

Clearwater County

RURAL WATER SUPPLY FOR FIRE PROTECTION IN MULTI-LOT SUBDIVISIONS

EFFECTIVE DATE: July 2008

Amended December 02, 2013

SECTION: Assessment and Development

POLICY STATEMENT:

The purpose of this policy is to aid developers of multi-lot subdivisions in meeting rural fire protection needs through the proper construction and location of “dry hydrant” fire suppression facilities in rural areas and rural subdivisions not serviced by a pressurized municipal fire protection system. This policy adopts NFPA 1142 *Standard on Water Supplies for Suburban and Rural Fire Fighting* (2001 Edition) as a basis, with some specifics and variations specific to Clearwater County. The standards contained within this document are considered *minimums* only, and higher standards should be sought when practical. The County maintains its discretion to require higher standards where specifically required. This policy does not negate the obligation to follow the latest edition of the Alberta Building Code.

This policy is developed in accordance with the enabling legislation of the *Municipal Government Act*, Part 1, Section 3, which states “*The purposes of a municipality are to... (c) develop and maintain safe and viable communities.*” Part 2, Division 1, Section 7 states that “*A council may pass bylaws for municipal purposes respecting the following matters: (a) the safety, health and welfare of people and the protection of people and property.*”

The *Forest and Prairie Protection Act* states in Clause 7(1) that “*The council of a municipal district is responsible for fighting and controlling all fires within the boundaries of the municipal district*” and further under Clause 27 that “*An urban municipality in or bordering on a forest protection area shall take all necessary precautions that the Minister orders to prevent and suppress fires on land within its boundaries or under its control*”.

This is a summary policy document and is not meant to be comprehensive. More specific details should be referenced directly in the NFPA 1142 document. References to specific NFPA clauses are provided in brackets for reference, for example (9.3.2). The standards in this document and NFPA 1142 are not required if:

- a) NFPA 13, 13D, or 13R are fully met to provide an adequate sprinkler system protecting a building (7.4).
- b) A pressurized municipal system is present which NFPA 1142 considers as a piped communal system capable of 250 USgpm flow for a minimum of 2 hours at 20 psi pressure from fire hydrants at an adequate spacing.

Although a pressurized system is preferred, the County recognizes that such a system is not always practical due to high costs, low development densities, or specific land use policies. The County has therefore developed this policy to identify the level of fire protection that is to be maintained if a pressurized water system is not provided.

In general, this document is aimed at low-density “acreage” type country residential developments that are becoming more prevalent throughout the County. However, this policy and NFPA 1142 can also provide guidance for fire protection within commercial, institutional, and industrial developments, though more detailed and site-specific standards may have to be adopted. This document, and NFPA 1142, have limitations due to their general nature. In very specialized or extremely hazardous situations, standards may be applied that exceed the standards set out in this document.

2.0 Intent and Professional Involvement

NFPA 1142 identifies “*minimum requirements for water supplies for structural fire fighting purposes in rural and suburban areas where adequate and reliable water supply systems for fire-fighting purposes, as determined by the authority having jurisdiction, do not otherwise exist.*” These minimum requirements can be increased at the discretion of the local authority.

This policy document is provided for general reference only, for use by the development community, facility designers, and in the review and approval process by the County Development Officer (abbreviated “DO”) and the County Fire Department (abbreviated “FD”).

As part of the requirements of Subdivision Conditions, Development Permit, and/or Development Agreement, a fire protection system may be required at the County’s discretion. All calculations and design drawings for such a system must be prepared and stamped by a Professional Engineer registered to practice in the Province of Alberta (the “Engineer”).

3.0 Definitions and Formula – Summary of NFPA 1142

Following are select definitions and calculations from NFPA 1142 to be made by the Engineer:

Minimum Water Supply (MWS) – The quantity of water required for fire control is calculated as follows. The factors are summarized below but should be derived directly from NFPA 1142:

$$MWS (USgal) = \frac{\text{Total Volume of Structure (cubic feet)}}{OHN} \times CCN \times EH$$

Or Metric:

$$MWS (Litres) = \frac{\text{Total Volume of Structure (cubic metres)}}{\text{Adjusted OHN}} \times CCN \times EH$$

The MWS should be a minimum of 2,000 USgal (7,570 litres) if there is no exposure hazard (EH=1.0) and a minimum of 3,000 USgal (11,355 litres) if exposure hazard is present (EH=1.5).

Construction Classification Number (CCN) – A series of numbers from 0.5 to 1.5 based on building construction classifications outlined in NFPA 220 *Standard on Types of Building Construction*. Refer to NFPA 1142 and NFPA 220 for details. The CCN closely follows the *Type* of construction classification as summarized below. Generally Type I (CCN=0.5) construction provides the highest fire resistance, while Type V (CCN=1.5) provides the lowest.

Type	CCN	Comments (General Only; Refer to NFPA 220 and 1142 for detail)
I	0.5	Exterior and Interior structural members made of approved non-combustible or limited-combustible materials (See Table 6.2.2 of NFPA 1142).
II	0.75	Similar to but not qualifying as Type I as per Table 6.2.2 of NFPA 1142.
III	1.0	Exterior walls and exterior wall structural members made of approved non-combustible or limited-combustible materials, and interior structural members are entirely or partially of wood of smaller dimensions than required for Type IV construction as per Table 6.2.2 of NFPA 1142.
IV	0.75	Exterior and interior walls and structural members are of approved non-combustible or limited-combustible materials. Other interior structural members are of specified solid or laminated wood without concealed spaces.
V	1.5	Exterior and interior walls and structural members are entirely or partially of wood or other approved combustible material smaller than material required for Type IV construction. For a <i>single dwelling</i> the CCN is no larger than 1.0

Occupancy Hazard Number (OHN) – A series of numbers from 3 to 7 that are mathematical factors used in a formula to determine total water supply requirements.

OHN	Fire Hazard	Examples (General Only; Refer to NFPA 1142 for more uses)
3	Severe	Combustible storage or manufacturing: cereal or flour mills, straw or hay in bales, explosives, flammable liquids spraying, sawmills, etc.
4	High	Commercial barns & stables, building materials supply storage, department stores, exhibition halls and theatres, repair garages, some warehouses, etc.
5	Moderate	Amusement occupancies, clothing manufacturers, cold storage warehouse, farm storage building, machine shops, restaurant, unoccupied buildings, etc.
6	Low	Armory, bakery, barber or beauty shop, cement plant, gas service station, horse stable, municipal building, post office, phone exchange, etc.
7	Light	Dwellings, apartments, colleges, fire stations, hospitals, hotels, motels, museum, offices, police station, schools, prison, theatre without stage, etc.

For metric (SI) calculations, use the following conversions

OHN	Adjusted OHN
3	0.0224
4	0.0299
5	0.0373
6	0.0448
7	0.0523

Exposure Hazard (EH) – A structure is considered to be an *Exposure Hazard*, and have an EH factor of 1.5, if:

- a) it is 9.29 m² (100 sq. ft.) or larger in area and is within 15.24 m (50 feet) of another structure, or
- b) it has an OHN of 3 or 4 (Severe or High Occupancy Hazard) and is within 15.24 m (50 feet) of another structure.

All other structures are considered to be *No Exposure Hazard*, and an EH factor of 1.0 is applied.

Dry Hydrant – An arrangement of pipe permanently connected to a water source other than a piped, pressurized water supply system that provides a ready means of water supply for fire-fighting purposes and that utilizes the drafting (suction) capability of fire department pumps.

4.0 Water Supply Requirements – Summary of NFPA 1142

The following shall be addressed in the design of any fire protection system:

- 4.1 Water source shall be of suitable quality and be maintained and accessible on a year-round basis (8.1).
- 4.2 If the water is from a private source, a water use agreement acceptable to the County shall be required to ensure access to the water source (8.3). An example agreement is provided in Annex A of NFPA 1142.
- 4.3 Adequate water source indicators (signs and/or painted indicators) acceptable to the County shall be provided, and shall take into account potential for snow depth accumulation and snow ploughing operations.
- 4.4 Fire department connections shall be 4.82 inch (122 mm) and shall meet County requirements (6.5) and NFPA 1963 *Standard for Fire Hose Connections*.
- 4.5 Means of access to any required water supply or dry hydrant shall be constructed and maintained to meet NFPA 299 *Standard for Protection of Life and Property from Wildfire*; NFPA 1141 *Standard for Fire Protection in Planned Building Groups*; and local County regulations.
- 4.6 Locations for and the immediate area around dry hydrants shall provide for fire fighter safety (9.4.1).
- 4.7 Dry hydrants shall be located to be accessible under all weather conditions (9.4.2).
- 4.8 System and site accessibility criteria shall ensure the dry hydrant can be reached with one or two 10 foot (5.03 m) lengths of hard suction (9.4.3).
- 4.9 Dry hydrants shall have a minimum clearance of 20.0 feet (6.1 m) on each side and to be located a minimum of 100 feet (30 m) from any structure. Vehicle traffic shall not be impaired during the use of the dry hydrant (9.4.4).
- 4.10 Dry hydrants shall be protected from damage by vehicular and other perils, including freezing and damage from ice and other objects (9.4.5).
- 4.11 Dry hydrant locations shall be made visible from the main roadway during emergencies by reflective marking and signage approved by the authority having jurisdiction. All identification signs shall be approved by the County and/or Alberta Infrastructure and Transportation prior to installation if they are to be located on the right-of-way or are subject to local or provincial laws (9.4.6).
- 4.12 Vehicle access shall be designed and constructed to support the heaviest vehicle the County currently utilizes (9.4.7).
- 4.13 The hydrant shall be painted as needed in colours determined by the County, with reflective material to maintain visibility during emergencies (9.7.2).
- 4.14 Static lift should not exceed 3.1 m to 3.7 m (10 to 12 feet). At design flow, head losses should be less than 6.1 m (20 feet) (A.9.3.3).

5.0 Facility Planning Considerations

In addition to the requirements of NFPA 1142, the County has developed the following criteria:

- 5.1 The County recognizes that there are several methods for water supply storage. The preferred facility types are constructed in-ground storage tanks (cisterns) and open storage ponds.
- 5.2 The County will consider applications involving locations within a natural stream, lake, or other water body, as long as adequate measures are taken to address issues of seasonal fluctuations in water level, access restrictions, and environmental concerns. The County may accept the following installations in unusual circumstances where no other reasonable options are possible, provided satisfactory measures are taken to address concerns with freezing, construction, maintenance, and supply logistics: shallow installations, shallow or seasonal ponds, above-ground storage tanks, bridge installations, and/or facilities that include a roadway obstruction between the water source and the dry hydrant.
- 5.3 Dry hydrants, including their required lands and water storage facilities, shall be zoned as Public Utility Lots.
- 5.4 There shall be no overhead utilities on the Public Utility Lot.
- 5.5 There shall be no underground utilities permitted on the Public Utility Lot where there may be interference with the operation of the dry hydrant and/or its water supply, or where the dry hydrant and/or the water supply operation could impede the utility.
- 5.6 As outlined in NFPA 1142 (A.9.1), the need and locations for a dry hydrant depends on a number of factors, including but not limited to:
 - Current and future population and building trends,
 - Property values being protected,
 - Potential for loss,
 - Proximity to structures (dry hydrant to be min. 30 m from structure it is protecting),
 - Fire history of the area protected,
 - Current water supply systems,
 - Potential water supply sources and reliability,
 - Cost of project,
 - Other factors of local concern (location of responding fire department, etc.).
- 5.7 The spacing and location of dry hydrants will remain within the discretion of Clearwater County, Clearwater Fire Department and the Development Officer, with input from engineering professionals and other agencies (i.e. Alberta Sustainable Resource Development). For any particular subdivision, many factors must be considered, such as nearest responding fire department, proximity to existing lakes and ponds, proximity to forested areas, the nature of and value of proposed structures, setbacks, and other factors.
- 5.8 In general, the following considerations may be made by the County:
 - 5.8.1 Provided an elevated fire hazard risk does not exist, and on approval by the County, dry hydrant requirements may be reduced where the County considers a proposed development is within a reasonable distance and response time from an existing hamlet or community with a pressurized municipal water system that has adequate capacity to provide fire water flow.
 - 5.8.2 Specific dry hydrant requirements may be reduced or waived for an individual lot or development provided it falls within a larger identified area serviced by a specifically designated rural fire protection system developed by the County, or acceptable to the County. For example, within North Nordegg a rural fire protection

system has been developed by the County following the New Boston Fire Department criteria (NFPA 1142 Annex B Section B.3). This consists of strategically located cisterns constructed to service approximately 120 to 150 acreage lots. Generally such cistern systems become economically feasible when at least 25 to 50 lots are being proposed.

- 5.8.3 Shared dry hydrant systems may be considered by the County on a site-specific basis to reduce costs among proposed developments, or to improve fire protection in existing areas adjacent to proposed developments.

6.0 General Design Considerations

In addition to the requirements of NFPA 1142, specifically Chapter 9, the County has developed the following criteria:

- 6.1 The Minimum Water Supply volume shall be:
- 6.1.1 As per NFPA 1142, which specifies a minimum of 7,570 L (2,000 USgal) (Article 7.2.1) if there is no exposure hazard (EH=1.0) and a minimum of 11,355 L (3,000 USgal)(Article 7.3.2) if exposure hazard is present (EH=1.5). The County reserves the right, at its discretion, to require a larger minimum volume to provide a higher level of fire protection for multi-lot subdivisions.
- 6.1.2 As identified in the individual *“In-Ground Open Storage Pond”* and *“Cistern”* sections of this document.
- 6.2 The design of the dry hydrant, including miscellaneous materials and liners, shall be for a minimum life span of 25 years.
- 6.3 The materials of construction shall be suitable to meet fire flow needs and shall be appropriate for the installation conditions. Buried pipe should be rated for suction conditions. Should rubber gasket PVC pipe be proposed, it shall meet AWWA C900 or C905 with a minimum Class 150 (DR18) rating and wall thickness. Should HDPE pipe be proposed, it shall be rated for a minimum 150 psi (DR11). Should steel pipe be considered, it shall be a minimum of Schedule 40, with corrosion protection and sacrificial anodes considered. Minimum size of suction and buried piping is 250 mm (10 inch) diameter. Above ground metal pipe shall be primed and painted.
- 6.4 The dry hydrant shall be designed and constructed to provide a minimum flow of 4,545 L/min (1,200 USgpm / 1,000 Igpm) at draft.
- 6.5 Fire department connection to consist of a male steamer port 4.82 inches outside diameter with National Hydrant Thread at 6 threads per inch. The protective cap on the connection shall be lockable as per fire department and acceptable to the County.
- 6.5 All pipe shall be adequately bedded and all trenches and excavations fully compacted to 98% SPD minimum. Pipe cover should consider the potential for frost penetration of at least 2.7 m.
- 6.6 The dry hydrant riser shall be primed and painted above ground in Chromium Yellow. Riser shall be protected from vehicular damage by a minimum of four bollards placed in square configuration at a distance of 1.2 to 2.0 m from the riser. Bollards shall be constructed of concrete-filled 100 mm diameter steel pipe, and primed and painted Chromium Yellow.
- 6.7 Signage shall be provided at the dry hydrant location as follows:
- Minimum size, 300 mm x 600 mm.
 - Signage to read as follows, in 65 mm red letters against a bright yellow background:

FIRE DEPT. USE ONLY

- Mount with standard Telespar post system.
- 6.8 System strainers and associated components shall be stainless steel. Manufactured PVC strainers may be considered on a site-specific basis.
- 6.9 A gravelled approach shall be constructed with adequate gravel base (minimum 150 mm depth of 25 mm crush gravel on 300 mm compacted native material), culvert (minimum 400 mm diameter), and of sufficient length and width to allow the responding fire truck to pull fully out of traffic with a minimum 1.5m clearance on all sides to allow for safety during filling operations.
- 6.10 Access to a dry hydrant location shall be designed as right-in / right-out, however, access to or from the opposite traffic direction shall not be inhibited by any type of barrier.
- 6.11 The County reserves the right to request, at its discretion, materials and geotechnical information relating to the design of roads, approaches, backfill, bedding, foundations, material tests (i.e. concrete, liner materials, etc.) as required. All such information shall be provided by and stamped by a Professional Engineering firm registered in Alberta.
- 6.12 The area within a distance of 3.0 m around the hydrant assembly shall be surfaced with gravel or similarly inert material to minimize growth of grass, brush, or other vegetation.
- 6.13 A reliable water source for filling and topping up the dry hydrant must be identified and approved by the County prior to approval. The dry hydrant assembly, as well as the method of topping, up shall be approved by the County and any other provincial and/or federal approving agencies as required. Filling can be achieved by a dedicated well, stream access, or in the case of buried tank storage only, *trucked-in*. For open ponds, topping up by *trucking-in* is not acceptable due to the larger volumes typically stored within ponds, and the potential for larger losses due to seepage and evaporation when compared to buried tanks. Open ponds filled by stormwater flows may be acceptable, provided adequate sedimentation traps are provided upstream of the fill location, emergency overflow provisions are made, and reliable flows exist. Stormwater routes that flow adjacent to the facility, allowing off-stream filling, are preferred rather than routes that directly flow through the facility, which can have higher maintenance and potential for damage due to flood events.

7.0 In-Ground Open Storage Ponds - Design Considerations

In addition to the requirements of NFPA 1142, specifically Chapter 9, the County has developed the following criteria:

- 7.1 The Minimum Water Supply volume shall consider the practicality of constructing an open storage pond. Based upon the criteria outlined below, assuming a square pond with a 3 m x 3 m bottom, the minimum active Water Supply Volume (below the ice allowance and above the suction line intake) that can be provided by a constructed open pond is 182 m³ (48,100 USgal / 40,100 Igal).
- 7.2 The following design criteria should be considered:
- Minimum 3H:1V sideslopes inside and outside.
 - Minimum horizontal bottom dimension of 3.0 m.
 - Minimum depths as per table below.

- Minimum driving bank of 4.0 m width around pond.
- Fencing typically 2.0 m beyond driving bank.

	Volume
Minimum freeboard above ice	152 m ³ (40,200 USgal / 35,232 lgal)
Minimum ice depth allowance	372 m ³ (98,200 USgal / 81,751 lgal)
Minimum active storage depth	182 m³ (48,100 USgal / 40,100 lgal)
Dead Storage	52.4 m ³ (13,850 USgal / 11,528 lgal)
Minimum Total Pond Depth	758 m ³ (200,350 USgal / 168,610 lgal)

Note: 1 m³ = 1,000 L

- 7.3 The above design criteria accommodate the minimum desired frost cover of 2.7 m above pipes. Vertical risers that may contain water within the frost zone and are thereby subject to freezing may require special treatment (i.e. heat trace, insulation, etc.) to prevent a frost plug from forming. See Annex A of NFPA 1142 A.9.4.5 for examples. Satisfactory operation of the riser must be demonstrated over a period of two winters before final acceptance by the County, including necessary field proof tests witnessed by the County.
- 7.4 The minimum site area required is 30 m x 30 m, or approximately 0.23 acres (0.09 ha) based upon a square pond and the above criteria not including any allowance for an approach. Given this, plus the additional area required for an approach and other pond geometries, the minimum total site area required for an open pond dry hydrant would be in the order of 0.5 acres (0.2 ha). Larger areas may be required depending on site conditions.
- 7.5 Ponds shall only be considered in areas where water sources for topping up by means other than trucking in are readily available (i.e. wells, stormwater routes, stream access).
- 7.6 The ponds must hold and maintain water on a continuous basis.
- 7.6.1 Where groundwater conditions merit it, the pond may be unlined to allow for replenishment by natural infiltration. If unlined, deepening of all or a portion of the pond should be considered to allow for anticipated fluctuations in water level.
- 7.6.2 In all other situations, lining is required. Lining can be *in situ* native clay materials or synthetic liners. Both must be properly designed by a qualified geotechnical Engineer. Synthetic liners can include plastic (HDPE or PVC) and clay (bentonite) materials, or variations thereof. Generally plastic liners should be a minimum of 40 to 60 mil thickness (1.0 to 1.5 mm), with the HDPE on the thicker end of the range. Joints should be fused or similarly sealed. HDPE liners are generally more resistant to ultraviolet radiation from

sunlight than PVC and can remain exposed on the surface. PVC and bentonite liners typically require a compacted clay or gravel armour cover. Gravel armour is also necessary to hold down a liner in areas subject to high water table. The minimum acceptable thickness for a compacted clay liner is 0.6 m. The minimum requirement for cover by a gravel armour is a 0.3 m thick layer containing at least 25% by weight material with a size range of 100 mm to 200 mm.

- 7.7 Should an exposed PVC or HDPE plastic liner be used, the side slopes can be slippery to maintenance personnel and animals, especially if wet. For safety, consideration should be given to roughening the liner surface to provide adequate traction, covering the exposed liner with clay or gravel to allow footing, and/or decreasing the sideslopes. These measures should be applied to all sides of the liner. If the liner is left exposed, the pond must be fenced.
- 7.8 At ponds equipped with an exposed plastic liner, a 2.0 m high chain link fence complete with a top 3-wire barbed security attachment shall be provided around the exterior of the open storage pond and driving bank. The fence shall be located 2.0 m outside of the outside shoulder of the driving bank to allow adequate vehicular access around the entire perimeter of the pond. A sliding gate shall be provided so as to not block the entrance or gravel driving surface when open. Preference should be given to locating the fire department connection outside of the gate.
- 7.9 At the County's discretion, consideration shall be given to allowing two trucks to fill simultaneously from the open pond dry hydrant.
- 7.10 A compacted gravel driving bank of similar construction to the approach in Section 6.0 shall be provided.
- 7.11 Warning signage at open ponds shall meet the following requirements:
- A minimum of four signs, one on each corner of the pond, installed diagonally.
 - Minimum size, 600 mm x 900 mm.
 - Signage to read as follows, against a bright yellow background
CAUTION (75 mm Red Letters)
THIN ICE (65 mm Black Letters)
DROWNING HAZARD (65 mm Black Letters)
 - Mount with standard Telespar post system.
- 7.12 The pond shall be provided with a means to monitor water level, such as by staff gauge. The developer shall supply tables indicating storage volumes at various water levels.

8.0 Cisterns - Design Considerations

In addition to the requirements of NFPA 1142, specifically Chapter 9, the County has developed the following criteria:

- 8.1 Cisterns and buried underground tanks are acceptable storage facilities for dry hydrants. They are often preferred in rural subdivisions where open surface water sources are not readily available, where available land and/or top-up capabilities for open ponds are severely limited, where development densities and property values are high, or where a number of other factors and considerations make them more feasible.
- 8.2 Cisterns and tanks should be sized based upon the Minimum Water Supply calculations outlined in Sections 3.0 and 6.1. Sizing shall be such that the Minimum Water Supply volume is provided as *active* storage, meaning the volume of water available to be pumped out of the tank or cistern, not including water below the suction pipe intake (i.e. *dead* storage) that cannot be pumped out.
- 8.3 Tanks shall be provided with an adequate dry hydrant head assembly, vent assembly, and fill assembly. Examples are provided in Annex A of NFPA 1142.

8.4 For larger more intensive developments, large concrete cisterns equivalent to those developed by the New Boston Fire Department (New Boston, New Hampshire, USA) may be required at the discretion of the County. These cisterns have been utilized in Clearwater County within the North Nordegg Subdivision and are illustrated in NFPA 1142 Section B.3. Some specifics of the New Boston cisterns are as follows:

- Cisterns located no more than 671 m (2200 feet) truck travel distance from the nearest lot line of the furthest lot,
- Minimum capacity of 113,560 L (30,000 USgal / 25,000 Igal),
- Concrete construction (fibreglass is an alternative),
- Suction system capable of 3,785 L/min (1,000 USgpm / 833 Igpm) for 75% of the cistern capacity,
- Design includes suction connection, Siamese fill pipe, vent, and manhole access complete with ladder,
- Access approach complete with protective bollards.

9.0 Fees and Development Levies

The County reserves the right to develop and charge levies and fees for the provision of rural fire protection facilities. Where warranted, the County may develop *Endeavour to Assist* policies. Such levies, fees and policies may be considered to more equitably distribute costs, especially those of shared facilities that benefit multiple subdivisions or a broader area within the County.