

Table of Contents

H1.	WATER SYSTEM DESIGN OVERVIEW	1
H1.1	Water System Proposals	1
H1.2	Cross Connection Control Devices.....	2
H2.	WATER SOURCES AND TREATMENT	2
H2.1	Capacity	2
H2.2	Sources	3
H2.3	Treatment.....	4
H2.4	Water Storage and Handling	5
H3.	DISTRIBUTION – WATER MAINS	7
H3.1	Alignment	7
H3.2	Installation	7
H3.3	System Materials.....	8
H3.4	Fittings.....	9
H3.5	Valves.....	9
H3.6	Fire Hydrants.....	10
H3.7	Service Connections.....	10
H3.8	Pumping	11
H4.	INSTRUMENTATION, CONTROL, AND ALARMS.....	11
H5.	PUMP HOUSE.....	12
H6.	DOCUMENTATION	13

H1. WATER SYSTEM DESIGN OVERVIEW**All utility installation shall conform to CSA S250 Mapping of Underground Utility Infrastructure standard**

The potable water system shall be of sufficient capacity to service the ultimate population projection of the development area. The flows and factors outlined in the following sections shall be used in the design of potable water systems.

The Developer and the developer's consultant shall provide a proposal for sustainable, uninterrupted, safe and clean supply of drinking water for development. Alberta Environment and Parks and Alberta Health Services in accordance with the following; *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, Code of Practice for Waterworks Systems Using High Quality Groundwater, Code of Practice for Waterworks Systems Consisting Solely of a Distribution System, Water Act: Water Regulation and Environmental Public Health Field Manual for Private, Public and Communal Drinking Water Systems in Alberta.*

H1.1 Water System Proposals

System proposals must be in accordance with Alberta Environment regulations and guidelines. Plan-profile drawings, specifications and a letter report shall be prepared by a qualified Professional Engineer and be submitted to the County and Alberta Environment for review and approval prior to construction.

The letter report shall include the design parameters and design calculations for sizing the lines based on:

1. **Cistern System:** 9 L/Min restricted flow at minimum residual pressure of 150 kPa at ground level at a cistern (min 3.400 L capacity) on each lot

or

Pressure System: Minimum residual line pressure under peak hour flow conditions shall be 300 kPa at ground level

2. **Fire Protection:** Shall only be incorporated into a Rural Water System if accepted by the County, and if adequate flows are demonstrated for intended use

The letter report shall also include design parameters for raw water supply and metering, disinfection, residual chlorine monitoring, storage requirements and distribution pumping and metering requirements.

System design should take into consideration the potential for future integration with a Regional Water System. Factors requiring consideration would include:

- a) Possible decommissioning of equipment made redundant by connection to Regional System.
- b) Suitable connection point for Regional supply.
- c) Decommissioning of wells that would cause “blended water” of well and regional supply.

H1.2 Cross Connection Control Devices

Cross connection control devices shall be installed at any location where a connection is made to an approved waterworks system for the purpose of serving a hamlet, municipal development, privately owned development or a truck fill station located outside the service boundary of the approved waterworks system. Cross connection control devices must be testable and of the Double Check Valve Assembly or Reduced Pressure type. See Figure G-19 for examples. Backflow preventers shall be installed in accordance with the latest edition of the Cross Connection Control Manual, published by AWWA (Western Canada Section).

H2. WATER SOURCES AND TREATMENT

H2.1 Capacity

1. In determining residential flows, a minimum of 2.5 persons per household shall be used unless otherwise determined by the County.
2. An average water supply rate of 375 L/person/day shall be used to design the system, unless otherwise determined by the County.
3. The maximum daily flow rate shall be at least 1.8 times the average daily flow. Raw water supply and treatment equipment shall be designed for 110% of the peak daily flow. Harmon’s peaking factor shall be used to determine the peak hourly flow rate for distribution, but must be a minimum of two (2) times the maximum daily flow rate.

H2.2 Sources

1. Groundwater:

a) When establishing a location for a well, the following minimum setback shall be followed:

- 100m from above ground fertilizer and pesticide storage containers
- 100m from livestock yards, animal barns or manure storage
- 100m from any existing leaching cesspool
- 100m from a watertight septic tank
- 100m from a sub-surface weeping tile effluent disposal field or evaporation mound
- 100m from sewage effluent discharge to the ground
- 100m from a sewage lagoon
- 50m from above-ground storage tanks
- 3.25m from existing buildings
- 1.2m from the wall of a ground water well pump house
- 2.0m from overhead power lines if the line conductors are insulated or weatherproofed and the line is operated at 750 volts or less
- 6.0m from overhead power lines if the well does not have a pipe and sucker rod pumping system
- Well casing sections no greater than 7.0m in length
- 12.0m from overhead power lines for all other well constructions
- 500m from a sanitary landfill, modified sanitary landfill, or dry waste sit

b) Additionally, a ground water well shall have the following features:

- Well casing shall be at a minimum 20cm above ground/floor with sloping away from well to prevent ponding around casing.
- A well will need to be installed at a depth as specified from a test hole report completed by an experienced drilling contractor.
- Have a PVC or non-conducting pipe pumping system
- If housed in a building, the building may only contain the well and its pump
- All wells shall be pitless.
- If well casing cap is not water-proof it shall be 60cm above highest recorded flooding.

c) A drilled well is constructed when the aquifer is found to be deeper than 30 meters. The drilled well may be completed with surface casing with slotted or perforated liner, sand screen with continuous slot openings, single string slotted, or perforated casing. The casing size must have an inside diameter of at least 102 mm.

2. Surface Water
 - a) For surface water supply, the raw water intake must be designed to account for seasonal variation in water level.
 - b) Adequate raw water storage must be installed that compensates for reductions in water availability. Minimum storage will be two cells that can be independently operated, each capable of storing 75% of the average annual water demand.

H2.3 Treatment

The Developer shall refer to Alberta Environment’s current Codes of Practice and Design Guidelines for proper establishment of water supply, treatment, and distribution guidelines and procedures. The system shall be designed to produce water that meets or exceeds the American Water Works Association drinking water quality standards and minimum performance requirements as outlined in Alberta Environment’s Water Performance Standards, and Alberta Environment’s documents *Standards for Municipal Waterworks* and *Guidelines for Municipal Waterworks*.

1. Surface Water or Surface Water Influenced Groundwater Source Treatment

The minimum treatment for surface water and surface influenced groundwater sources shall be filtration and disinfection. Acceptable filtration methods are:

- a) Chemically Assisted Rapid Sand Filtration: This is a multi-step treatment process that includes chemical mixing, coagulation and filtration. Filtration is usually preceded by flocculation and solids separation.
- b) Slow Sand Filtration: This process operates at very low filtration rates, and uses finer sand than is used for a rapid filter.
- c) Cartridge Filtration: Cartridge filters use a fibrous medium to remove particles larger than one (1) micron. When used in surface water treatment, it is usually preceded by a sand filtration step.
- d) Membrane Filtration: Membrane filters are non-fibrous materials that can remove particles larger than one (1) micron.

Disinfection may be compiled of entirely or partially of controlled chlorination addition into the system. Other additional methods of disinfection may include approved alternate chemicals such as fluoridation, chloramines, ozone, etc. and/or radiation such as ultra-violet radiation.

2. Groundwater Well Source Treatment
 - a) The minimum level of treatment for ground water not classified as “ground water under the direct influence of surface water” should be continuous and effective chlorine disinfection.
 - Treatment design shall be such that the residual disinfectant concentration in the distribution system, measured as total chlorine, free chlorine, or combined chlorine shall be a minimum of 0.1 mg/L throughout the system and 0.2 mg/L at the water treatment plant.
 - Developments that are less than 15 service connections or 3 km of total water distribution system fall under the jurisdiction of Alberta Health Services and are governed by the *Environmental Public Health Field Manual*. Developments that are 15 or more service connections, greater than 3 km of water distribution system or have a well that falls under ground water under the influence of surface water are under the jurisdiction of an Albert Environment Code of Practice.
 - b) Naturally occurring fluoride up to a concentration of 2.4 mg/L is acceptable by Alberta Environment, raw water with a concentration greater than 2.4 mg/L shall be treated to reduce the level of).8 mg/L, which is the optimum level for the control of dental cavities. Note: the *Guidelines for Canadian Drinking Water Quality* maximum allowable concentration for fluoride is 1.5 mg/L, if levels are over this concentration and under 2.4 mg/L yearly analysis shall be performed.
 - c) Reverse osmosis may be used as an additional treatment process to purify water and remove salts and other impurities in order to improve the color or taste of the treated water.
 - d) If aesthetic objectives such as the reduction of Iron and Manganese are desired, the Guidelines for Canadian Drinking Water Quality (GCDWQ) shall be used.
 - e) At a minimum trihalomethanes shall be monitored four times, once every 3 years (spring, summer, fall, winter) in the waterworks system according to the requirements of Alberta Environment’s Code of Practice for Waterworks Systems Using High Quality Groundwater.

H2.4 Water Storage and Handling

1. Reservoirs shall be designed to prevent damage from freezing.

2. The total water storage requirements for a given water supply system where the treatment plant is only capable of satisfying the maximum daily design flow may be calculated using the formula:

$$S = A + B + (\text{the greater of } C \text{ or } D)$$

Where: S = total storage requirement, m³

A = fire storage, m³

B = equalization storage (approximately 25% of projected maximum daily design flow), m³

C = emergency storage (minimum 15% of projected average daily design flow), m³

D = disinfection contact time (T₁₀) storage to meet the CT requirements, m³

If fire flow is to be provided by the treated water system, fire storage is determined as follows:

- a) Allow for a minimum two hours fire flow at a minimum rate of 4,500 L/minute
 - b) Where developments contain buildings other than single family dwellings, use fire flow guidelines of the Fire Underwriters Survey.
3. Provide at least two (2) reservoir cells to allow flexibility in maintenance and storage retention depending on water demand.
 4. An economical site selection will depend on the type of reservoir, but in general the major factors to consider are soils conditions, compatibility with future expansion requirements, and site access.
 5. When planning the type of reservoir, the designer shall ensure that treated water is not stored or conveyed in a compartment adjacent to untreated water. The type of material to be used for the reservoir is to be reinforced concrete if the reservoir is located above ground and reinforced concrete or fiberglass if the reservoir is located below ground.
 6. Elevated tanks and standpipes shall be insulated and hot water re-circulated, or heat traced, to prevent problems associated with ice formation. Generally, they should be maintained at a temperature of 4° C or greater.

7. Where subsurface locations for storage tanks are proposed, these locations shall be free from sources of possible contamination, having drainage for overland and ground waters, chemical spills, overflows and flooding.
8. Treated water storage reservoirs shall be disinfected and flushed before being put into service, in accordance with the current American Water Works Association Standard.

H3. DISTRIBUTION – WATER MAINS

H3.1 Alignment

In country residential subdivisions the water main alignments shall be as approved by the County. The following alignment features are expected:

1. Looping: Looping of main flow is of particular importance in smaller developments, where potential exists for extended periods of low flow, especially in recreational developments in off-season. Dead-end lines should be avoided. Where dead-end lines are unavoidable, they should end at a hydrant or other means of flushing.
2. Water recirculation: for small systems, in addition to looping within the development, there must be a return flow line back to the water treatment plant, upstream of the chlorination point. The return line should be located so as to prevent short circuiting (see Figure G-1) and be provided with a flushing point at the downstream point.
3. A minimum distance of 3.0m horizontal separation must be maintained between a water main and any sewer main unless otherwise approved by a Professional Engineer, Alberta Environmental Protection and the County.
4. A minimum distance of 2.0m horizontal separation must be maintained between a water main and any gas line.
5. Public Utility Lot (PUL) widths shall be a minimum of 5.0m. A minimum 1.0m easement is required on the lots on each side of a PUL.
6. A utility right-of-way is required to be registered on all lots.

H3.2 Installation

In addition to the requirements set out in Section G3.6, the following standards apply:

1. Mains shall be at a depth adequate to provide a minimum of 2.90m depth of cover from finished grade to top of pipe.

2. Air release valves are required at high points in the line and blow offs at the ends of lines.
3. Marker posts shall be installed perpendicular to all valve and appurtenances locations, adjacent to the property line. Warning signs and painted fence posts shall be installed at the edge of the road right-of-way where water mains cross roadways.
4. Mark locations of water valves and other underground appurtenances with a stake painted blue, 100mm in diameter, 1.8m long, driven 0.6m into the ground.

H3.3 System Materials

In addition to the requirements set out in Section G3.2, the following standards apply:

1. High Density Polyethylene (HDPE) Pipe

- a) High Density Polyethylene pressure (HDPE) pipe suitable for potable water shall be conforming to CSA B137.1 and ASTM F714 Series 160 (DR 11) standard iron sized pipe.
- b) Pipe sizes 50 mm to 300 mm shall meet HDPE Grade PE 3408.
- c) Pipe age not to exceed two (2) years at time of installation.

2. Poly Vinyl Chloride (PVC) Pipe

- a) Poly vinyl chloride (PVC) pipe shall be DR 18, Class 150, and (1035 kPa) cast iron outside diameter, with bell and spigot ends.
- b) The pipe shall be supplied with integral wall thickened bell ends and continuous (joint-less) elastomeric gasket.
- c) Gaskets shall be of a pressure actuated seal design.
- d) PVC pipe shall be certified under CSA 137.3 – “Rigid Poly Vinyl Chloride Pipe for Pressure Applications”.
- e) The interior of the pipe shall be clean and no debris or PVC shavings shall be trapped inside the pipe.
- f) Pipe sizes 100 mm to 300mm shall also conform to the AWWA C900 Standard.

- g) The pipe shall be manufactured from clean, 12454B PVC compound conforming to ASTM resin specification D1784.
- h) PVC pipe shall not be installed in areas contaminated or potentially contaminated with organic compounds (organic solvents or petroleum products), i.e. near buried petroleum fuel tanks, abandoned gas stations, petroleum storage areas or petroleum refinery sites.

H3.4 Fittings

1. High Density Polyethylene (HDPE), DR 11 conforming to ASTM F714 and CANB 137.1, shop molded fitting shall be used.
2. All HDPE molded fittings shall meet the requirements of ASTM D2683 for socket-type fittings, ASTM D3261 for butt-type fittings, or ASTM F1055 electro-fusion-type fittings.
3. Polyvinyl Chloride (PVC) injection-molded fittings Class 150 conforming to AWWA C907 shall be used. Fittings shall be supplied with continuous (joint-less) elastomeric gaskets. All gaskets for PVC fittings shall be of a pressure actuated seal design.
4. PVC tees, elbows, tapped (AWWA thread) couplings and reducers sizes 100 – 200 mm shall conform to CSA B137.2.
5. Cast iron fittings shall comply with AWWA Specification C-110, C-111 and be supplied with Tyton Joints and require a zinc sacrificial anode as per County requirements. The exterior of all fittings shall be coated with asphaltic coating or a fusion bonded epoxy coating conforming to AWWA C213.

H3.5 Valves

1. Valves shall be iron body; bronze mounted gate valves with a non-rising spindle, which open by turning in a counter clockwise direction. All valves shall conform to AWWA C500 for bronze mounted solid wedge gate valves or AWWA C509 for resilient seated gate valves.
2. Interior to be factory coated with epoxy coating conforming to AWWA C550. Exterior to be factory applied epoxy coated. Corrosion reduction to be provided by installation of a zinc sacrificial anode.
3. Valve ends compatible with pipe joint type (Cast Iron Outside Diameter).

H – COMMUNAL WATER SYSTEMS

4. Cast iron valve boxes conforming to ASTM A48, Class 25 of the screw or sliding type shall be required on all valves. Coating inside and outside shall be an asphaltic coating or fusion bonded epoxy conforming to AWWA C213. Set screws to be galvanized. Top of box to be marked "WATER".
5. Extension stem to be 25mm square mild steel with 50 mm operating nut and flange suitable for 3.0m bury. A rock disk nut is required on all valves.
6. All valves in roadways or sidewalks shall be Norwood Foundry Type B screw type valve boxes or an approved equal.
7. Schedule 40 PVC valve boxes for the bottom boot of Norwood Foundry Type 'A' siding type valve boxes or approved equal are permitted in areas not exposed to vehicle loading.

H3.6 Fire Hydrants

1. Where fire protection is being provided by the water system, hydrants shall be installed at a spacing of no more than 180m as measured along the pipeline.
2. The distance from a residence to the nearest hydrant shall not be greater than 100m.
3. The preferred location of hydrants is at an intersection.

H3.7 Service Connections

1. Each lot unit must have a separate service.
2. Water service pipe shall be minimum 25mm, Series 160 Municipal tubing certified potable water. Water service pipe shall conform to Series 160 Type "K" soft copper AWWA C800 c/w brass compression coupling, Kytac or approved equivalent.
3. Main connections shall be made by means of a tee saddle or tapping tee. All fittings and joints must be assembled by electro-fusion or butt-fusion for HDPE piping. Services to be in one piece, no mechanical connections permitted between main connection and meter chambers.
4. Curb stops shall be located such that they do not conflict with driveway locations.

5. Minimum depth of cover shall be 2.90m from finished grade over a vertical gooseneck and to the top of pipe.

H3.8 Pumping

1. A system pressure of at least 300 kPa must be provided throughout the system under peak flow conditions.
2. At least two (2) distribution pumps are required and the distribution system must be able to supply the maximum hourly flow rate at 300 kPa service pressure anywhere on the system, with the largest pump out of operation.
3. At least one (1) pump shall have variable speed drive to reduce pressure transients.
4. Provide back-up pumping in event of power failure, either by stand-by generation or gas or diesel engine-driven pump.

H4. INSTRUMENTATION, CONTROL, AND ALARMS

Small water systems will be expected to have sufficient instrumentation and controls to provide reliable water supply for extended periods unattended. Consult Section 2.3.6 of Alberta Environment *Standards and Guidelines* for further guidance.

As a minimum, the following features must be provided:

1. Remote monitoring for various treatment plant and water supply processes shall be supplied and installed as required by Alberta Environment or the County.
2. Any water treatment facility must include remote monitoring capabilities that allow County operators to operate and monitor the facility. Parameters to be monitored shall be determined by the Alberta Environment or Alberta Health Approval, and may any other parameter as required by Lacombe County.
3. Measurement Instrumentation:
 - a) Raw water supply flow rate
 - b) Treated water supply flow rate to distribution
 - c) Treated water supply pressure
 - d) Chlorine flow rate

- e) Chlorine residual, shown as a daily minimum, maximum and average
 - f) Ground water well level
 - g) Treated water reservoir level
4. Alarms:
- a) Low well level
 - b) Low reservoir level
 - c) High reservoir level
 - d) Low residual chlorine analysis
 - e) Low distribution pressure
 - f) Low building temperature
 - g) Building smoke alarm

Depending on the complexity of the treatment system, other parameters (for example high water turbidity or high filter pressure) may be warranted. Use Alberta Environment Standards and Guidelines for guidance.

5. Data Storage:
- a) Raw water flow
 - b) Treated water flow
 - c) Chlorine residual, shown as a daily minimum, maximum and average

H5. PUMP HOUSE

The pump house design shall be submitted at the same time as the construction drawings and no work shall take place until approved by Lacombe County.

The pump house shall incorporate the materials and design that will fit into the subdivision aesthetics and generally shall have exterior materials with long life and low maintenance in mind.

The pumphouse shall have an intrusion alarm.

Brick exterior siding is preferred.

The parking area around the pump house shall be paved to the same standard as the adjacent road.

The tank site will be fenced with chain link, include a locking gate, leveled and landscaped to prevent weeds.

H6. DOCUMENTATION

The developer or developer's consultant shall provide:

1. Water well drilling report
2. Complete water analysis by an accredited lab
3. Plan of record drawings of all water and wastewater
4. Standard Operating Procedures and Emergency Response Plan
5. Manufacturer specifications for maintenance