUING STANDARDS:

ASTM-American Society for Testing and Materials

AWWA-American Water Works Association

CSA-Canadian Standards Association

NFPA-National Fire Protection Association

NSF-National Sanitation Foundation

Fire Underwriter's Survey

A-3 WATER MAINS

A.3.1 Flow Requirements

1. Average Daily Demand	-	400 L/person/day
2. Population Density (residential)	-	3.5 persons/residence
3. Maximum Daily Demand	-	2 × Average Demand
4. Peak Hourly Demand	-	4 × Average Demand
5. Minimum Residual Water Pressure During Peak Hour Flow	-	350 kPa (50 psi)
6. Minimum Residual Water Pressure During Maximum Day + Fire Flow	-	140 kPa (20 psi)
7. Minimum Residual Water Pressure Maximum Day Flow (for operation of residential fire sprinklers)	-	350 kPa (50 psi)

A.3.2 Pipe Sizing

1. Sizing of water mains shall be determined by hydraulic network analysis. Results shall be submitted to the City Engineer for approval.
2. The minimum size for a distribution main shall be 200mm. Lines must be sized to accommodate the anticipated land use.
3. The minimum size for a recirculation line shall be 50mm. Lines must be sized to accommodate the anticipated land use.
4. The maximum velocity under normal operating conditions shall not exceed 3.0 m/s.
5. Hazen-Williams "C" value shall be 120 for H.D.P.E. pipe.
6. Analysis shall be made to ensure that there is a minimum residual pressure of 350 kPa (50 psi) under Peak Hour Demand conditions.
7. Separate analysis shall be made to ensure that there is a minimum residual pressure of 140 kPa (20 psi) under Maximum Day Demand plus Fire Flow Conditions.

A.3.3 Water Main Alignment and Location

1. Water mains shall be located within the road right-of-way and outside the carriageway.
2. Water mains shall be located a minimum of 230mm outside of insulation to outside of insulation horizontally and 300mm from invert to obvert vertically from any sewer line.
3. Public Utility Lot (PUL) widths shall be at least 6.0m for a single utility and 8.0m for two utilities.
4. Water distribution and transmission systems in new subdivisions shall be looped.

A.3.4 Required Depth for Water Mains

1. The water main shall have a minimum depth of cover of 2.5m measured from finished grade to the top of pipe.
2. Water mains shall cross above sewer where ever possible. Water mains crossing below sewers shall require special approval from the City Engineer.
3. Water mains crossing above the sewer with sufficient clearance to allow for proper bedding and structural support of the pipes. Pipe clearance when passing over any sewer shall be a minimum of 300mm separation between the top of the sewer pipe and the bottom of the water main.
4. Water mains crossing under sewers shall be a minimum of 500mm separation between the bottom of the sewer pipe and the top of the water main. Efforts shall be made to pass over the sewer when possible.

A.3.5 Water Pipe Material

General

1. Approved materials shall be as per City of Iqaluit standards.
2. Only new materials shall be deemed acceptable. All materials found to be defective or damaged shall be replaced at the no cost to the City. The pipe shall not be more than two years old at the time of installation.
3. Records of quality control testing performed by the manufacturer shall be made available upon request.
4. All pipe and joint lubricants must be certified for potable water use in accordance with N.S.F. Standards.

Polyethylene

1. All pipe materials and fabrication shall conform to AWWA C901 or C906, as applicable
2. Polyethylene pipe shall conform to CSA B137.1 and ASTM F714, D3035, D3350
3. Water main shall be HDPE DR11 (Series 160, 1100 kPa)
4. All pipe to have a 50mm thickness shop cast polyurethane insulation and black jacket.
5. Moulded fittings shall conform to ASTM D2683 or D3261
6. Fabricated fittings shall be manufactured form pipe of the same series as that used in the piping system.
7. Pipe shall be joined by thermal butt-fusion, flange assemblies or compression type fittings.
8. Compression couplings shall be used with stainless steel inserts.
9. Couplers shall be Victaulic Type 995 for use with HDPE piping or approval equal.
10. Valves shall be cast iron gates valves with flanged connections.
11. Each pipe length shall be marked for use with potable water, the manufacturer's name, nominal pipe size, dimension ratio, material grade, manufacturing standard, and a code indicating the date and place of manufacture.

Steel Fittings

1. Fittings for H.D.P.E pressure pipe shall conform to AWWA C200 and C208 with a minimum working pressure of 1035 kPa and a yield point strength of 207 Mpa.
2. Slip-on flanges of forged steel shall conform to AWWA C207, Class D and flat faced or weld-neck flanges shall conform to ANSI B16.1, Class 125.
3. Use stainless steel double threaded studs with two nuts, ASTM A307, Grade B.
4. Full-faced rubber gaskets shall be used with 1035 kPa working pressure.

5. Weldolets and threadolets of forged steel shall comply with ASTM A105.
6. Welding of shop-fabricated fittings shall conform to CSA Z662.
7. The exterior of all fittings shall be factory coated with an epoxy coating conforming to AWWA C213.

A.3.6 Water Main Installation

1. The pipe installation shall be conducted in compliance with the pipe manufacturer's specifications.
2. Align pipes carefully from access vault to access vault. Keep joints free of mud, gravel and foreign material and ensure that the joint is complete as outlined in the manufacturer's specifications. Deflections shall not exceed those permitted by the manufacturer.
3. The pipe must be thoroughly flushed of all dirt, stones and pipe lubricant when complete.
4. The alignment of pipes less than 900mm in diameter shall not be more than 150mm of the designated alignment.
5. The invert of pipe shall not deviate from the design grade by more than 40mm.

A-4 VALVES

A.4.1 Materials

1. All water valves shall be certified to National Sanitation Foundation (NSF) Standard 61 – Drinking Water System Components: Health Effects and Standard 14 – Plastics and Plumbing System Components.

Pressure Reducing Valves

1. Valves 200mm and smaller shall be of single diaphragm type. Valves 250mm and larger shall be double diaphragm type.
2. Valves shall be globe style, hydraulically operated, pilot controlled with flanged cast iron body to ANSI B16.1, Class 125. Valves shall have type 304 stainless steel seat and stem.

Flow Control Valves

1. Valves shall be diaphragm type, globe or angle style with cast iron body and bronze trim.
2. Provide an "O" ring seat seal on main valve and strainer and needle valve on pilot inlet lines.

Air Valves

1. All air valves shall conform to AWWA C512 with cast iron body and stainless steel float. Minimum working pressure shall be 1035 kPa.

A.4.2 Valve Location and Spacing

1. The location and spacing of valves should be such that when the system is in operation:
   - No more than two hydrants will be put out of service by a water main shutdown
   - No more than four valves are required to effect a shutdown
   - No more than 20 lots are out of service due to a water main shutdown
2. Valves should be no greater than 250m apart.
3. Valves shall be located in access vault.
4. Valves shall be located at both ends of a main passing through a utility lot or easement and shall be placed 500mm from the property line.
5. Valves shall be the same size as the corresponding main.
6. All valves locations shall be reviewed and approved by the City Engineer and the Fire Department.

A.4.3 Valve Installation

1. Valves, valve casings and fittings shall be installed in accordance with the manufacturer's specifications.
2. Upon completion, all valve casings must be checked to ensure that they are plumb and that the operating nut can be turned properly.

A-5 HYDRANTS

A.5.1 Materials

1. All hydrants shall be 200mm Crane McAvity M-67 inline fire hydrants unless otherwise approved by the City Engineer.
2. All hydrants shall be certified to NSF Standard 61 – Drinking Water System Components: Health Effects and Standard 14 – Plastics and Plumbing System Components.
3. Compression type hydrants shall be supplied conforming to AWWA C502 for dry barrel fire hydrants.
4. Hydrant shall be designed for 1035 kPa working pressure.

5. Hydrants shall have one pumper connection, 146mm outside diameter, and two hose connections (63.5mm) with MPSH thread at least 415mm above the ground flange. Nipples shall be provided with caps without chains or cables. The hose and pumper caps and hydrant valve shall open clockwise.
6. Hydrants shall consist of a minimum 2.45m barrel with 300mm extension.
7. Hydrants shall have a 200mm cast iron outside diameter inlet elbow with bell end and harnessing lugs. Elbow shall be flanged to the barrel.
8. Valve stem in hydrant head to have "O" ring seals.
9. Operating nut shall be three sided, each side being a 36.5mm long arc.
10. Hydrants shall have stainless steel bolt assemblies throughout.
11. External paint shall conform to AWWA C550 – corrosion resistant fluorescent red.

A.5.2 Hydrant Location and Spacing

1. The maximum spacing between hydrants shall be 120m for residential areas
2. For school, industrial or commercial areas hydrant spacing shall be such as to provide complete coverage to the building from a maximum distance of 90m.
3. For sprinkled buildings, a hydrant shall be located within 45m of the buildings siamese connection.
4. All hydrants to be placed inside access vaults as per City of Iqaluit standards.
5. Hydrants and access vaults shall be located at the projection of the property lines where possible.
6. Hydrant spacing shall be approved by the Fire Department.

A.5.3 Hydrant Installation

1. Hydrants shall be installed in accordance with the manufacturer's specifications and AWWA M17.
2. Upon completion, all hydrants must be checked to ensure that they are plumb and that the operating nut is functioning properly.

A-6 COUPLINGS AND ADAPTORS

1. Bolted sleeve couplings shall conform to AWWA C219 with ductile iron or carbon steel bodies with epoxy coating conforming to AWWA C213 or AWWA C550 as applicable. Coupling shall have a minimum operating pressure of 1035 kPa. Linings shall be in accordance with AWWA C210, C213 or C550 and be suitable for use with potable water.
2. Flange adapters shall conform to AWWA C219 with ductile iron or carbon steel bodies with epoxy coating conforming to AWWA C210, C213 or C550 as applicable.

The minimum operating pressure shall be 1035 kPa. Flanges shall conform to AWWA C207, Class D. Linings shall be in accordance with AWWA C210, C213 or C550 and be suitable for use with potable water.

3. Couplings for grooved and shouldered joints shall conform to AWWA C606 and shall have operating pressures, coatings and linings as above.

A-7 TRENCHING BEDDING AND BACKFILLING

1. All trenching and backfilling shall be completed in strict accordance with Occupational Health and Safety Guidelines.
2. If unsuitable soil conditions are encountered, proper measures for dealing with the conditions shall be identified either on the design drawings or as a brief report to the City Engineer prior to construction.
3. Modified Granular C pipe bedding shall be utilized in suitable soil conditions. Bedding sand shall have minimum depth of 100mmm below the pipe, shall extend up both sides to the trench wall and provide a minimum cover of 300mm above the pipe.
4. Test pits are to be excavated every 15m to a depth of 450mm below the invert of the pipe to check for the presence of silt. Subexcavate 450mm below the invert of the pipe when silt is found and backfill with Granular B compacted to 95% Standard Proctor Density.
5. The minimum trench width measured at the pipe springline shall be the pipe outside diameter plus 450mm. The maximum trench measured at the pipe springline shall be the pipe outside diameter plus 600mm. The City Engineer must be notified if the trench must be excavated deeper or wider than specified.
6. Excavated material shall be stockpiled at a safe distance from the edge of the trench.
7. The Design Engineer shall identify areas where the trench excavation requires sheathing, shoring or bracing in order to protect workers, property or adjacent structures.
8. Trench excavations shall be kept free of water.
9. Utility trenches shall be adequately compacted.

   Native backfill under existing or proposed roads or laneways shall be compacted to:

   - 98% standard proctor density form subgrade to 1.5m below subgrade or original ground, whichever is lower;
   - 95% standard proctor density greater than 1.5m from the subgrade or original ground, whichever is lower;

   to a distance equal to the trench depth past the shoulder.

   Granular backfill under existing or proposed roads or laneways shall be compacted to 95% of standard proctor density throughout the entire trench depth below subgrade to a distance equal to the trench depth past the shoulder.

Backfill in all other areas shall be compacted to 95% standard proctor density.

Subgrade and base course compaction for roadway construction shall be as specified in Section D – Roadways, Walking Trails and Snow Mobile Trails.

If the above standards cannot be achieved due to a large variation in soil types throughout the development, the City Engineer may at his sole discretion, establish a more appropriate standard on an individual case basis.

10. If the minimum compaction standards cannot be met due to abnormal weather or wet ground conditions, the City Engineer may establish a more suitable standard on a site-specific basis provided adequate justification is presented.
11. All landscaping, pavement structures, sidewalks, curb and gutter damaged or removed during trenching shall be restored or replaced unless otherwise directed by the City Engineer.
12. All debris, surplus fill and unused materials must be removed form the site.

A-8 INSPECTION AND TESTING

1. All water installations shall be subject to inspections by the City Engineer prior to issuance of the Substantial Certificate of Completion and Final Certificate of Completion.
2. Visual inspections of all lines are required prior to Substantial Certificate of Completion. Any deflections, sags obstructions and other defects affecting the performance of the line shall be corrected and the line re-inspected prior to Substantial Certificate of Completion.
3. All material testing (backfill densities and concrete testing) shall be performed by an accredited agency and certified by a Professional Engineer. All test results shall be submitted to the City Engineer with a report indicating any deficiencies and remediation.

A.8.1 Testing

1. The Fire Department shall be responsible for pressure and flow testing of the entire water system. If discrepancies are found, the Design Engineer shall indicate the corrective action that must undertake to remedy the deficiency.

A-9 DISINFECTION

1. Water mains are to be disinfected and flushed in accordance with AWWA C651.
2. Fill section of main to be disinfected with a chlorine solution, and measure the starting residual.
3. Disinfect for 24 hours and measure residual. If no chlorine is measured repeat the disinfection procedure.

4. When disinfection is completed, test for bacteria.
5. When the City Engineer has approved the bacteria test, flush water mains and safely discharge the water so that no downstream damage occurs.
6. If repairs are made on any section of pipe, disinfection shall be repeated.
7. The mains shall not be commissioned and put into use until the bacteriological sample results are approved by the City Engineer.

A-10 OPERATION OF BOUNDARY VALVE & EXISTING HYDRANT

1. City representatives shall be notified at least 24 hours in advance of valve operation requirements. City personnel shall operate the boundary valves.
2. Use of fire hydrants, tap faucets or the like, connected to the City's treated water supply is strictly forbidden. Any violations will result in appropriate fines as stipulated in the bylaws. All water used in the performance of the work must be obtained from truck fill stations as directed by the City.

B SANITARY SEWER SYSTEM

B-1 GENERAL

These guidelines are intended as a guide only. The Design Engineer is responsible to ensure that the sanitary sewer system is designed and constructed according to accepted engineering practice.

These Guidelines shall not be considered as a substitute for a detailed material and construction specification prepared by the Design Engineer.

These Guidelines only apply in areas where underground sanitary servicing is specified.

B-2 ORGANIZATIONS ISSUING STANDARDS:

ASTM – American Society for Testing and Materials

CSA – Canadian Standards Association

B-3 SANITARY SEWERS

B.3.1 Flow Generation Rates

The sanitary system shall be of sufficient capacity to carry peak flows plus an inflow and infiltration allowance. The flow and factors listed below shall be used as minimum requirements in the design of the sanitary sewer systems.

1. Average Sewage Flow	-	400 L/person/day
2. Population Density (residential)	-	3.5 persons/residence
3. Peak Sewage Flow	-	Average Flow x Peaking Factor
4. Peaking Factor	-	$1 + 14/(4+P^{1/2})$ (residential) (Harmon's Formulas) where P = the contributing design population in thousands where P<1, a peaking factor of 4.5 shall be used 3.0 (non-residential)

The total design peak flow rates for the sanitary sewer shall be the sum of the peak flow rates plus all extraneous flow allowances.

B.3.2 Gravity Sewer Pipe Sizing

The following design factors shall be used in determining the sanitary sewer pipe sizes:

1. Minimum pipe size - 200mm diameter
2. Manning's Formula "n" - 0.013
3. Required sewer capacity - $\frac{\text{Estimated Peak Design Flow}}{0.86}$
4. Minimum flow velocity - 0.6 m / sec (during average flow)
5. Maximum flow velocity - 3.0 m / sec
9. Minimum design slopes

Sewer Diameter (mm)	Minimum Design Slope
200	0.40%
250	0.28%
300	0.22%
375	0.15%
450	0.12%
525 and greater	0.10%

9. Minimum slopes shall be increased by 50% on all curved sections.
9. The minimum grade of the first upstream leg shall not be less than 1.0%.
9. It is recommended that all sanitary sewers be designed with a slope of 0.5% or greater, wherever possible.

B.3.3 Sanitary Sewer Alignment and Location

1. Sewer mains shall be located within the road right-of-way and outside the carriageway.
2. Sanitary sewers shall be located a minimum of 230mm outside of insulation to outside of insulation horizontally and 300mm from obvert to invert vertically from any waterline.
3. Public Utility Lot (PUL) widths shall be at least 6.0m for a single utility and 8.0 for two utilities.
4. Curved sewers shall run parallel to the road centre line.

B.3.4 Required depth for sanitary sewers

1. Sanitary sewers shall be installed at a sufficient depth to meet the following requirements:
2. The main shall have a minimum depth of cover to ensure the mains are in permafrost. No main shall be installed with less than 3.0m of cover measured from finished grade to the top of the pipe.
3. Gravity mains shall have sufficient depth to allow all buildings to drain by gravity to the sewer. Service lines shall have a minimum cover of 2m from the finished lot surface to the top of pipe at the property line.
4. Sanitary Sewers shall cross below water mains where ever possible. Sewers crossing above water mains shall require special approval from the City Engineer.
5. Sanitary sewer crossing above the water main with sufficient clearance to allow for proper bedding and structural support of the pipes. Pipe clearance when passing over any sewer shall be a minimum of 300mm separation between the top of the sewer pipe and the bottom of the water main.
6. Sanitary sewers crossing above water mains shall be a minimum of 500mm separation between the bottom of the sewer pipe and the top of the water main. Efforts shall be made to pass under the water main when possible.

B.3.5 Sanitary Sewer Materials

1. Only new materials shall be deemed acceptable. All materials found to be defective or damaged shall be replaced at no cost to the City.
2. Where specific products are specified, it is intended that approved equals are also acceptable. Approval must be obtained by the City Engineer prior to installation.
3. Polyethylene pipe and fitting shall conform to the following:
    - DR11 Polyethylene pipe shall conform to CSA B137.1 and ASTM D3035, D3350
    - Minimum pressure rating of 1100 kPa (series 160)
    - Moulded fittings shall conform to ASTM D2683 or D3261
    - Fabricated fittings shall be manufactured form pipe of the same series as that used in the piping system.
    - Pipe shall be joined by thermal butt-fusion, flange assemblies or compression type fittings.
    - Flanges shall be stainless steel or epoxy coated ductile iron conforming to ASTM A536-80 with stainless steel nuts, bolts and washers.
    - Compression couplings shall be used with stainless steel inserts.
    - Outlet sleeve saddle shall be Robar type 6626 or approved equal.

- Valves shall be cast iron gates valves with flanged connections.
- Each pipe length shall be marked with the manufacturer's name, nominal pipe size, dimension ratio, material grade, manufacturing standard, and a code indicating the date and place of manufacture.

B.3.6 Sewer Installation

1. The pipe and gasket installation shall be conducted in compliance with the pipe manufacturer's specifications. Installation of HDPE pipe and fittings shall conform to CSA-B137.1.
2. Pipe installation shall start at an access vault and work upstream to the next access vault.
3. Align pipes carefully when jointing. Keep joints free of mud, gravel and foreign material and apply sufficient pressure to ensure that the joint is complete as outlined in the manufacturer's specifications. Complete each joint before laying the next length of pipe. Deflections shall not exceed those permitted by the manufacturer.
4. The pipe must be thoroughly flushed of all dirt, stones and pipe lubricant when complete.
5. The alignment of pipes shall not be more than 150mm off the designated alignment.
6. The invert of the pipe shall not deviate from the design grade by more than 6mm plus 20mm per metre of diameter of sewer pipe.

B-4 SANITARY CLEANOUT DESIGN AND LOCATION

1. Clean outs shall be located at the end of each line, at all changes in pipe size, grade and alignment.
2. Clean outs shall be located in all access vaults.
3. The maximum distance between clean outs shall not exceed 120m.
4. The drop across access vaults should be of sufficient magnitude to account for any energy losses in the access vault.
5. Pipe deflections of less than 45º require a drop of at least 30mm
6. Pipe deflections of 45º to 90º require a drop of at least 50mm
7. Invert drops for pipes larger then 600mm or for high flow situations shall be assessed on an individual basis
8. The obvert elevation of a sewer entering a manhole shall not be lower than the obvert elevation of the outlet pipe.
9. Pipe deflection in the manhole shall not be greater than 90º.
10. Risers for service lines shall be required when sewer mains exceed 4 metres in depth.

B-5 TRENCHING, BEDDING AND BACKFILLING

1. All trenching and backfilling shall be completed in strict accordance with Occupational Health and Safety Guidelines.
2. If unsuitable soil conditions are encountered, proper measures for dealing with the conditions shall be identified either on the design drawings or as a brief report to the City Engineer prior to construction.
3. Modified Granular C pipe bedding shall be utilized in suitable soil conditions. Bedding sand shall have minimum depth of 100mm below the pipe, shall extend up both sides to the trench wall and provide a minimum cover of 300mm above the pipe.
4. Test pits are to be excavated every 15m to a depth of 450mm below the invert of the pipe to check for the presence of silt. Subexcavate 450mm below the invert of the pipe when silt is found and backfill with Granular B compacted to 95% Standard Proctor Density.
5. The minimum trench width measured at the pipe springline shall be the pipe outside diameter plus 450mm. The maximum trench measured at the pipe springline shall be the pipe outside diameter plus 600mm. The City Engineer must be notified if the trench must be excavated deeper or wider than specified.
6. Excavated material shall be stockpiled at a safe distance from the edge of the trench.
7. The Design Engineer shall identify areas where the trench excavation requires sheathing, shoring or bracing in order to protect workers, property or adjacent structures.
8. Trench excavations shall be kept free of water.

   Native backfill under existing or proposed roads or laneways shall be compacted to:

   - 98% standard proctor density from subgrade to 1.5m below subgrade or original ground, whichever is lower;
   - 95% standard proctor density for depths greater than 1.5m from the subgrade or original ground, whichever is lower;

   to a distance equal to the trench depth past the shoulder.

   Granular backfill under existing or proposed roads or laneways shall be compacted to 95% of standard proctor density throughout the entire trench depth below subgrade to a distance equal to the trench depth past the shoulder.

   Backfill in all other areas shall be compacted to 95% standard proctor density.

   Subgrade and base course compaction for roadway construction shall be as specified in Section D.

   If the above standards cannot be achieved due to a large variation in soil types throughout the development, the City Engineer may at his sole discretion, establish a more appropriate standard on an individual case basis.

9. If the minimum compaction standards cannot be met due to abnormal weather or wet ground conditions, the City Engineer may establish a more suitable standard on a site-specific basis provided adequate justification is presented.
10. All landscaping, pavement structures, sidewalks, curb and gutter damaged or removed during trenching shall be restored or replaced unless otherwise directed by the City Engineer.
11. All debris, surplus fill and unused materials must be removed from the site.

B-6 INSPECTION AND TESTING

1. All sewer installations shall be subject to inspections by the City Engineer prior to issuance of the Substantial Certificate of Completion and Final Certificate of Completion.
2. Visual inspections of all lines are required prior to Substantial Certificate of Completion. Any deflections, sags obstructions and other defects affecting the performance of the line shall be corrected and the line re-inspected prior to Substantial Certificate of Completion.
3. All material testing (backfill densities and concrete testing) shall be performed by an accredited agency and certified by a Professional Engineer. All test results shall be submitted to the City Engineer with a report indicating any deficiencies and remediation.

B-7 SANITARY WASTEWATER PUMPING SYSTEMS

B.7.1 General

1. Wastewater pumping systems shall only be installed where site constraints restrict the gravity collection system from tying to an existing sanitary trunk line. The requirement must be justified in an initial subdivision design report taking the development plans for the surrounding area into account.

B.7.2 Standards and Approvals

1. The design and construction of the pumping system must meet the requirements of other governmental authorities and regulations including Federal, Territorial and Municipal. The Design Engineer is responsible for all submissions and applications required for approval.

B.7.3 Location

1. The pumping station shall be located in such a manner as to minimize the impact to adjacent development in terms of visibility, odour and noise.

2. Pumping stations shall not be located in areas subject to flooding during a major rainfall event.
3. Pumping stations shall always be accessible by road.

B.7.4 Configuration

1. A wet well configuration with submersible pump or above ground suction head pump is preferred.
2. A wet well/dry well configuration may be considered for larger facilities.
3. A building will be required for all pumping stations.
4. A collection access vault shall intercept flow from all incoming sewers before discharge to the pumping station. The station shall receive flow from one inlet only.
5. Provision shall be made to shut off flow from the collection manhole if required.

B.7.5 Pumping Station Design

1. The pumps shall be sized to accommodate the maximum expected flow as determined by accepted engineering practice and according to the requirement specified in Section B.3.1 - Flow Generation Rates.
2. Pumping stations shall be equipped with two or more pumps sized such that if one pump is out of service, the remaining pump(s) is/are capable of pumping the design capacity flow rate. Pumps shall be identical and interchangeable for a duplex pumping station. Pumps starts shall alternate between pumps.
3. Pumps shall be provided by a well-recognized manufacturer.
4. Submersible pumps shall have a non-clog impeller design and flush valves.
5. Pump motors shall operate on 3-phase power wherever possible. This requirement may be relaxed by the City if 3-phase power cannot be supplied at a feasible cost.
6. Dead storage shall be minimized while meeting minimum depth requirements specified by the pump manufacturer.
7. Wet wells shall be sized based on accepted engineering practice. Storage shall be provided to minimize the frequency of pump starts but maximum retention time in the wet well should not exceed 30 minutes. The design shall meet pump manufacturer's specifications.
8. Wet wells shall be sized and equipped to accommodate operator access, maintenance and safety requirements.

B.7.6 Valves and Piping

1. The minimum diameter for all pump suction and discharge piping shall be 100mm.

2. Pipe sizing shall allow for minimum and maximum flow velocities of 0.75m/s to 3.5m/s respectively within the station.
3. The minimum pressure rating of piping within the station shall be determined based on calculated operating pressures but shall not be less than 900 kPa.
4. Pumps shall be connected in parallel to a common discharge header located within the station. Check valves and isolation valves shall be installed on the discharge line between each pump and the discharge header.
5. A forcemain isolation valve shall be installed on the main discharge pipe outside the wet well.

B.7.7 Water Supply

1. Water supply must be provided to the facility for washing/cleaning purposes.
2. The design shall ensure that the connection between the potable water supply and the wastewater pumping station does not cause contamination of the potable water supply. The design shall comply with the conditions stipulated in the Environment "Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems" for Water Supply and Wastewater Facilities.
3. Where a potable water supply is to be used for washing/cleaning purposes, a break tank, pressure pump and pressure tank shall be provided. In-line backflow preventers are not acceptable. The potable water shall be discharged to the break tank through an air gap at least 150mm above the maximum flood line or the spill line of the tank.

B.7.8 Alarms and Emergency Backup

1. Stations shall be equipped with or provided with the feature for future connection of remote sensing and telemetry equipment enabling operators to monitor the alarms.
2. Power must be supplied from two independent sources. In the event of a power failure, secondary power must automatically engage through a diesel generator or direct-coupled motor.
3. Special consideration shall be made to control any possible overflow in a manner acceptable to the City and the Department of Environment.

B.7.9 Access and Maintenance

1. Permanent hoist equipment and access hatches of sufficient size and capacity shall be provided for removal of station equipment.
2. All access points shall have locking devices.
3. Ladders shall be non-skid and shall comply with Occupational Health and Safety requirements.
4. Stations shall have adequate interior and exterior lighting.

5. An Operating and Maintenance manual shall be provided for the facility. The manual shall include a complete parts list for all mechanical and electrical components including control diagrams, schematics and manufacturer's operation, maintenance, service and repair specifications. Five (5) copies along with all commissioning and testing results shall be submitted to the City prior to issuance of the Substantial Certificate of Completion.

B.7.10 Heating and Ventilation

1. Forced mechanical ventilation is required for dry wells below ground level and for wet wells containing screens or mechanical equipment requiring maintenance or inspection.
2. Equipment shall be able to provide at least six air changes per hour. Provision shall be made for ventilation of the wells with portable equipment in case of system failure. Ventilation failure alarms are required.
3. There shall be no interconnection between wet well and dry well ventilation systems.
4. Multiple air inlets and outlets are recommended for dry wells over 5m deep. Air intakes and outlets shall be designed to function year round and screen openings should be sized to avoid frost build-up or clogging.
5. Air shall be forced into the dry well at a point 150mm above the pump floor and into the wet well at a point 150mm above water level.
6. Automatic heating and dehumidification equipment shall be provided in all dry wells.

B.7.11 Building Requirements

1. All lift stations shall be provided with a building to house all electrical and control equipment and to provide a workspace for pump maintenance.
2. Buildings shall be of an adequate size to allow for the required access hatches, hoist equipment, ventilation and control equipment while allowing for an appropriate workspace for pump maintenance.
3. Access to the wet well shall not be from within the building.
4. Building layout and access shall be designed to facilitate the removal of any equipment that may require off-site maintenance.
5. Structural members shall be masonry, concrete or structural steel. Wood frame buildings are not permitted. Buildings shall comply with the National Building Code.
6. The design shall incorporate measures to reduce the noise and odour impact on the surrounding development.
7. Buildings shall be designed to blend architecturally with the surrounding development.
8. Windows shall not be permitted in lift station buildings.

B.7.12 Forcemains

1. System head curves shall be developed for each forcemain to be submitted to the City Engineer upon request.
2. The minimum forcemain diameter shall be 100mm.
3. The pressure rating of the pipe shall be twice the operating pressure or 690 kPa, whichever is greater.
4. The velocity shall be within 0.9 m/sec to 3.5 m/sec. The minimum velocity for pipes larger than 300mm shall be 1.1 m/sec. Special design provisions in order to stabilize the line shall be incorporated when design velocities exceed 3.0 m/sec.
5. The forcemain design pressure shall allow for the normal static and dynamic operating pressures including water hammer effects.
6. A series of 45º bends shall be used in lieu of 90º bends.
7. Air release valves shall be installed in access vaults at all relative high points. Forcemain grades should be designed in order to avoid the requirement for an air release valve wherever possible.
8. Blow-off valves shall be provided at all low points.
9. Vacuum relief valves shall be installed wherever necessary in lines designed to drain by gravity between pumping cycles.
10. The forcemain invert at the receiving manhole shall be a maximum of 300mm above the highest invert. The outlet invert of a lagoon inlet manhole shall always be above the high water level.
11. When forcemain length exceeds 1000 metres, cleanouts should be installed in concrete access chambers complete with isolation valves and adaptor coupling for line flushing.

C ACCESS VAULTS

C-1 GENERAL

These guidelines are intended as a guide only. The Design Engineer is responsible to ensure that the access vaults are designed and constructed according to accepted engineering practice.

These Guidelines shall not be considered as a substitute for a detailed material and construction specification prepared by the Design Engineer.

C-2 ACCESS VAULT DESIGN

C.2.1 Fabrication

Steel access vaults (AVs) shall be prefabricated, complete with all piping, fittings, and accessories.

Fabricator to provide shop drawing, to be approved by the Design Engineer.

Access vaults are to be finished, inspected and tested in the prefabrication shop prior to shipping. A certificate of testing shall be provided for each access vault. The certificate shall include the date of testing, method of testing and test results, and shall be signed by the inspector.

All piping and fittings shall be set horizontally and vertically as shown on the detail drawing and in approved shop drawings.

C.2.2 Materials

1. Access vault to be constructed of steel plate:
   - Sides (interior and exterior) – 6 mm thick steel plate
   - Cover – 6 mm thick steel plate
   - Bottom – 10 mm thick steel plate
2. Urethane foam insulation shall be injected from above to prevent the formation of voids. Urethane foam insulation to have the following properties:
   - Density (kg per cubic metre core) (ASTM D-1622): 35
   - Compressive Strength kPa @ 25°C 10% Deflection measured axially (ASTM D-1621-64): 240
   - Thermal Conductivity W/m°C @ 25°C (ASTM D-2326-64T): 0.0187
   - Operating temperature range °C Cyrogenic to +: 93
   - Closed cell content % (ASTM D-2856): 90 min
   - Water absorption gm/1000cc (ASTM D-2856): 12

- Dimensional Stability, % (ASTM D2126 Procedure B & E): 3

3. Pipe Fittings shall be constructed from "Tube Turn", or approved equal standard wall welding fittings and 1,030 kPa (150 psi) flanges). All fitting shall be hot dipped galvanized inside and outside after fabrication.
4. Flanged cast iron fittings shall be "Grinnell" 1,030 kPa (150 psi), standard fittings, coated inside and outside with asphaltic coat tar epoxy paint, or approved equal.
5. Fabricated steel pipe supports shall be hot dipped galvanized.
6. Styrofoam insulation shall be Dow Chemical Company HI 410 kPa Styrofoam or approved equal.
7. All bolts and washers shall be cadmium plated.

C-3 ACCESS VAULT CONSTRUCTION

1. Access Vaults shall be constructed to a size to allow the required piping and fitting to be installed and maintained, and shall have a minimum inside dimension of 1830 millimetres.
2. Interior piping and fittings to be set horizontally and vertically as specified on Access Vault Design Drawings. Where an access vault has both water mains and sanitary sewers and unless otherwise specified, the water main and sanitary sewer shall be grade separated through the access vault.
3. All interior and exterior surfaces of the access vault, with the exception of the access vault top plate, lid and ladder shall be sandblasted and epoxy coated after fabrication as follows:
   - Surface Preparation: steel surfaces shall be prepared in accordance to the Steel Structures Painting Council specification SSPC #10 near white blast condition.
   - Painting: Access vault to be painted with two coats of epoxy paint, 8mils dry film thickness. Interior colour to be off white and exterior colour to be grey. Floors painted with Indurall Ruff Stuff 3300 or equal.
4. Access vault top plate, lid and ladder shall be hot dipped galvanized after fabrication. Galvanizing to conform to CSA G164 (minimum 610 g/m^2).

C-4 ACCESS VAULT INSTALLATION

C.4.1 Access Vault Location

1. Access vaults to be located at alignment or grade changes.
2. Access vaults shall be spaced at a maximum of 120 metres.

C.4.2 Installation

1. All work to be carried out in a dry excavation.
2. Access vaults shall be placed on 300 mm of Modified Granular 'C' bedding compacted to 95% standard proctor, and 38 mm thick Styrofoam insulation base. Bedding and Styrofoam to extend 300 mm beyond the base plate.
3. Base plate to be covered with 38 mm Styrofoam insulation, to extend 300 mm beyond the edge of the base plate. 10 mm thick filler piece to be installed between insulation below and above base plate.
4. Access vault to be backfilled with 300 mm modified granular 'C', 300 mm above insulation and adjacent to access vault.
5. Access vault shall be installed to maintain design alignments and grades.
6. Access vault shall extend above grade between 150 to 450 mm.
7. Damaged to exterior finish shall be repaired by repainting with epoxy paint to match manufactured finish.

C-5 INSPECTION AND TESTING

1. All materials are subject to inspection and testing at the discretion of the Engineer. Any materials found to be flawed or defected shall be rejected and shall be removed from the site and replaced.
2. The Contractor shall provide sufficient notice to the Engineer to allow the Engineer to witness and approve the test.
3. Written certificates shall be issued to the Contractor by the Engineer verifying successful completion of testing.

C.5.1 Static Leakage Test

1. Upon completion of the fabrication of the inner shell and the installation of the piping, and prior to the installation of the exterior shell the access vault shall have a static leakage test preformed. The inner shell shall be support above the floor, conduit entries capped and the access vault filled with water. There shall be no signs of leakage after 4 hours.

C.5.2 Water Pressure Test

1. Water main piping shall be water pressure tested at 1,380 kPa for four hours. There shall be no leakage or signs of leakage during the testing period.

C.5.3 Air Pressure Test

1. Sanitary sewer piping shall be air pressure/bubble tested at 100 kPa for two hours. There shall be no leakage or signs of leakage during the testing period.
2. Water pressure testing shall be an accepted alternative.

D SERVICE CONNECTION

D-1 GENERAL

These guidelines are intended as a guide only. The Design Engineer is responsible to ensure that the water system is designed and constructed according to accepted engineering practice.

These Guidelines shall not be considered as a substitute for a detailed material and construction specification prepared by the Design Engineer.

These Guidelines only apply where service connections are specified.

D-2 WATER SERVICE

D.2.1 General

1. Separate water service connections shall be provided for each separately titled lot.
2. The minimum size of a residential water service shall be a 25mm supply and a 25mm return placed inside a 100mm insulated carrier pipe. Non-residential service connections shall be sized according to anticipated demand.
3. Carrier Pipe for all water services shall be installed to the property line at the time of initial subdivision development.
4. Water services complete with service saddles and associated connection kit shall be installed at the time of house construction.
5. The minimum allowable distance between services shall be 1000mm.
6. Water services greater than 50mm shall be connected and valved inside an access vault.
7. Services shall be located such that they do not conflict with driveway locations.

D.2.2 Materials

1. Water service pipe shall be Series 160 SDR9. Polyethylene tubing conforming to AWWA C901 and CSA B137.1.
2. Compression connections with stainless steel inserts are required for all materials.
3. All fittings shall be designed for and operating pressure of 1035 kPa.
4. Water service saddles shall be stainless steel type 304, bronze or a combination. Bronze components shall conform to ASTM B62. Single or double band design.
5. Service saddles for use on polyethylene pipe shall be Romac type 101, 202, 305 or 306 series, Robar 2706 or approved equal for use on polyethylene pipe.
6. Operating rods shall be Type 304 stainless steel with brass cotter pins.

D.2.3 Service Installation

1. Residential water services shall be installed in common trench with the sanitary sewer services.
2. Tapping for residential service connections shall be done with full operating pressure in the main. The tap shall be made within 30º of the pipe crown and graded to service trench level.
3. A tapping valve and sleeve must be used for services 100mm and larger.

D-3 SANITARY SERVICE

D.3.1 General

1. Separate sanitary sewer connections shall be provided for each separately titled lot.
2. The minimum size of a residential gravity sanitary sewer service shall be 100mm.
3. Non-residential service connections shall be sized according to anticipated user requirements.
4. The sanitary services including sewer saddles shall be installed to property line at the time of the initial subdivision development.
5. The minimum grade for gravity sanitary sewer service line shall be 2.0% for 100mm diameter lines and 1% for 150mm diameter lines and larger.
6. Services shall be located such that they do not conflict with driveway locations.

D.3.2 Materials

1. Water service pipe shall be Series 160 SDR9. Polyethylene tubing conforming to AWWA C901 and CSA B137.1.
2. Sanitary sewer service saddle to be Robar No. 6626 outlet sleeve saddle – sized to fit main and service lateral.

D.3.3 Service Installation

1. Residential sanitary services shall be installed in common trench with the water services.

E ROADWAYS, WALKING TRAILS, SNOW MOBILE TRAILS

E-1 GENERAL

These guidelines are intended as a guide only. The Design Engineer is responsible to ensure that the transportation system is designed and constructed according to accepted engineering practice.

These Guidelines shall not be considered as a substitute for a detailed material and construction specification prepared by the Design Engineer.

For each new subdivision development, the appropriate roadway classifications and design designation shall be determined during the planning stages in consultation with City officials.

Where conflicts or inconsistencies with the General Municipal Servicing Standards arise due to adoption of other transportation planning documents, the more stringent requirements shall be satisfied.

These Guidelines only apply in areas where roadway construction is specified.

E-2 DESIGN CRITERIA

1. The trip generation rate for single detached housing in the City of Iqaluit shall be 9 one-way trips per household. Trip generation rates for other types of development shall be justified by the Design Engineer and approved by City Engineer.
2. The City of Iqaluit uses the following design designations for subdivision roads. The cross section elements for each of these design designations are shown in drawings at the back of this section.

Local Undivided	Collector undivided
Gravel surfaced	Gravel Surfaced

3. For the purpose of these servicing standards, all roadways within The City of Iqaluit will be considered collector roads or local roads. Although some may perform minor collector functions, local road design designations should apply to most roadways.
4. The roadway design shall be prepared considering the future requirements, economic factors, safety considerations, staging, and other road users not associated with the development.
5. The design speed selected should relate to the expected operating speed on the road after improvement. It should reflect public expectations and include an allowance for safety. The design speed is typically 10 km/hr higher than the anticipated posted speed limit.

E-3 ROAD STRUCTURE

1. Roadway structures shall be based on results of a geotechnical investigation. A report shall be submitted specifying the required structure and all design factors including design traffic loading and the design life. The road structures specified in the Municipal Standards are intended as minimum standards only.

E-4 CUL-DE-SACS

1. The maximum length for any cul-de-sac without a Public Utility Lot (PUL) is 120m from the centreline of the intersecting street to the start of the bulb. Cul-de-sacs in excess of 120m shall require a 6.0m minimum wide PUL allowing emergency vehicle access and water main looping.
2. PUL's provided to allow for emergency access shall be properly graded to ensure positive drainage and gravelled to prevent erosion.
3. Cul-de-sacs should be graded to drain towards the intersection unless a PUL is provided to allow drainage to escape to other drainage courses.
4. The minimum cul-de-sac bulb radius for residential areas is measured to the face of the curb or shoulder. Minimum radius shall be 14 metres.

E-5 INTERSECTIONS

1. Intersections shall be designed at 90º wherever possible. The minimum angle of intersection for two roadways shall be 75º unless otherwise approved by the City Engineer.
2. Intersection design shall incorporate accepted sight distances based on the roadway classification and good engineering practice.
3. Minimum intersection spacing shall be 60m measured from centreline to centreline.

E-6 WALKING TRAILS AND SNOW MOBILE TRAILS

1. Walking and snowmobile trail alignments and locations within any development must allow for adequate public access to Nuna, parks, recreational areas and environmental and municipal reserves.
2. Where trails cross drainage swales, ditches or natural drainage courses, culverts or footbridges shall be designed to accommodate a 1:25 year storm without overtopping.
3. Wherever possible, trails should be centered within the right-of-way. Trails may be offset from the centreline in situations where this will prevent conflicts with utilities sharing the same right-of-way.
4. Trail grading shall ensure positive drainage with a minimum grade of 0.5%. Grading shall be designed in order to incorporate the overall drainage pattern of the development.

5. Where the trail right-of-way is not shared with other utilities, it shall be a minimum of 6m wide.
6. The subgrade must be compacted to a minimum 95% Standard Proctor Density (SPD) for a depth of 150mm.
7. For granular trail, the excavation may require geotextile fabric liner prior to placement of the granular material depending on the type of in-situ material. The granular material shall be spread uniformly and compacted to 95% SPD.
8. Trail surfacing material must be approved by the City prior to installation. Walkway materials shall be selected to minimize the maintenance and replacement costs.

E-7 DRIVEWAYS

1. Driveways shall have a minimum clearance of 1.5 metres from any surface feature such as hydrants, power poles, curb cocks, etc…
2. Driveways shall not be situated on intersection turning radius.
3. For corner lots, the driveways should access the road with the lesser traffic volume, wherever possible. Wherever possible, driveways should not be located within 100m of an intersection with the exception of multi-lot subdivision.
4. For industrial lots, the selection of the driveway location may be delayed until parking lot configurations are determined. A caveat on title will be required to inform future owners of their responsibility to pay for the installation while adhering to design recommendations.
5. Residential driveways shall be between 7.5 and 9.0 metres in width. Industrial driveways shall be between 10.0 and 12.0 metres in width.
6. All driveways shall have the same structure as the adjoining roadway and be constructed up to the property line.

E-8 SIGNAGE

1. Traffic control signs shall be manufactured and installed in accordance with the latest edition of "Uniform Traffic Control Devices for Canada".
2. Street addressing signs shall be located within 10.0m of the intersection in the direction of the nearside approaching traffic. Signs shall be offset at least 1.0m from the edge of the road and mounted 3.0m to 3.5m above the finished road surface. Street addressing signs shall be a minimum size of 15cm x 60cm and a maximum of 15cm x 90cm. The lettering shall be 10cm high. If the address does not fit on the maximum size, two signs may be joined with an end bracket and H-clip. Signs shall have silver lettering with a blue background.
3. All signs shall be placed so as not to obstruct the view of oncoming vehicles.

4. Material for temporary signs, such as subdivision layout signs, shall be approved by the City prior to installation.

E-9 DRAINAGE AND CULVERTS

1. Drainage systems shall meet the flow requirements outlined in Section G for both local and collector cross sections.
2. Ditches for roadways shall have back slopes no steeper than 3H:IV.
3. Swale and ditch grades shall match the road grades wherever possible.
4. Swale and ditch grades shall have a minimum grade of 0.5% wherever possible. Grades less than 0.5% shall be subject to review and approval by the City Engineer.
5. Drainage channels shall be provided with ditch checks and/or other means of erosion control as necessary.
6. Ditches shall have a flat bottom, width as per applicable design standard.
7. Culvert sizing is the responsibility of the Design Engineer. Culverts and ditches shall be designed to accommodate a 1:25 year rainfall event. Ditches shall be allowed to back up during such an event to the height of the subgrade.
8. Culverts shall be new galvanized corrugated steel pipe with a minimum wall thickness of 1.6mm or as required to meet the design loading criteria.
9. Minimum pipe sizes for various uses are as follows;
10. Residential Driveway Culvert 400mm diameter
11. Industrial Driveway Culvert 450mm diameter
12. Roadway Centreline Culverts 450mm diameter
13. All culverts shall have appropriate end treatments depending on application. Inverts shall be extended to the toe of the side slope.
14. The culvert grade shall not be less than the ditch grades at the inlet and outlet.
15. Culverts shall have a sufficient amount of cover to protect against damage from the expected traffic loading. Minimum cover shall be 300mm or one-half the diameter of the culvert, whichever is greater as measured from the finished shoulder grade tot he top of the culvert.

E-10 QUALITY ASSURANCE

Quality control testing related to the roadway construction shall include but not necessarily limited to sieve analysis, densities, mix design, core sampling and concrete testing. Quality control shall be performed by an independent party and certified by a professional engineer licensed to practice in the Territory of Nunavut.

F TRUCKED WATER AND SANITARY SERVICES

F-1 GENERAL

These guidelines are intended as a guide only. The Design Engineer is responsible to ensure that the water system is designed and constructed according to accepted engineering practice.

These Guidelines shall not be considered as a substitute for a detailed material and construction specification prepared by the Design Engineer.

These Guidelines only apply in areas where trucked water and sewer servicing is specified.

F-2 WATER SERVICES

1. All single family residential water storage tanks shall be a minimum of 5,000 litres.

F-3 SANITARY SERVICES

1. All single family residential sanitary storage tanks shall be a minimum of twice the size of the water storage tanks.

F-4 SERVICE INSTALLATION

1. All installations must exceed applicable Nunavut, National Building and Canadian plumbing codes

G AGGREGATE

G-1 GENERAL

The following granular classifications will be used for City of Iqaluit projects.

G-2 GRANULAR CLASSIFICATIONS

ASTM Sieve Designation	Percent Passing			
	Granular A	Granular B	Granular C	Modified Granular C
200mm	-	-	100	-
100mm	-	100	-	-
75mm	-	95-100	-	-
50mm	-	-	-	-
38.1mm	-	-	-	-
25mm	100	45-100	50-100	-
19mm	85-100	-	-	-
12.5mm	65-90	-	-	-
9.5mm	50-73	-	-	100
4.75mm	35-55	25-70	20-100	55-100
1.8mm	15-40	-	10-100	30-100
0.425mm	-	4-50	-	-
0.300mm	5-22	-	2-65	10-50
0.075mm	2-8	0-8	0-8	0-10

1. Gradations to be within the limits specified when tested to ASTM C136-84a and ASTM c117-84 and are to have a smooth curve without any sharp breaks when plotted on a semi-log grading chart.
2. Granular A and Granular B to be crushed stone or crushed gravel and shall be free of clay lumps, cementation, organic material, frozen material and other deleterious materials.
3. Granular C to be crushed stone or gravel or screened stone or gravel and shall be free of clay lumps, cementation, organic material, frozen material and other deleterious materials.

4. Modified Granular C to be crushed stone or gravel or screened stone, gravel or sand and shall be free of clay lumps, cementation, organic material, frozen material and other deleterious materials.

H STORMWATER MANAGEMENT SYSTEM

H-1 GENERAL

These guidelines are intended as a guide only. The Design Engineer is responsible to ensure that the water system is designed and constructed according to accepted engineering practice.

These Guidelines shall not be considered as a substitute for a detailed material and construction specification prepared by the Design Engineer.

The stormwater management system should be designed with major and minor drainage systems. In general, a minor system consists of swales, ditches and culverts that have been designed in order to avoid property damage and flooding due to runoff generated by a 1 in 5 year rainfall event. When the capacity of the minor system is exceeded, the major system must provide a continuous overland flow route allowing the excess runoff to reach the designated ponding areas or water body.

H-2 ORGANIZATIONS ISSUING STANDARDS:

ASTM – American Society for Testing and Materials

CSA – Canadian Standards Association

H-3 MINOR SYSTEM

H.3.1 Flow Rates

1. The stormwater management system shall be designed as a separate system. Effluent from sanitary sewers or any potentially contaminated drainage shall not be discharged in the ditches or swales.
2. The Minor System shall be designed to accommodate the runoff generated from a 1:5 year or more frequent rainfall event without overflowing swales or ditches.
3. The Rational Method shall be used in estimating flows for the design of storm ditches and swales for areas less than 65 hectares.

$$Q = \frac{CIA}{360}$$

where Q = the design peak flow rate in cubic metres per second

I = the intensity of rainfall in millimetres per Hour

A = the contributing area in hectares

C = the runoff coefficient

4. Minimum runoff coefficients shall be according to the following table:

Land Use/Surface Characteristics	Runoff Coefficient, C
Residential Lots	0.2
Undeveloped Land	0.1
Pavement, concrete, buildings	0.9
Gravel Roadways	0.3

5. Due to the large variation in lot sizes for commercial and industrial areas, a weighted runoff coefficient for these types of developments can be calculated using the following formula:

$$C = \frac{(0.9 \text{ X Impervious Area}) + (0.15 \text{ X Pervious Area})}{\text{Total Area}}$$

6. The intensity for the rational formula is selected from the available rainfall data using the time of concentration (T_c). T_c is the sum of inlet time and travel time. The inlet time is the time for the overland flow to reach the ditch. The maximum inlet time for residential areas shall be 10 minutes. Inlet times for commercial or industrial areas shall be calculated on a site-specific basis.

7. For areas larger than 65 hectares, acceptable computer modeling of the area must be submitted for review.

H-4 MAJOR SYSTEM

H.4.1 General

The major conveyance system accommodates flows not intercepted by or beyond the capacity of the minor drainage system through planned surface flow routes and storage facilities. The intent of the major system is to provide surface flow management in order to minimize flooding and property damage from a 1:100 year rainfall event. The design of the major drainage system must not be limited to the immediate development area but must consider overland flows that may enter the area from adjacent land as well as down stream effects on adjacent development and receiving water bodies.

H.4.2 Lot Grading

Proper lot grading is the first step towards a well-planned major drainage system. The goal of the lot grading shall be to ensure that water flows away from the building. Flow from lots shall always have an escape route to a public right-of-way. The lot-grading plan shall develop a proper balance between the road elevation, proposed building elevations, surrounding development and existing topography.

Generally, the lots shall be designed to drain to adjacent laneways or public right of ways without crossing adjacent lots. An overall drainage plan will be required for all subdivisions.

H.4.3 Swales

1. Drainage swales on municipal or private property shall be constructed prior to any development of subdivision lots. Complete swale construction shall be a prerequisite to the issuance of the Substantial Certificate of Completion.
2. Drainage swales located on private property shall be covered by an easement in favour of the City. A minimum clearance of 200mm should be provided between the edge of the swale and the property line. Major rainfall event flows shall be contained within the easement.
3. Drainage swales crossing several properties for the collection of runoff shall not be permitted unless special circumstances warrant.
4. The minimum design slope for swales is 1%.

H.4.4 Roadways

Grading of streets comprising the major drainage system shall follow the guidelines listed below:

1. Continuity of over flow routes between adjacent developments shall be maintained.
2. Collectors shall have at least one lane that is not inundated.

Local roads should not have a depth of water more than 50mm above the crown of the road.

I STREET LIGHTING

I-1 STANDARD AND GUIDELINES

These guidelines are intended as a guide only. The Design Engineer is responsible to ensure that the water system is designed and constructed according to accepted engineering practice.

These Guidelines shall not be considered as a substitute for a detailed material and construction specification prepared by the Design Engineer.

The street lighting design shall be in accordance with the "Guide for the Design of Roadway Lighting" published by the Transportation Association of Canada (TAC) as well as applicable standards published by the Illuminating Engineering Society of North America (IES).

All roadway lighting systems shall be installed in strict compliance with the Canadian Electrical Code.

These Guidelines only apply in areas where street lighting is specified.

I-2 ENGINEERING DRAWINGS AND APPROVAL

1. The Design Engineer is responsible for the preparation and submission of design drawings prepared by a qualified professional engineer showing the layout, pole spacing, types and heights and luminaire wattages. The street lighting plan shall include all surface features and utilities. The layout, products and materials are subject to approval by the City.

I-3 DESIGN AND OPERATIONS

1. The Design Engineer shall be responsible to work with the local wires owner for the design, supply and installation of the street lighting system.
2. The responsibility for energizing the street lighting system shall be the responsibility of the City.

I-4 SAFETY

1. The lighting design shall ensure the proper illumination of conflict areas such as intersections and crosswalks. The design shall be prepared with public safety in mind.

I-5 ENERGY USAGE

1. The Street lighting design should be optimized to allow for the least possible energy consumption while still maintaining acceptable safety standards. The City of Iqaluit encourages the use of the highest efficiency lamps available at the time of installation.

I-6 POLE LOCATION

1. In some cases, the road and lot configuration will dictate the pole layout. Wherever possible, poles should be located at the projection of lot lines. Pole locations shall not conflict with other utilities or approaches. Spacing shall be selected by the Design Engineer and the City Engineer based on the optimum spacing/height/light distribution combination but shall not exceed the minimum standards published by the TAC.
2. Pole setbacks shall be as outlined in the TAC guidelines. Where roadways are designated for widening within five years of pole installation, the pole setback shall allow for said widening.

I-7 TYPE OF POLE

1. Pole types shall be consistent with adjacent developments. All poles within a new development shall be of the same type and height in order to obtain continuity.
2. All poles shall be resistant to all climatic and environmental conditions encountered within The City of Iqaluit.

I-8 AESTHETIC

1. Street lighting design shall be compatible with the type of development and proposed buildings.
2. The use of decorative poles shall be subject to approval by the City. Proposed decorative poles and luminaries should share common optical systems and components as other decorative items found in existing developments within the City.

I-9 FOUNDATIONS

1. Foundations shall be designed based on the specific soil conditions on site. The foundations shall be designed to withstand all loading, wind loading in particular.