FIRE UNDERWRITERS SURVEY
A SERVICE TO INSURERS AND MUNICIPALITIES

C/o CGI Information Systems and Management Consultants

May 8, 2006

District of Lake Country
10591 Okanagan Centre Road East
Lake Country, BC V4V 1K3

Attention: Mr. Steve Windsor, Fire Chief – Lake Country Fire Department

Re: Fire Underwriters Survey – District of Lake Country

A survey of the District of Lake Country fire defences was conducted in 2004 - 2005. The results of this survey are now complete and offered for your information. Fire Underwriters Survey (FUS) conducted the assessment primarily for fire insurance grading and classification purposes. The following report provides a brief description of the grading process and outlines significant findings of the assessment. In addition and at the request of the District of Lake Country, this report also includes comments and general recommendations that are aimed at improving the level of fire protection within the District of Lake Country - in areas of fire department operations that were identified by the fire insurance grading process.

The comments made within this report are general statements giving indication where fire protection improvements can be considered. This report was not commissioned to provide detailed recommendations. Nor was the assessment an operational audit.

3999 Henning Drive, Suite 101, Burnaby, B.C. V5C 6P9
Tel: (604) 609-4137 • Fax: (604) 688-6986 • Toll Free: 1-800- 665-5661

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Table of Contents

1.0 Fire Insurance Grading Results

The District of Lake Country was incorporated on May 2, 1995. The official boundaries include Winfield, Okanagan Centre, Carr's Landing and Oyama. Both the Winfield and Oyama fire protection districts were dissolved December 31, 1995 to become a single municipal fire protection service.

The individual communities were previously graded by the Fire Underwriters Survey and their results were as follows:

Community	Year	PFPC		DPG		
		Hydrant areas	No Hydrant areas	Hydrant areas	No Hydrant areas	Outside Boundary
Winfield (including Okanagan Centre)	1974	7	9	3A	3B	5
Carr's Landing (including Juniper Cove)	1987	NA	9	NA	3b → 4 (downgraded in 2004)	NA
Oyama	1982	8	8	3A	4	NA

We are pleased to advise that our inspection and analysis has determined that fire department operations and services in the District of Lake Country have improved significantly from the former assessments. As a result, the community's fire insurance grading classifications will be revised as follows:

A. Public Fire Protection Classification (P.F.P.C.)

Class 6 in recognized hydrant protected areas (HPA)

Class 9 in non-hydrant or non recognized hydrant protected areas

Class 10 in areas outside District of Lake Country boundaries

Our congratulations are extended to the District of Lake Country, Fire Department and community members for continuing to work towards and support improving the level of fire protection and prevention throughout the community.

The P.F.P.C. is a numerical grading system scaled from 1 to 10. One is the highest grading possible and Class 10 indicates that little or no fire protection is in place. The PFPC grading system evaluates the ability of a community's fire protection programs to prevent and control major fires that may occur in multi-family residential, commercial, industrial, institutional buildings and course of construction developments.

Class HPA –	refers to the protection provided in recognized hydrant-protected areas within the boundaries of the fire protection district.
Class – 9	refers to the protection provided beyond a recognized hydrant-protected area within the boundaries of a fire protection district.
Class – 10	refers to portions outside the fire protection district boundaries.

As a result of this assessment, the following water supply systems are recognized by FUS for fire insurance grading purposes:

1. Winfield/Okanagan Centre Water System
2. Oyama Water System

The following water supply systems are not recognized by FUS for fire insurance grading purposes:

1. Wood Lake Water System
2. Ponderosa Water System
3. Coral Beach Water System
4. Alto Utility
5. Lakepine Utility
6. Eastside Utility

In areas of the District of Lake Country where "non-recognized" water supply systems are located, a fire insurance grading of PFPC Class 9 applies.

Fire Underwriters Survey also assigns a second grading classification to communities. The second grading system entitled Dwelling Protection Grades (D.P.G.) assesses the protection available for small buildings such as single-family dwellings. The District of Lake Country's DPG ratings are as follows:

B. Dwelling Protection Grade (D.P.G.)

DPG	**3A**	(formerly DPG –3A)
DPG	**3B**	(formerly DPG-3B)
DPG	**5**	(formerly DPG -5)

The DPG is a numerical grading system scaled from 1 to 5. One (1) is the highest grading possible and DPG 5 indicates little or no municipal fire protection is available. This grading system reflects the ability of a community to respond to fires in small buildings.

Grade – 3A	Refers to the protection afforded to single-family residential buildings and like structures within 300 metres of a "recognized" fire hydrant (part of a recognized water system), within 8 km. of a primary responding fire station within the boundaries of the fire protection area.
Grade – 3B	Refers to the protection afforded to single family dwellings and like structures beyond 300 metres of a recognized approved fire hydrant within 8 km. of a primary responding fire station within the boundaries of the fire protection area.
Grade – 5	Applies to areas within the District of Lake Country that are beyond 8 km from the closest responding fire station and to building structures not accessible by gazetted road. The rating also applies to all areas outside the District of Lake Country.

2.0 The Public Fire Protection Classification System

The PFPC grading system is a measure of a community's overall programs of fire protection. Alternatively, the DPG grading system only evaluates a fire department's ability to respond adequately to fires in small buildings.

The ability of a community's fire defences are measured against recognized standards of fire protection relative to fire hazard and fire / life safety risk present within the community. The following broad areas of fire protection are reviewed in the survey and have the following weights within the FUS grading system:

- Water supplies and distribution system 30%
- Fire department operations 40%
- Fire service communications 10%
- Fire safety control within the community 20%

The PFPC and DPG classifications are conveyed to subscribing companies of Fire Underwriters Survey. FUS subscribers represent approximately 90% of the fire insurance underwriters in Canada. Typically, subscribers use this information as a basis in their fire insurance underwriting programs to sets limits in the amount of risk they are willing to assume within a given community or portion of a community, and to set fire insurance rates for commercial properties. Improved fire protection grades may result in increased competition for insurance underwriting companies to place their business within a community. Our analysis indicates that an improved fire protection grade has a positive effect on fire insurance rates.

In addition to fire insurance grading categorization, FUS classifications are a measure of the fire protection within a community. Many progressive communities use the classification system to assess the performance and adequacy of their fire protection programs.

The majority of small to mid size communities that have volunteer or paid on call structured fire departments fall into FUS Classes 5 to 8 within the PFPC grading system. This is normally due to the limited financial resources available to smaller communities to support higher levels of protection such as having paid full time fire fighters.

Class 5 represents a lesser level of protection for a municipality with a full-time fire department, but is very respectable for a volunteer or composite fire department, and is considered to be achievable for the District of Lake Country Fire Department.

A summary of the Protection Grades assigned to Canadian communities is presented in Table 1.

Table 1 - Protection Grades – Canadian Cities

*Source: Fire Underwriters Survey 01-1

Class/ Population	1	2	3	4	5	6 - 8	9 - 10
Over 100,000	1	12	15	4	-	-	-
50,000 - 100,000	-	5	18	24	5	2	-
25,000 - 50,000	-	-	13	28	21	13	-
Under 25,000	-	2	7	75	304	1493	1138
Total	1	19	53	131	330	1508	1138

The strength of fire defence within a community depends largely on the willingness and financial ability of the community to support this emergency service. FUS statistics indicate that the larger the population, typically, the better the ability of fire protection when measured against the risk of major fires within the community. The best scenario on the level of fire protection occurs when community expectations of fire suppression and prevention match the community's willingness to pay for this expectation.

Table 2 – Protection Grade for BC Communities with Populations Bet. 8000 - 20000

Municipality	Population	PFPC Class	Municipality	Population	PFPC Class
View Royal	8045	6	Williams Lake	11833	6
Sechelt	8488	6	Comox	12394	5
Sooke	9730	6	Terrace	12565	5
Whistler	9754	5	Powell River	13680	6
Nelson	9784	5	Colwood	14825	7
Coldstream	9896	6	Prince Rupert	15020	5
Quesnel	10417	6	Squamish	15390	5
Kitimat	10449	4	Pitt Meadows	16001	6
Lake Country	**11000**	**6**	Central Saanich	16451	6
North Saanich	11103	7	Salmon Arm	16466	5
Parksville	11245	7	Esquimalt	17038	7
Dawson Creek	11290	5	Fort St. John	17280	6
Sidney	11495	6	Oak Bay	18357	4
Summerland	11776	6	Cranbrook	19608	5
			White Rock	19735	5

The grading assignments of other BC communities with similar populations to the District of Lake Country are contained in Table 2. As the Table indicates, based on population, the District of Lake Country is now rated standard in class with other communities with similar populations that have good progressive fire protection programs. The Table was expanded to communities with 20,000 residents due to the fact that District of Lake Country's population is reported to swell to 20,000 or more during tourist season periods. Alternatively, the Survey found that there are areas within the District of Lake Country Protective Service programs where improvement is needed and is recommended. PFPC classifications should not only be viewed in terms of improved fire insurance rates but also as a measure of fire protection that is present within a community.

Improvements that would have a cumulative positive effect in fire insurance grading classifications and fire protection ability are discussed within this report. The intent of identifying areas where improvements can be made is to provide the District of Lake Country Fire Department direction in their community fire protection planning – if so desired and supported by the community.

3.0 Overview of the Assessment Process

There isn't any one universal model of fire defence that can be applied to all situations or to a community requiring this emergency service. Ideally, the strength of a fire protection program is balanced between the risk of serious fire and with a community's fire experience. Fire defences should be tailored to meet both of these needs. To gauge the needs of the fire service based on experience alone would be to ignore perils that have not yet occurred. Ignoring experience and focusing on risk alone may tend to build-up a fire department force beyond its financial acceptability of the taxpayer paying for this service.

FUS measures the ability of a fire department against the risk of fire likely to occur within a community. This measurement is usually not determined by the most significant risk, nor is it based on the average fire risk. Our measurement tends to focus on those structures where there is a considerable risk to fire and life safety, and where total or temporary loss of a particular structure would have a significant impact to a community's tax base and economy. A fire department should be structured and supported to effectively deal with everyday emergencies while at the same time capable to control and extinguish most fires that may occur.

To achieve this objective, the structure of a fire department must be tailored to the needs of a community, and will vary for each community. Each component, comprising a community's ability of fire defence, must be evaluated and developed to achieve the desired and correct level of benefit. For this reason no two fire departments will be the same. Some of the factors that must be balanced and tailored against the fire risk, degree of criticality, community expectation, fire experience, and the ability to financially support this emergency service, are as follows:

- Type, number and condition of fire apparatus
- Pumping capacity
- Response to alarm protocols
- Response times to critical risks
- Adequacy of the fire fighter and emergency responder training program including specialized training
- Emergency communication systems
- Ancillary equipment
- Fire department roster type and response levels
- Fire safety education
- Building controls
- Fire prevention inspections
- Adequacy & reliability of emergency water supplies
- Automatic fire protection systems
- Management of emergency services

FUS examines the entire program of community fire defence in order to assess and grade the overall program. For instance, strengths in community fire safety can offset some deficiencies in emergency water supplies, and vice versa. Alternatively, there are some areas within a FUS grading that carry substantial weight, such as:

- The type of manning (i.e. career fire fighters vs. volunteers),
- The quality of training programs,
- The type of apparatus and ancillary equipment for the hazards present,
- The condition, age and maintenance of fire apparatus and fire suppression equipment,
- The distribution of companies relative to fire risk,
- The availability, adequacy and reliability of emergency water supplies
- Response to alarms procedures, and
- Fire safety inspections.

The Survey has found that District of Lake Country has good programs of protection in the areas of:

- Organization, administration, management and planning of the fire department
- Risk and hazard planning programs
- Pre-fire planning program
- Recruit and drill training program
- Officer strength
- Fire fighting equipment
- Fire prevention and public education programs

Alternatively, the Survey found that improvement would be beneficial in the following protection programs:

- Reliability of response to alarms
- Suitability and functionality of fire stations
- Emergency water supply coverage across the District

In this report the District of Lake Country refers to the District of Lake Country communities and properties within the boundaries of the specified Fire Protection Area.

4.0 Summary of Major Recommendations Listed Within Report

A summary of the most significant District of Lake Country recommendations that have been made within this report are presented below:

Recommendation 5.0a:

To improve the reliability and consistency of the water systems throughout the District of Lake Country, the privately owned/operated systems should be purchased and operated by the local government. Additionally, the existing water systems should be connected where possible. Standards for design, installation and maintenance should be developed and applied to all water systems within the District of Lake Country.

Note: see additional comments in section 5.0.

Recommendation 5.1a:

Provide additional storage to qualify water systems for fire insurance grading recognition minimums.
Applicable to the following water systems: Wood Lake; Coral Beach and Ponderosa

Recommendation 5.1c:

Water systems should be provided with back up power for all key components (including pumps, telemetry, etc.) This will reduce the risk of fire losses resulting from insignificant water supplies at the fire scene. Additionally, back up equipment (for key components such as pumps) should be kept available to minimize down-time during maintenance/breakdowns.
Applicable to the following water systems: Winfield/Okanagan Centre; Oyama; Wood Lake; Coral Beach and Ponderosa

Recommendation 5.1d:

Hydrant distribution should be improved such that all single family residences (and duplexes) are located within 300 metres (1000 feet) (hose lay) of fire hydrants. This standard is accepted and utilized by insurers across Canada to reduce the amount of time that it takes fire fighting crews to start the initial attack on a working fire. The standard of 1000 feet for residences and duplexes ensures that firefighters will be able to set up and start their attack without excessive hose lay times and travel distances between apparatus and fire.
Applicable to the following water systems: Winfield/Okanagan Centre; Oyama; Wood Lake; Coral Beach and Ponderosa

Recommendation 5.1e:

Hydrant distribution should be improved such that all buildings/structures other than single family residences (and duplexes) are located within 150 metres (500 feet) (hose lay) of fire hydrants. This standard is accepted and utilized by insurers across Canada to reduce the amount of time that it takes fire fighting crews to start the initial attack on a working fire. The standard of 1000 feet for residences and duplexes; and 500 feet for other buildings, ensures that firefighters will be able to set up and start their attack without excessive hose lay times and travel distances between apparatus and fire.
Applicable to the following water systems: Wood Lake; Coral Beach and Ponderosa

Recommendation 5.1g:

Fire flows were noted to be sub par and/or inconsistent in some of the industrial and commercial zones in Winfield/Okanagan Centre and Oyama. To reduce the risk of property losses and to reduce the risk to the life safety of firefighters responding to fires in the commercial and industrial areas of Oyama and Winfield/Okanagan Centre the water supplies to these areas should be improved. Steps should be taken to improve the flow capabilities of the system. Additionally, steps should be taken to periodically review the flow capacities through areas of increased value and risk (multi-family, commercial and industrial zones) by flow testing to ensure that adequate water supplies are consistently available for the type of risks in these areas.
Applicable to the following water systems: Winfield/Okanagan Centre and Oyama

Recommendation 10.2.A:

To address the issue of providing a minimum standard response to the type of fires that are expected to occur in this community, the community should purchase an aerial apparatus

Purchasing an aerial device would allow the Fire Department to keep the device in a central location in the community which would decrease response time to incidents. There would be an increased cost involved in purchasing the apparatus, however there would also be a cost benefit. **We recommend acquiring a 65 foot aerial ladder which will provide several benefits and improve the Fire Underwriters Survey grading of the community.** Purchase of this type of vehicle would allow the Fire Department to provide an appropriate level of response to fires in tall buildings. It is expected that in a community of this size, new developments are likely to include tall buildings. As such, the local Fire Department should be provided with equipment that is appropriate for fires in such buildings. An additional benefit of this type of apparatus is that it would be an investment in the long term needs of the community. As the community grows, the need for this type of apparatus will increase.

Recommendation 10.5.C:

Replace/upgrade engine E91 due to age.

Recommendation 10.5.D:

The water tender T81 should be replaced as there is no recognition for apparatus exceeding 30 years of age for emergency service.

Recommendation 10.7.C:

The service level provided by the Lake Country Fire Department should be examined through a master planning approach. Develop a long term Master Plan for Fire Protective Services.

Recommendation 10.14.A:

The Winfield fire station should be replaced from a functional fire service delivery perspective. The replacement fire station should remain at the same location as the original station. Design of the building and site should be in accordance with NFPA 1201 – Developing Fire Protection Services for the Public.

5.0 Evaluation of Water Supplies for Fire Fighting

Water supplies for fire fighting are a critical component of the community's fire defence systems. Water supplies for fire fighting were evaluated for adequacy in several areas including but not limited to:

- Storage adequacy – quantity of stored water reasonable for expected demands and duration of appropriate flows during expected fire events
- Distribution system adequacy – layout and arrangement of piping and pump capabilities, looping/grid design of pipe networks for maximum versatility and minimum losses
- Hydrant layout – appropriate spacing to minimize hose lays and other delays in setting up an initial attack during structure fires
- Maintenance of system and components – system and component maintenance meets recognized standards and improved reliability of system

As a result of this assessment, the following water supply systems are recognized by FUS for fire insurance grading purposes:

1. Winfield/Okanagan Centre Water System
2. Oyama Water System

The following water supply systems will remain not recognized by FUS for fire insurance grading purposes:

3. Wood Lake Water System
4. Ponderosa Water System
5. Coral Beach Water System
6. Alto Utility
7. Lakepine Utility
8. Eastside Utility

A number of water system hydrant flow tests were performed during the survey. The results of the tests are contained in Appendix A. Overall the test results were fairly consistent with only a few areas of concern. Flow test results are compared to fire flow need in the vicinity of the test.

Fire flow need is based on various factors including but not limited to building construction, fire loading, operations and density of construction.

The water supplies throughout the District of Lake Country are inconsistent. This is likely a result of the water supplies being developed and managed separately. It appears that different design standards were used for each water system.

Recommendation 5.0a:

To improve the reliability and consistency of the water systems throughout the District of Lake Country, the privately owned/operated systems should be purchased and operated by the local government. Additionally, the existing water systems should be connected where possible. Standards for design, installation and maintenance should be developed and applied to all water systems within the District of Lake Country.

Noted: Director of Engineering Michael Mercer has stated that District Council has requested 5 year capital plans for each of the private water utilities. The District has a Bylaw for Servicing that governs design and installation requirements of water systems. Additionally, he has stated that the private utilities will be required (within their 5 year plans) to provide water supplies at a minimum flow rate of 60 LPS (790 IGPM), adequate for typical detached single family dwellings.

5.1 Water System Evaluation Results

Storage facilities should have sufficient capacity, as determined from engineering studies, to meet domestic demands (equalization), emergency demands, and where fire protection is provided, fire flow demands. Emergency supply is required in case of events such as power outages, main breaks, equipment failure, drought, and various other factors which may result in interruption of supply.

Table 3 summarizes the available water resources for each of the following communities:

1. Winfield/Okanagan Centre Water System
2. Oyama Water System
3. Wood Lake Water System
4. Ponderosa Water System
5. Coral Beach Water System

The following private utilities were not assessed and therefore are not recognized for fire insurance grading purposes:

6. Alto Utility
7. Lakepine Utility

8. Eastside Utility

The first step in determining the adequacy of water systems for fire protection adequacy was determining the Basic Fire Flow (BFF) of each community/water system. The Basic Fire Flow was determined by evaluating the Required Fire Flows across the community (for each building and/or zone). A risk profile was created for each community and a Basic Fire Flow was calculated and assigned. The Basic Fire Flow is an indicator of the required flows for fire fighting within the scope of typical fire events that would be expected within the community based on the community risk profile.

The determination method of Required Fire Flows (RFF), Basic Fire Flows (BFF), fire event duration and minimum hydrant distribution is detailed in the Fire Underwriters Survey document "Water Supplies for Public Fire Protection" (Appendix C).

The absolute minimum water storage for fire fighting for any water system to be recognized is 24,000 Imperial Gallons.

The maximum capacity of the reservoirs and the refill rate of the reservoirs (for the typical fire event duration) is de-rated with a safety factor for the calculation of the total available water resources for fire fighting.

Table 4 summarizes the minimum required fire storage volume (BFF for the typical fire event duration) for each water system (column referred to as "Req'd Fire Storage"). Table 4 also shows the recommended emergency storage (.25 of sum of "Req'd Fire Storage" and Domestic Storage).

Water supply systems designed to provide fire protection should meet the following to be considered a **"Good Supply"** with regard to adequacy of storage.

Eq-i. The required total effective storage should be based on the following formula:

Total Storage Required = A + B + C

Where:

A = fire protection storage capacity as calculated (based on Basic and Required Fire Flows determined utilizing the accepted Standard "Water Supply for Public Fire Protection" and Fire Underwriters Survey methodologies

B = equalization storage capacity equal to 25% of projected maximum day demand (MDD)

C = emergency storage capacity (25% of (A + B))

Water supply systems designed to provide fire protection should meet the following to be considered an **"Adequate Supply"** with regard to adequacy of storage.

Eq-ii. The required minimum storage of the water system to be considered adequate for fire insurance grading is based on the following formula:

Minimum Storage Required = A + D

Where:

A = fire protection storage capacity as calculated (based on Basic and Required Fire Flows determined utilizing the accepted Standard "Water Supply for Public Fire Protection" and Fire Underwriters Survey methodologies

D = Calculated volume equal to MDD flow rate for the typical fire event duration

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Alternatively, to meet the minimum requirements for fire insurance grading, water systems **without storage** may be able to qualify as an **"Adequate Supply"**, if they are consistently available. Ie. For water supplies to be considered to be consistently available, documentation must be provided of water levels of source(s) for minimum 25 years (50 years preferred).

Eq-iii. The required minimum firm flow availability of the water system (to be considered adequate for fire insurance grading) is based on the following formula:

Minimum flow availability = BFF + PHD

Where:
BFF = Basic Fire Flow
PHD = Peak Hourly Demand = (MDD/24) x 2

The formulas noted above may be modified if the level of risk within the community is unusual, or if the situation warrants. In some cases alternatives to the above noted formulas are developed and considered based on specific situations.

Ideally, the water supply should be capable of providing fire flows to all built-up areas of the protected community. The water supply system should be designed and constructed such that water supplies are uninterrupted even during system maintenance, main breaks, reservoir cleaning, catastrophic events (seismic, wind storm, power failures, etc.). This can be achieved through the use of redundant design with multiple sources and storage locations, looped distribution system, back up power, and other safety factors included within the scope of good engineering practices.

For each of the water systems, Figure 1 shows a comparison of the minimum water required (for fire fighting) to the recommended storage capacity (to qualify as a "Good Water Supply"). The figure also shows the amount of water that is actually available for fire fighting (including reservoir refill during fire event) and the quantity of water storage in the system.

As noted in Table 4 and Figure 1, Oyama and Winfield/Okanagan Centre have storage capacities that are considered to be adequate (for the minimum storage capacity). Neither of these systems qualifies as being a good water supply. These systems have enough storage to provide water for fire fighting during a typical situation where there are no unusual circumstances adversely affecting the water system. The quantity of stored water is adequate to fight a fire while simultaneously flowing max day demand (MDD) for a typical fire event duration.

The remaining three systems Wood Lake, Coral Beach and Ponderosa do not qualify to be recognized as water systems that are reliable or effective for use as a water supply for fire fighting.

Flow test summary: see Appendix A

The flow tests in the Oyama and Winfield/Okanagan Centre water systems indicated that although most areas have adequate flow capacity, pressure and supply for fighting fires in single family residences and small buildings, the water distribution system capacity is not consistently adequate in several of the commercial/industrial areas.

Table 3 - Water Supplies

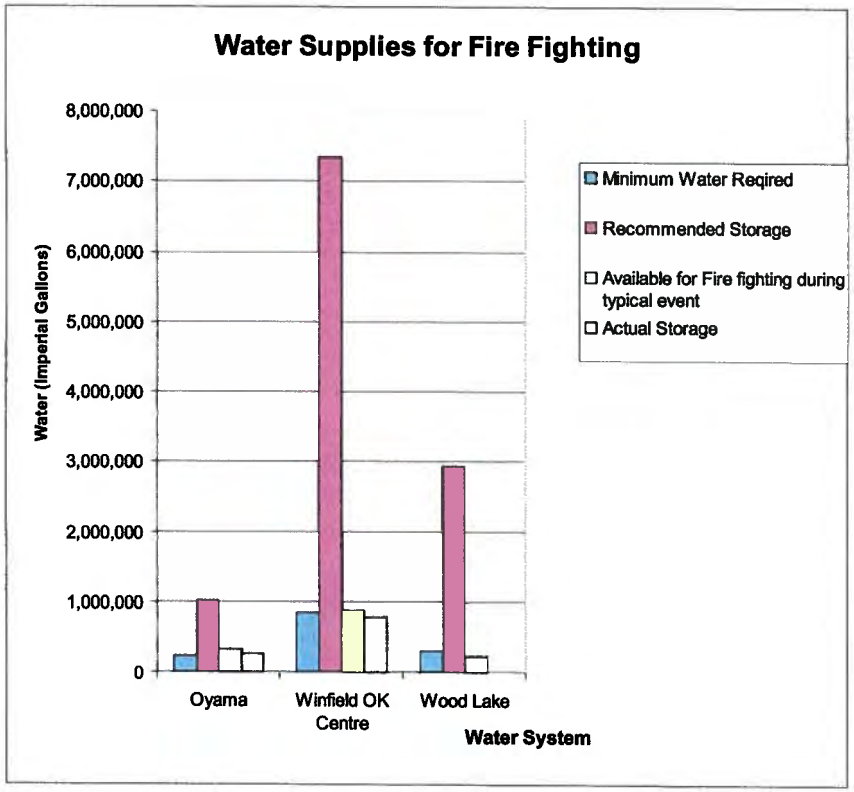
	Serving (pop)	BFF	Fire Duration	ADD	MDD	PHD	Total Storage	Total Refill Rate	Refill during Event Duration	Total Water Resources
		IGPM	*hrs*	*MGD*	*MGD*	*IGPM*	*l. gal*	*IGPM*	*l. gal*	*l. gal*
Oyama	775	2200	1	0.755	2.148	2983	265,000	2043	122,580	334,580
Winfield OK Centre	5050	3000	1.25	3.945	11.8	16389	765,000	3,563	267,188	879,188
Wood Lake*	770	1500	1	1.842	4.865	6757	0	3700**	222,000	222,000
Coral Beach	170	800	1	0.074	0.222	308	20,000	105	6,300	22,300
Ponderosa	87	800	1	0.021	0.063	88	16,652	75	4,500	17,822

Table 4 - Fire Flows

	Req'd Fire Storage	Emerg storage	Domestic Storage	Minimum Water Req'd	Recommended storage	Supply Adequate?	Supply Good?	B/U Power	Number of Hydrants
	l. gal	*l. gal*	*l. gal*	*l. gal*	*l. gal*				
Oyama	132,000	167,250	537,000	221,500	1,015,250	Yes	NO [5.1b]	No [5.1c]	41 [5.1d]
Winfield OK Centre	225,000	793,750	2,950,000	839,583	7,354,167	Yes	NO [5.1b]	No [5.1c]	163 [5.1d]
Wood Lake*	90,000	326,563	1216250	292,708	2,927,917	NO [5.1a]	NO [5.1b]	No [5.1c]	46 [5.1e]
Coral Beach	48,000	25,875	55500	57,250	177,500	NO [5.1a]	NO [5.1b]	No [5.1c]	2 [5.1d]
Ponderosa	48,000	15,938	15750	50,625	84,750	NO [5.1a]	NO [5.1b]	No [5.1c]	0 [5.1e]

* Wood Lake does not have storage capacity. Minimum Flow Capacity = BFF + PHD = 8257 GPM

** Hazen Williams used to calculated max flow for 500 mm pipe (est. Int. diam = 457mm); max pipe velocity = 1.5 m/s (5 fps) -> 3700 GPM - see Hazen Williams nomograph in Appendix B


Water Supplies for Fire Fighting
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Water (Imperial Gallons)
Minimum Water Reqired
Recommended Storage
Available for Fire fighting during typical event
Actual Storage
Oyama
Winfield OK Centre
Wood Lake
Water System

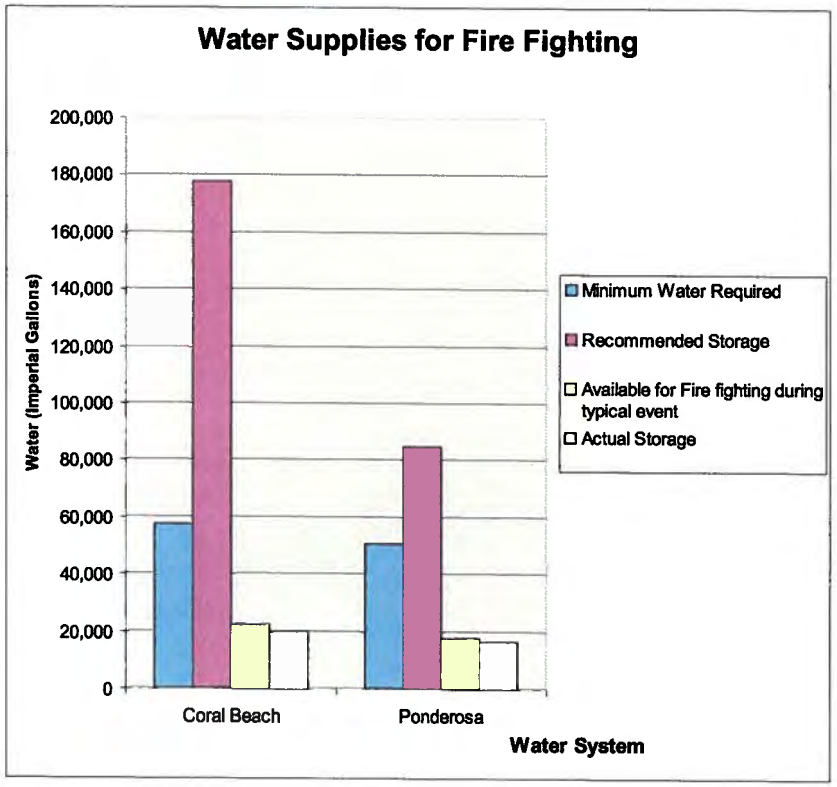

Water Supplies for Fire Fighting
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Water (Imperial Gallons)
Minimum Water Required
Recommended Storage
Available for Fire fighting during typical event
Actual Storage
Coral Beach
Ponderosa
Water System

Figure 1

Recommendation 5.1a:

Provide additional storage to qualify water systems for fire insurance grading recognition minimums.
Applicable to the following water systems: Wood Lake; Coral Beach and Ponderosa

Note:
Wood Lake water system: Wood Lake system does not have water storage. Provide reservoir to qualify for recognition for fire insurance grading purposes (or add additional supply mains). Alternatively, provide additional sources to meet flow requirements.
Minimum Flow Capacity = BFF + PHD = 8257 GPM
Note: use 5 fps as maximum pipe velocity

The Director of Engineering, Michael Mercer has stated that he believes that the Wood Lake water system may be able to qualify for fire insurance grading purposes.

For the Wood Lake water system to qualify, the following must occur:

- the system be physically reviewed by Fire Underwriters Survey
- hydrants throughout the system be flow tested by Fire Underwriters Survey
- the reliability of the supply must be verified with statistical documentation
- the system be must proven to be capable of flowing the BFF + the PHD simultaneously where the BFF = 1500 IGPM (115 LPS) and
  the PHD = 6700 IGPM (500 LPS)

Alternatively, the minimum required flow capacity of the system may be reviewed and lowered based on site specific conditions.

Recommendation 5.1b:

The quantity of stored water should be improved for each of the water systems. Providing only the minimum amount of water to qualify for fire insurance grading is adequate for typical fire events with no adverse circumstances. Many factors can contribute to fire losses. One significant factor is inadequate water supplies at the fire scene.

Providing water storage in accordance with the recommended practice of the Fire Underwriters Survey would significantly reduce the risk of failure to control fires resulting from inadequate water supplies.
Applicable to the following water systems: Winfield/Okanagan Centre; Oyama; Wood Lake; Coral Beach and Ponderosa

Recommendation 5.1c:

Water systems should be provided with back up power for all key components (including pumps, telemetry, etc.) This will reduce the risk of fire losses resulting from insignificant water supplies at the fire scene. Additionally, back up equipment (for key components such as pumps) should be kept available to minimize down-time during maintenance/breakdowns.
Applicable to the following water systems: Winfield/Okanagan Centre; Oyama; Wood Lake; Coral Beach and Ponderosa

Recommendation 5.1d:

Hydrant distribution should be improved such that all single family residences (and duplexes) are located within 300 metres (1000 feet) (hose lay) of fire hydrants. This standard is accepted and utilized by insurers across Canada to reduce the amount of time that it takes fire fighting crews to start the initial attack on a working fire. The standard of 1000 feet for residences and duplexes ensures that firefighters will be able to set up and start their attack without excessive hose lay times and travel distances between apparatus and fire.
Applicable to the following water systems: Winfield/Okanagan Centre; Oyama; Wood Lake; Coral Beach and Ponderosa

Recommendation 5.1e:

Hydrant distribution should be improved such that all buildings/structures other then single family residences (and duplexes) are located within 150 metres (500 feet) (hose lay) of fire hydrants. This standard is accepted and utilized by insurers across Canada to reduce the amount of time that it takes fire fighting crews to start the initial attack on a working fire. The standard of 1000 feet for residences and duplexes ensures that firefighters will be able to set up and start their attack without excessive hose lay times and travel distances between apparatus and fire.
Applicable to the following water systems: Wood Lake; Coral Beach and Ponderosa

Recommendation 5.1f:

Scheduled maintenance of hydrants throughout the water systems should be improved to once per year (and after each use). Hydrant inspections should take place every 6 months. Detailed records should be kept for each hydrant.
Note: hydrant maintenance sheets were received, but no actual records.
Applicable to the following water systems: Winfield/Okanagan Centre; Oyama; Wood Lake; Coral Beach and Ponderosa

Note: the Director of Engineering stated that the District maintains hydrant records and they are available for review.

Recommendation 5.1g:

Fire flows were noted to be sub par and/or inconsistent in some of the industrial and commercial zones in Winfield/Okanagan Centre and Oyama. To reduce the risk of property losses and to reduce the risk to the life safety of firefighters responding to fires in the commercial and industrial areas of Oyama and Winfield/Okanagan Centre the water supplies to these areas should be improved. Steps should be taken to improve the flow capabilities of the system. Additionally, steps should be taken to periodically review the flow capacities through areas of increased value and risk (multi-family, commercial and industrial zones) by flow testing to ensure that adequate water supplies are consistently available for the type of risks in these areas.
Applicable to the following water systems: Winfield/Okanagan Centre and Oyama

6.0 Evaluation of Fire Department Operations

Fire Department operations have seen many improvements since previous FUS studies of the communities including improvements in almost all areas that were reviewed. Noted improvements have occurred in fire apparatus, fire equipment, management, administration and planning programs and fire prevention activities. The relative classification of fire department operations has improved one protection class from a Class 7 to Class 6.

7.0 Evaluation of Fire Safety Control

The District of Lake Country fire safety control programs have improved to a relative protection Class 6. The improvement is a result of:

- Implementation of a Fire Prevention Officer
- The quality and frequency of fire inspections
- Pre-incident planning

Fire prevention plays a significant role in the FUS grading system and is seen as a proactive means to reduce the number of fires and the reduction of damage or injury from fire. This program's continued support is encouraged.

Recommendation 7.0a:
Continued improvement in the frequency of inspections for all occupancies is recommended.

Recommendation 7.0b:
In addition to the development of a formal public education program that includes visits to Schools, Daycares and Care Facilities.

Recommendation 7.0c:
We also recommend developing a smoke detector program for the community as such programs save lives and reduce property losses.

Recommendation 7.0d:

Development of formal Building Plan Review program that requires fire department plan checker to review plans for new construction (Industrial, Commercial, Institutional, etc.) automatically. Permits should not be issued without the Fire Department's approval.

8.0 Evaluation of Emergency Communications

The District Of Lake Country Fire Department's emergency communication program rated fairly high within the FUS fire insurance grading system. The relative classification has improved to a PFPC Class 6. The resultant improvement is due to a number of factors associated with the regional emergency call dispatch system and 911 systems.

The Kelowna Dispatch Centre, handles 9-1-1 calls for the District Of Lake Country Fire Departments as well as other departments within the Central Okanagan Regional District. The Dispatch Centre processed 13,734 incidents in 2003 resulting in approximately 158,500 radio and telephone transactions.

Emergency communications are considered consistent with the protection program needs within the community and few areas for improvement are being suggested within the report.

9.0 Conclusions

Since the last FUS assessment, the District of Lake Country Fire Department has improved in many areas in their fire protection programs. The most significant improvement is the overall organization of the department since the community's incorporation in 1995. The sharing of resources and combination of services has resulted in improved protection of risks throughout the communities.

Several areas of fire defence still require improvement in the District of Lake Country for the community to be considered at a consistent level with other communities of similar size, population and density. These improvement areas include the implementation of Bylaws for sprinkler systems, the provision of additional apparatus to meet the needs of the growing community and the construction of a new Fire Hall. Additional areas of recommended improvements include water supplies for fire fighting and fire prevention.

The improvements that have been made in the various aspects of the protection programs have warranted an improved fire insurance grading classification. However, this report recommends that the District of Lake Country continue to improve the fire / emergency protection levels on throughout the community.

10.0 Additional Lake Country Fire Department Comments

The following fire service comments are not provided in order of importance or outline all areas where improvements could be made. They are provided here to give the District of Lake Country guidance from a fire insurance grading perspective where improvements to protection programs can be considered, if so desired and supported by the community. The improvements suggested here would continue to improve the fire insurance grading of the community.

10.1 Engines and Apparatus in Service

The FUS grading standard evaluates the number of fire trucks that are in service relative to the community's fire risk and fire hazard. The greater the risk and hazard rating the more resources are needed to control or suppress a given fire, and consequently the greater the number of fire apparatus that are required. In assessing the number of Pumper trucks that can be credited available for service a number of factors are considered including:

- Apparatus type,
- Apparatus condition
- Apparatus age
- Apparatus maintenance programs
- Community emergency response profile requirements
- The number and location of emergency response points

Mutual aid assistance is credited for the actual value it represents; the inherent delay of its arrival; and the ability of the fire departments to safely and efficiently work together. Partial mutual aid credit for Pumpers was considered due to their inherent delay of arrival from adjacent communities.

Apparatus Definitions

Aerial Truck - Also known as a ladder truck, aerial ladder, or just plain truck. A hydraulically powered ladder or articulating platform, mounted on a vehicle that also carries several different length extension ladders, extrication gear, ventilation equipment, and lighting.

Engine - This is an apparatus designed for fire attack. It is the most common vehicle in fire departments. This apparatus carries hose and usually about 500+ gallons of water. It also has a fire pump. Modern fire pumps can pump over 1500 GPM (Gallons Per Minute). These vehicles can also have the ability to supply foam and usually carries 3-6 personnel. In Canada, fire departments refer to these apparatus as **"Pumpers"** or **"Triple-combination Pumpers"**. Some departments, may refer to their engines as "Pump 2" etc. at times. They can be just about any color. You can see apparatus colored: Red, Blue, Black, Lime Yellow, Yellow, or White, just to name the more common colors.

Master-stream - A master stream is a large and fixed stream of water. Master streams are used on the end of aerial ladders on ladder trucks and on top of pumper trucks. Master streams can deliver larger amounts of water than hand-held hose.

Monitor - A type of master stream similar to a deck gun, but removable from the apparatus. Hose can be laid into it, making it mobile.

Quad - Apparatus that has four capabilities; sometimes referred to as quadruple combination, a quad combines the water tank, pump, and hose of a triple-combination pumper with the ground ladder complement of a truck company. While not as common as a "Quint" some departments do use such vehicles.

Quint - A piece of firefighting apparatus that can perform five of the major functions of fire apparatus. These include: Carry hose. Carry water. Pump water. Carry ground ladder complement. Aerial ladder/Water tower operations.

Squirt - A smaller, articulating boom, usually mounted on an engine. The main purpose is to have an elevated fire stream. This does not make an "engine" a "quint" or "quad". This gives the engine's deck gun more reach and versatility.

Water Tower - This is the name given to operations where the aerial on the truck is used to provide an elevated fire fighting nozzle. Just about any apparatus mounted aerial device can be used for this. Most ladders or articulating booms now have a water pipe built into the system. But even one that does not can quickly be adapted. In these cases a hose of 2 ½ to 3 inches is laid on the ladder and secured to the top fly. A nozzle is clamped to the top rung and you are in business. The nozzle angle or pattern can be fixed or it might be changeable from the ground by cables.

Credit was given to each of Lake Country Fire Department's class A Engines. Partial credits were given to the Lake Country Fire Department's other trucks with permanently mounted pumps primarily due to their lack of ULC certification. Due to the size of response coverage area along with fire fighting need in each fire response zone, the FUS grading schedule calls for five Pumpers to be in service to provide initial response to alarms of fire.

Table 5 – Profile of Existing Fire Apparatus (2004)

Count	Hall	Year	Unit Identification	Vehicle Type	Pump & Tank GPM – Gallons	Manufacturers	Age	ULC	Foam	Credit
1	71	1991	E71	Pumper	1050 x 1000	Pierce/Superior	14	3462C	Class A	Full
2	71	2004	P71	Pumper	1040 x 700	Rosenbauer	1	12001	Class A	Full
3	71	1997	T71	Tanker	350 x 1500	Profire/International	8	-	-	Partial
4	71	1995	B71	LAV - (Bush Truck)	250 x 200	Dodge 4x4	10	-	Class A	Partial
5	81	1997	E81	Pumper	1050x 800	Superior/Internationa l	7	147 *	-	Full
6	81	1971	T81	Tanker	500 x 1500	Ford	34	-	-	None **
7	81	1993	M81	LAV	500 x 400	GMC	12	-	-	Partial
8	91	1986	E91	Pumper	840 x 1200	Superior / Ford 8000	19	4500C	Class A	Full
9	91	1995	P91	Pumper	625 x 1500	Fort Gary / Ford	9	18C	-	Full
10	91	2000	M91	LAV	120 X 200	HUB Snuffer	5	-	Class A	Partial
11	91	1985 (est.)	Z91	Water-based	75 gpm	Zodiak w/Fire Pump Twin 40 hp outboard	21 (est)	-	-	None

* Please verify if this is the ULC #

** No credit for apparatus exceeding 30 years in age for emergency service

Pumpers

The required number of Pumpers and their spatial arrangement is considered to be good in the District of Lake Country. In the majority of areas of increased risk such as small shopping malls (mercantile/commercial), multi-family residential, and light industrial, the expected initial response is 2 pumper companies providing a minimum flow capability of 2100 IGPM. It is expected that the Lake Country Fire Department will be able to achieve this initial response in a reasonable amount of time. The total amount of time for the initial response should be limited to a total of: dispatch time (1 minute); turnout time (1 minute) and response time (First Due = 3.5

minutes; Second Due = 5 minutes). It is expected that the response time limits will be achieved 90% of the time.

Other Apparatus

In order to receive full fire insurance grading credit through each fire apparatus's useful lifespan, all Pumpers, ladder trucks, tankers and LAV must be designed and constructed and labelled to ULC pamphlet S515 – Standard for Automotive Fire Fighting Apparatus and ULC pamphlet S523 – Standard for Light Attack Fire Fighting Apparatus.

Note: FUS does not accept 3rd party certification testing and labels unless the testing agency is accredited by Standards Council of Canada and by Fire Underwriters Survey.

Additionally, to continue to be credited and recognized for fire insurance grading, apparatus exceeding 20 years in age must be tested in accordance with the Fire Underwriters Survey Standard for Frequency of Listed Fire Apparatus Acceptance and Service Tests.

10.2 Ladder Truck Service

The Survey has determined that the District of Lake Country requires an aerial ladder device at present according to fire insurance grading criteria. The Grading Schedule requires a minimum of one aerial ladder apparatus if the community protected has five buildings (or more) that are three stories are greater.

The Lake Country Fire Department does not have any ladder companies or apparatus. The community has multiple buildings of 3 storeys and greater height. The Building Department permits construction of tall buildings (based on Council issued variances) and there are no Bylaws in place to provide sprinkler systems in such buildings. The Fire Chief stated that some tall buildings have been required to be sprinklered by the Building Department. Future plans for the community and current ongoing developments include multiple tall buildings 3 storeys and greater in height.

The Fire Department is not capable of providing a standard level of response to fires in such buildings. The standard level of initial response for fires occurring in tall buildings includes the deployment of a ladder company with an aerial device within a reasonable amount of time.

The Fire Underwriters Survey Grading of this community is adversely affected by the community's lack of:

- an aerial device,
- ability to respond with a ladder company,
- Bylaws to prohibit the construction of tall buildings, and
- Bylaws to require sprinkler systems in all buildings (except Single Family Residential).

Recommendation 10.2.A:

To address the issue of providing a minimum standard response to the type of fires that are expected to occur in this community, the community should consider one of the following:

1) Purchase an aerial apparatus
2) Contract out to Kelowna to have their ladder companies respond automatically
3) Develop Bylaws to require sprinkler systems in all buildings (except Single Family Residential).

See Table 5 Options for dealing with increase in number of tall buildings protected

The first option is preferable. Purchasing an aerial device would allow the Fire Department to keep the device in a central location in the community which would decrease response time to incidents. There would be an increased cost involved in purchasing the apparatus, however there would also be a cost benefit. **We recommend acquiring a 65 foot aerial ladder which will provide several benefits and improve the Fire Underwriters Survey grading of the community.** Purchase of this type of vehicle would allow the Fire Department to provide an appropriate level of response to fires in tall buildings. It is expected that in a community of this size, new developments are likely to include tall buildings. As such, the local Fire Department should be provided with equipment that is appropriate for fires in such buildings. An additional benefit of this type of apparatus is that it would be an investment in the long term needs of the community. As the community grows, the need for this type of apparatus will increase.

The Fire Underwriters Survey grading schedule permits an aerial ladder apparatus of an appropriate design (meeting the requirements of a triple combination pumper in addition to the aerial ladder) to be credited twice. The apparatus may receive a full credit as *aerial ladder* and an additional half credit as a triple combination pumper, or vice versa at the Fire Department's discretion.

The device must be designed and constructed in accordance with ULC pamphlet S515 – Standard for Automotive Fire Fighting Apparatus to be credited.

Note: FUS does not accept 3rd party certification testing and labels unless the testing agency is accredited by Standards Council of Canada and by Fire Underwriters Survey.

Additionally, the apparatus should be designed to meet the requirements NFPA 1901 - Standard for Pumper Fire Apparatus and NFPA 1904 – Standard for Aerial Ladder and Elevating Platform Fire Apparatus.

In selecting an apparatus to suit the needs of the community, we recommend that the apparatus selected be a ladder type device (as opposed to an articulating boom). This type of device provides versatility and improves rescue capabilities. The apparatus should have a plumbed master stream device for water tower operations. Consideration should be given to selecting an apparatus with piped air to the ladder (for breathing apparatus). Additionally, pressures available to the master stream device should be considered. We recommend selecting a pump that is capable of providing at least 750 IGPM to the elevated master stream device.

Table 5 – Options for dealing with increase in number of tall buildings protected

Option	Detriments	Benefits
1) Purchase	i.Large initial cost ii.Need hall to accommodate apparatus	i.Cost partly covered by purchasing quint instead of pumper that was already scheduled ii.Improved response times iii.Improved FUS grading results in reduced insurance rates
2) Contract	i.Ongoing costs ii.No control over cost increases iii.Increased response times iv.Poor response times may disqualify apparatus from providing credit in FUS grading	i.Equipment in place ii.Low initial cost iii.Low overhead (no maintenance costs / additional training)
3) Bylaw	i.Would not completely address the issue, even with sprinkler systems in place, tall building fires still require response with an aerial apparatus ii.May be a liability issue	i.Life safety improved in sprinkler protected buildings ii.Property losses reduced in protected buildings iii.Water supply requirements reduced in areas with protected buildings

Note: The total amount of time for the initial response to fires occurring in tall buildings, should be limited to a total of: dispatch time (1 minute); turnout time (1 minute) and response time (First Due = 3.5 minutes; Second Due = 5 minutes; Ladder = 6 minutes). It is expected that the response time limits will be achieved 90% of the time.

Table 6 – Initial Response to Alarms of Fire

TABLE OF EFFECTIVE RESPONSE

The following Table aids in the determination of Pumper and Ladder Company distribution and total members needed. It is based on availability within specified response travel times in accordance with the fire potential as determined by calculation of required fire flows, but requiring increases in availability for severe life hazard.

GROUP	DESCRIPTION EXAMPLES	FIRE FLOW		1ST DUE	2ND DUE	1ST DUE	TOTAL AVAILABILITY NEEDED			
							Pumper Co's.		Ladder Co's.	
		L/min X1000	Approx. Igpm Range	Pumper Company, Minutes	Pumper Company, Minutes	Ladder Company, Minutes	No.	Min.	No.	Min.
1 (a)	Very small buildings, widely detached. Scattered	2	400	7.5	-	*9	1	7.5	*1	9
(b)	development (except where wood roof coverings).	3	600	6	-	*7.5	1	6	*1	7.5
2	Typical modern, 1 - 2 storey residential subdivision 3 - 6 m 10 - 20 ft. detached).	4-5	800-1000	4	6	*6	2	6	*1	6
3 (a)	Close 3 - 4 storey residential and row housing, small mercantile and industrial.	6-9 10-13	1200-2000 2200-2800	3.5 3.5	5 5	*4 *4	2 3	5 6	*1 *1	4 4
3 (b)	Seriously exposed tenements. Institutional. Shopping Centres Fairly large areas and fire loads, exposures.	14-16 17-19	3000-3600 3800-4200	3.5 3.5	5 5	4 4	4 5	7 7	1 **1	4 4
4 (a)	Large combustible institutions, commercial buildings, multi- storey and with exposures.	20-23 24-27	4400-5000 5200-6000	2.5 2.5	4 4	3.5 3.5	6 7	7.5 7.5	2 2	5 5
4 (b)	High fire load warehouses and buildings like 4(a).	28-31 32-35	6200-6800 7000-7600	2.5 2.5	3.5 3.5	3.5 3.5	8 9	8 8	3 3	7 7
5	Severe hazards in large area buildings usually with major exposures. Large congested frame districts.	36-38 39-42 43-46	7800-8400 8600-9200 9400-10000	2.0 2.0 2.0	3.5 3.5 3.5	2.5 2.5 2.5	10 12 14	8 9 9	4 5 6	7.5 8 9

Source: Fire Underwriters Survey Grading Index

10.3 Distribution of Response

The three Lake Country Fire stations are located at or near their respective community centres. The stations are located as follows:

1) Station 71 Winfield, 10575 Okanagan Centre Road East
2) Station 81 Carr's Landing, 16625 Commonage Road
3) Station 91 Oyama, 15656 Oyama Road

Fire Underwriters Survey has reviewed the strategic positioning of the Fire stations and agrees with the current positioning. The community is currently considering relocating Fire Station 71, however we recommend that the Fire station remain at its current location. The location offers good access to areas within the community and also has good access to key arterials allowing quick response to both Carr's Landing and Oyama areas. The hall's location also allows a quick response to northern areas of Kelowna that Lake Country Fire Department is the first responder for.

To improve the ability of the Fire Department to provide a response in a reasonable time frame, all commercial buildings within a community should be located within three kilometres of a fire station. All single family residential buildings should be located no more than 5 km of any fire station. These benchmarks indicate that the majority of residential and commercial buildings within the District of Lake Country have reasonably good response run protection.

10.4 Pumping Capacity

Lake Country Fire Department has sufficient pumping capacity to meet the majority of fire fighting requirements within the District of Lake Country. The capacity credit of the fire department's Pumpers exceeds the community's required fire flows even with one Pumper out of commission.

Lake Country Fire Department has put into service several compressed air foam trucks and Light Attack Vehicles to aid in responding to interface fires and to respond to fires in areas where water flow capacities are limited and in non-hydrant protected areas.

10.5 Design, Maintenance and Condition of Apparatus

The District of Lake Country has a good fire apparatus maintenance program. Additional improvements to the program can be made and are recommended.

Fire trucks undergo a mechanical/ electrical systems/component check monthly by duty shift staff. In addition, fire fighting equipment is inspected and operated. Truck and equipment check sheets are used.

Trucks undergo provincial licensing inspection by local garage, which also performs minor automotive repairs when necessary. Fire department pumps on apparatus are serviced by HUB annually.

The Grading Schedule evaluates the overall maintenance and service program for fire apparatus and equipment. Well documented, preventative maintenance service performed by an in-house mechanical service department is the benchmark used for comparison. Mechanical service should be available on demand when needed.

Record management of the fire truck maintenance and service is rated fair. Individual truck service files are not kept. Management software is not used to facilitate record keeping and management of the fleet's maintenance history, schedule and performance. Service records are largely hand written forms and documents. In many cases, forms are not signed and it is not clear who performed the services. Qualifications of personnel performing services are not indicated. Organization is also not indicated on forms.

Recommendation 10.5.A:

Management software is the preferred choice to track apparatus service and maintenance schedules. Apparatus service and maintenance records should be kept on an apparatus by apparatus basis using similar management techniques to those used for fire fighter personnel records. In addition to suitably kept and arranged paper records, the use of management software should be considered to improve archiving of past service performance as well as service scheduling. Management software will improve forecasting of apparatus servicing cost trends.

Recommendation 10.5.B:

Paper records of services performed on any Fire Department apparatus should clearly indicate the following:

- Date of service

- Type of service
- Reason for service
- Name of person(s) providing service
- Qualification of person(s) providing service (if applicable)
- Name of organization or company responsible for service

Recommendation 10.5.C:

The average age of Lake Country Fire Department's fire apparatus fleet is commendable. The District of Lake Country and local Fire Department have developed an apparatus replacement budget that has been well-used to keep the fleet in good standing. Two vehicles are of concern in the fleet, E91 and T81 primarily due to their age.

E91 is currently scheduled to be replaced and as noted in section 10.2, Recommendation 10.2A, we recommend that the engine be replaced with a 65 foot aerial apparatus.

Recommendation 10.5.D:

The tender T81 should be replaced as there is no recognition for apparatus exceeding 30 years of age for emergency service. We recommend that Pumper 71 replace P91 and P91 replace retiring T81. The aerial apparatus should be positioned at station 71, closest to the commercial core. This would optimize response times to the areas at greatest risk.

Table 7 Fire Apparatus Acceptance and Service Test Frequency For Fire Insurance Grading Purposes

	Frequency of Test					
	@ Time of Purchase New or Used	Annual Basis	@ 15 Years	@ 20 Years	20 to 25 Years	After Extensive Repairs
Recommended For Fire Insurance Purposes	Acceptance Test if new; Service Test if used & < 20 Years	Service Test	Acceptance Test	Yes	Yes	Acceptance or Service depending on extent of repair
Required For Fire Insurance Purposes	Acceptance Test if new; Service Test if used & < 20 Years	No	No	Acceptance Test	Acceptance Test	Acceptance or Service depending on extent of repair
Factor in FUS Grading	Yes	Service Test	Yes	Yes	Yes	Yes
Required By Listing Agency	Acceptance Test	No	No	No	N/A	Acceptance Test
Required By NFPA	Acceptance Test	Service Test	No	N/A	N/A	Acceptance Test
Note 1: Acceptance Tests consist of 60 minute capacity and 30 minute pressure tests Note 2: Service Tests consist of 20 minute capacity test and 10 minute pressure test in addition to other listed tests						

10.6 Number of Chief and Line Officers

The Survey found that the number of chief and line officers currently in place whether career or volunteer is sufficient given the number of Pumpers in service and response districts. The Fire Department hired 4 full time career officers including two new career positions (assistant chiefs). The fire department also has 1 administrative staff. Due to illness and death one of the full time officers is no longer with the fire department. It is expected that this position will be filled in the near future and the department will return to having 4 full time career officers.

The increase in full time career staff from 2 to 4 is recognized by Fire Underwriters Survey as an extremely significant improvement in the organization and development of the Fire Protective Services of the community. The addition of 2 new staff allows the Fire Department to properly

develop training programs for the Fire Department. It also greatly improves the ability of the Fire Department to develop and maintain the Fire Prevention program (including fire inspections and prefire planning) which are important components of the Fire Underwriters Survey grading.

10.7 Total Fire Force Available

The Survey has credited a fire fighter roster of 65, which includes all line officers whether they are career or volunteer. Lake Country Fire Department utilize a system whereby fire fighters report to a fire station, forming suitably sized companies (typically 4) before responding to emergencies. This system is recognized as providing superior management control of an emergency incident.

Lake Country Fire Department had four career members at the time of the assessment whose normal work hours are during day time hours. The fire chief is included in this number. This will normally provide the fire department with two to three members on duty during the week day and one member on duty on week-end days. In addition, the fire department utilizes a duty crew system for 24 & 7 coverage.

Station 81 was noted to have a roster of 13 on the Emergency call out attendance sheet provided (2003). This adversely affects the Fire Department grading as the minimum manning for each station should be 15.

This assessment could not accurately quantify weaknesses in fire department response or coverage. Lake Country Fire Department tracks fire fighter attendance at incidents on incident reports, however this information is not collected or disseminated to identify trends in response weaknesses. Until such time as response weaknesses can be suitably quantified, comments and recommendations aimed at evaluating strengths and weaknesses in responses as well as putting forward options for improvement cannot accurately be forwarded.

Recommendation 10.7.A:

A minimum roster of 15 should be maintained at all times by all three fire stations. Maintaining this minimum will improve the overall grading of the community's fire defences as the expected response is more consistent.

Recommendation 10.7.B:

Lake Country Fire Department should track fire fighter response to emergencies corresponding to the type of emergency, its location and the time of day in order to fully establish response

weaknesses and trends. Further, apparatus response times and fire fighter response times should be recorded in order to provide meaningful analysis.

Recommendation 10.7.C:

The service level provided by the Lake Country Fire Department should be examined through a master planning approach. The intent of the plan is to establish and define an acceptable and achievable service level of response and service delivery along with options to provide a means to meet the desired service level. Community residents are normally included in the master planning process.

10.8 Fire Equipment

The Survey found that Lake Country Fire Department is fairly well equipped with ancillary fire fighting equipment and that existing budgets have capacity to meet current and future needs. The Department is well equipped with fire hose.

Recommendation 10.8.A:

Lake Country Fire Department's hose testing operating guideline should specify a testing interval for all hose such as, for instance "all hose will be tested within a three year testing cycle". This should ensure that no length of hose gets accidentally omitted from the testing program cycle.

10.9 Training Programs

The training program is currently being formalized and developed by the Fire Department Training Officer. The Fire department utilizes training management (database) software to track and plan training programs. The Fire department utilizes the facilities in Vernon (NORD) for Live burn training and regularly sends members to various training programs in both Vernon and Maple Ridge (Justice Institute).

10.9.1 Recruit Training

The recruit training program is not well structured, but it is expected that the new Training Officer will develop and implement a formal recruit training and initiation program. The

Training Program currently includes 40 hours of Live Fire training at the NORD training facility for all new recruits. This is superb and should be continued.

Recommendation 10.9.1.A:

A twelve month training curriculum for recruits should be developed and recruits should undergo a minimum of 40 hours of specific recruit training prior to the recruit being assigned to a platoon. This will provide the recruit with additional reinforcement of the training instruction received and expand upon their knowledge base of fire fighting and safety practices.

Recommendation 10.9.1.B:

Recruit training instruction should be delivered by senior officers under the scrutiny of the Lake Country Fire Training Officer. The recruit training program should be separated from regular drill training at least once per month.

10.9.2 Regular Training Program

Fire fighter training programs also follow a 12 month training curriculum which has been put into place within the past two years and is currently being developed by the newly hired Training Officer. Training sessions are normally two hours in length. Occasionally, training occurs on week-ends in order to meet special training instruction needs.

Practice sessions are held once per week. Firefighters are also sent to the NORD Fire Training Centre in Vernon for various courses as budgets permit.

Lesson plans have been and continue to be developed by the training division.

Lake Country Fire Department policy regarding training is contained in operating guidelines; however they do not utilize a specific training manual but instead rely on the course material of IFSTA and other national standards. Fire fighters do not normally work towards training instruction certification. Tactical inspections of high risk buildings occur along with the use of pre-incident plans.

Recommendation 10.9.2.A:

Consider the use of an in-house certificate or similar recognition to ensure fire fighters have training goals to work towards and to receive recognition for training milestones.

Recommendation 10.9.2.B:

Consider live fire training instruction on a more frequent basis such as once per year.

Recommendation 10.9.2.C:

Record keeping and database use should be further developed. These are invaluable tools in assessing the overall direction the training program is moving in, as well as setting goals and making improvements. The overall training program should involve the advancement and training of fire fighters as well as recruits.

Recommendation 10.9.2.D:

The training officer should continue to develop clear and simple lesson plans.

10.9.3 Qualifications of Officers

This component of the training program evaluation also rated highly in the FUS Grading Schedule. Career staff appears very dedicated and motivated to improve protection levels in the community.

Promotion to officer is based on seniority however the applicant must also undergo interview with senior officers, written test and be endorsed by the fire fighter membership. All officer positions are achieved via a posting with selection being made by the Fire Chief. Selection is based on qualifications and training not on seniority or membership endorsement.

Recommendation 10.9.3.A:

Career officers are encouraged to enroll in educational upgrading programs. Currently the officers have completed Fire Officer Level 1. The Lake Country Fire Department should continue in its move to make fire officer certification a job description requirement for its chief officers. This will help in succession planning of senior officers from within the organization.

Recommendation 10.9.3.B:

An in-house certification course is recommended for the volunteer officers.

10.9.4 Training Facilities

The Lake Country Fire Department have many good facilities for a modern training program and have access to the NORD Fire Training Centre which provides excellent facilities at a reasonable cost. Training facility are rated as very good.

10.10 Response to Alarms

An "Officers Page" is utilized for incidents other than fire or smoke showing. A general page is used for alarms of fire. Responses are pre arranged based on the type of call.

Fire fighters respond to a fire station, form groups and respond with appropriate equipment. Responding as a group of fire fighters with the appropriate equipment is a manageable, safe, effective and efficient approach when responding to an escalating emergency such as a fire.

10.11 Operating Guidelines

Lake Country Fire Department has a well developed, comprehensive and current set of operating guidelines. The current version was originally established by the first career Fire Chief and has been further developed since the arrival of the current fire chief. In addition, rules and regulations / policies and procedures and occupational health and safety requirements are similarly current and comprehensive. Fire fighters are required to sign–off that they have received and read the Department's rules and regulations.

10.12 Special Protection Requirements

Special protection requirements that have been identified in the District of Lake Country include bush and grass fire exposures (including orchards); wildland interface; and small water craft marina fire fighting requirements.

The Lake Country Fire Department has four wheel drive units with pumps and equipment for off road applications. There is also a zodiac for handling water surface incidents.

10.13 Fire Department Records

Overall, the Lake Country Fire Department's record management system is rated fairly good and is improving. In most areas evaluated suitable records are maintained and archived. The department has started using "Fire programs" database software to and keep records of

personnel, training, fire hydrants, and fire prevention inspections. The software is also being used in scheduling.

There appears to be the ability to generate selective reports and queries with the existing program.

Mechanical service records, as discussed earlier, need improvement.

Recommendation 10.13.A:

The use of database software should be expanded to include: pre-incident planning, fire and hazard mapping, incident reporting and apparatus/equipment inventory, needs and maintenance. Issues to be aware of with the use of database software for department administrative issues include (but are not limited to):

- Cross discipline information sharing issues
- Data archiving capacity issues
- Lack of data analytical tools
- Lack of select report generation
- Lack of long term technical support/maintenance
- Lack of upgrade-ability for new O/S platforms

10.14 Fire Stations

The three Lake Country Fire stations are located at or near their respective community centres. The stations are located as follows:

1) Station 71 Winfield, 10575 Okanagan Centre Road East
2) Station 81 Carr's Landing, 16625 Commonage Road
3) Station 91 Oyama, 15656 Oyama Road

The Fire Department also has an administration office located at 10591 Okanagan Centre Road East. Station 71 is the main Fire Station for the department and is designed with 4 bays, 1 of which is a double bay. The building is built with concrete and wood frame construction. There is limited space for training and no space for administration. As such, the Fire Department occupies an additional building nearby for Administration. Fire Station 71 is 35 years old and quite small for the number of fire fighters and apparatus using the facility. Storage space is

inadequate for the Fire Department's needs. The building appears to be in fair condition but has outlived its useful life.

Fire Station #91 in Oyama is a wood frame building constructed approximately 25 feet from an abandoned packing house. The station has 2 old bays (2 vehicles deep) and 1 new bay. The station has a classroom but does not have training space. The station is in fair condition and appears to meet the needs of the fire department.

Fire Station #81 in Carr's Landingis constructed with tilt-up concrete framework. The building has 2 full bays and 1 small bay (addition). The hall consists of 3 bays, 1 small office, and a training/common area.

The District of Lake Country's two outlying fire stations (81 and 91) have limited functionality, which is common with secondary fire stations in rural communities. These halls are described as 'secondary' due to the fact that the Winfield Fire Station is the focal point for administration, management, meetings, training and public access point for the District of Lake Country. The outlying halls seldom support these functions. Their primary duties include the storage of fire / emergency apparatus at strategic response points in their respective communities.

Both of these fire halls have very limited ability to handle administration and training functions without significant renovation and upgrades occurring. However the focus for training facility improvements, administrative space improvements and equipment and apparatus storage improvements should be made at the Winfield fire station (71).

The admin office in a separate building near Fire Station 71 is the administration centre of Lake Country Fire Department operations. The hall (71) contains limited office space, storage space, workshop area and classroom spaces. The building and lot has a number of drawbacks including:

- No training facilities other than its classroom / meeting room
- Very poor and insufficient number of administration offices
- Small and limited functional public access point
- Combustible construction; older design (not code conforming)
- Poor front apron
- Will not be capable to house needed aerial fire apparatus

The benefits of this building and lot, (which are mostly all non functional features), include:

- Central location
- Excellent access to other fire stations and adjacent communities via arterials
- Potential property value
- Owned by the District of Lake Country
- Heritage / ambiance value

From a functional perspective, the District of Lake Country is in need of a new fire station in the Winfield area.

Recommendation 10.14.A:

The Winfield fire station should be replaced from a functional fire service delivery perspective. The replacement fire station should remain at the same location as the original station. Design of the building and site should be in accordance with NFPA 1201 – Developing Fire Protection Services for the Public.

If there is a strong desire to maintain the existing Winfield fire station, the building could be partially torn down and reconstructed, with the interior gutted and rebuilt to improve its functionality.

10.15 Pre – Incident Planning

Lake Country Fire Department is currently in the development stages of its pre-fire planning program. The program will be maintained by newly hired career staff members. As part of the program, Lake Country Fire officers indicated that two fire fighter familiarization inspections of high risk occupancies will occur annually.

Pre-fire plans currently in place are very well constructed. At the time of the Survey it was not determined what percentage of buildings requiring a plan have been created.

Pre-fire plans are kept in the first line pumpers, however the plans are not regionally indexed in a manner that would make them easy to locate and file quickly.

Recommendation 10.15.A:

The pre-incident planning program's continued support and development is encouraged.

Recommendation 10.15.A:

New home construction should be inspected by the fire prevention division (LAFC's) with a focus on pre incident planning and risk reduction education for the home dweller.

10.16 Fire Service Administration

Since the hiring of a full time fire chief, Lake Country Fire Department is considered to be well managed, administered and is regularly planning for the fire / rescue needs of the community. Periodic and year end reports, budget projections and strategic plans are now being developed. A master plan of fire protection service level needs has not yet occurred. In concert with the master planning needs, at the time of the Survey there was little evidence of service performance evaluation and goal setting by the Lake Country Fire Department.

The Lake Country Fire Department appears satisfactorily supported by its Council. However, at the time of the Survey, there was some indication that residents of the District of Lake Country had issues with the both the Council and with the fire rescue department – including the level of service that the Lake Country Fire Department is providing. Noted: A fire loss in 1996 (estimated) resulted in a law suit against the municipality and fire department.

The Lake Country Fire Department should provide the level of service the community desires and will support. Therefore the fire department should strive towards determining the fire and rescue expectations of the community (master planning component); as well as determining the organizational and structural changes and cost needed to meet the expectations.

The Survey found that the District of Lake Country has a very good mix of prevention priorities versus suppression priorities.

The Lake Country Fire Department reaches out to the public through its public education programs and fire smart programs. The Fire Department also interacts with the public at the Fire Administration office through its public access counter. Alternatively, other portions of the community may not have the ability to access the Fire Department as well as Winfield residents are able to due to the outlying halls not being configured or operated as public access points.

The Lake Country Fire Department fire chief delegates responsibility and collaborates on management decisions with his chief officers. Managers meetings occur regularly. The Lake Country Fire Department management team appears to work together very effectively.

All chief officers are enrolled in recognized fire officer courses. The Fire Chief is currently upgrading his training levels by completing the Level 3 Officer program through the Justice Institute of BC.

The selection board criteria for chief officers were not evaluated.

10.17 Fire Prevention

The District of Lake Country's fire safety programs rated very well against the FUS Grading Index (PFPC 6). The strengths of the program include:

- Career officer hired to maintain, schedule and develop the program
- The fire inspection cycle of a minimum of once per year. (Industrial risks inspected twice per year; all other occupancies once per year).
- Maintaining the fire inspection cycle annually
- Target hazard programming such as diligence to inspecting schools, hospital, marinas, industrial and single family residential
- Fire scene preservation / fire cause investigation qualifications
- Fire extinguisher training / infant cpr
- Improvements to inspectors qualifications
- Public education programs

The Lake Country Fire Department should continue to work towards improvement in the following areas:

- Increasing the number of annual inspections for high life hazard buildings (ex. care facilities) and public service buildings (institutional) to a minimum of two per year.

- Integrating the Lake Country Fire Department into the building permitting process (including plan checking and plan review)

- Expanding the public education program
    - Setting targets
    - Setting Performance evaluation criteria

- Improving inspectors qualifications

Recommendation 10.17.A:

Increase inspection frequency for all occupancies to a minimum of two per year.

10.18 Emergency Communications

The Lake Country Fire Department emergency communication programs have also improved considerably with the use of the Kelowna 911 Dispatch system.

Recommendation 10.18.A:

Incident radio communications should be recorded and archived by the Lake Country Fire Department.

Recommendation 10.18.B:

Lake Country Fire Department should consider manning their base radio during emergency incidents. Use of a retired fire fighter or other trained community member has been found to be effective in other jurisdictions.

We would like to thank the District of Lake Country as well as the members of the Lake Country Fire Department for their valuable and courteous assistance in conducting this survey and preparation of the survey report.

The Survey found that fire protection has improved relative to the life safety and fire risk present within the District of Lake Country since the former Surveys of the separate communities of Oyama, Winfield and Carr's Landing. This has occurred despite our assessment that fire risk and fire hazards have also significantly increased in the District of Lake Country as the community continues to grow. We were impressed with the community's focus on fire protection through its fire department even through this report suggests some areas where improvements could continue to occur.

Please note that this report is Private and Confidential. The underlying data of this report has been developed for fire insurance grading and classification purposes. This report may also be used to assist in planning the future direction of the District of Lake Country fire protection services.

Please contact the undersigned if there are any questions or comments regarding the intent, content and recommendations made throughout this report.

Sincerely,

Michael Currie, AScT.
Public Fire Protection Specialist
Fire Underwriters Surveyor

Appendices

A Flow Test Summary

B Hazen Williams Nomograph (for Wood Lake water system)

C Fire Underwriters Survey – Water Supply for Public Fire Protection 1999

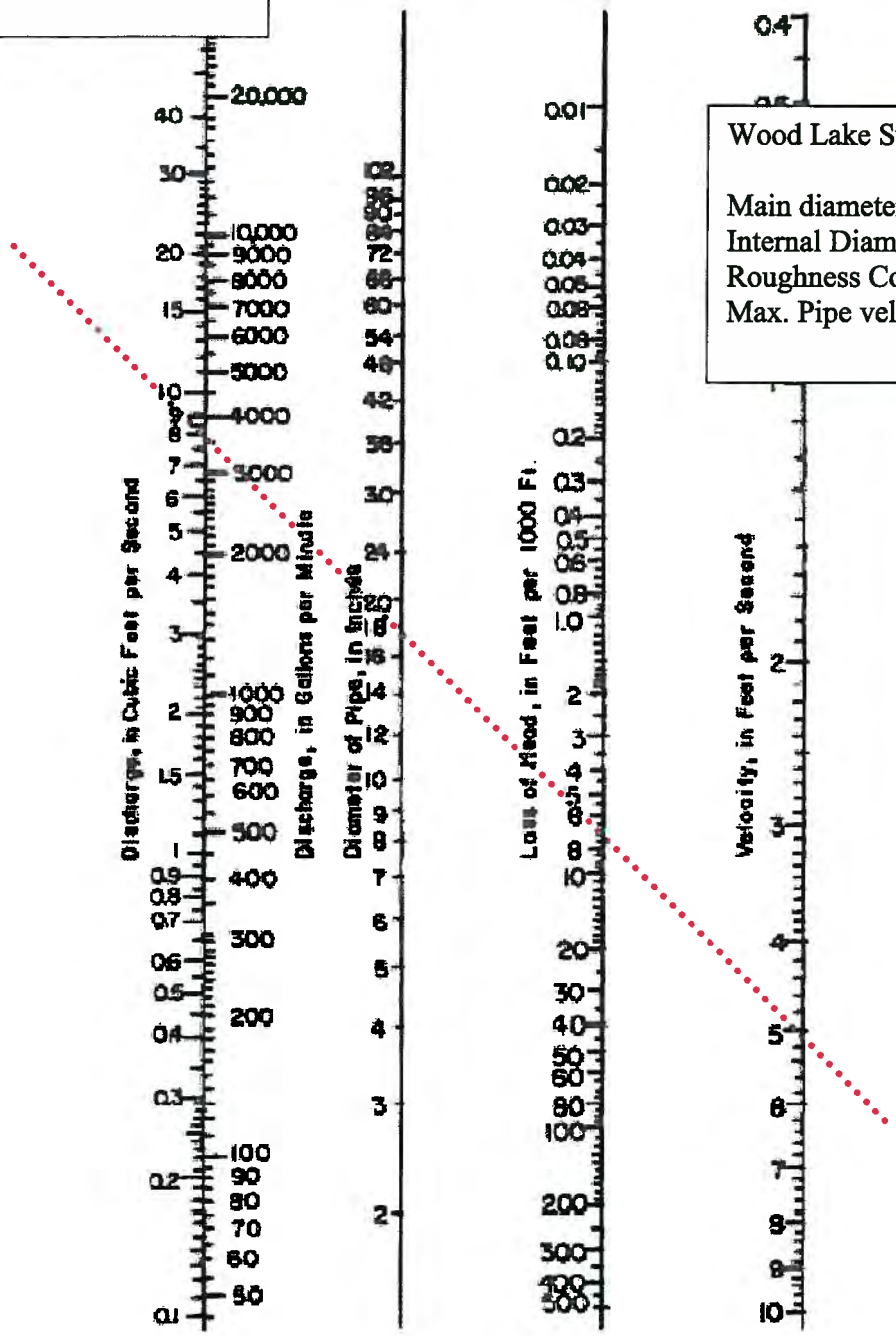
Appendix A

Flow Test Summary

Lake Country **Flow Test Summary Sheet**

Test	Hydrant Location	Risk Type / Zoning	Static	Actual Flow During Test	RFF GPM	Calculated Flow GPM @ 20 psi	Rating	Surplus or Deficiency
1	4th Street and Maddox	Single Family residential, typical with 10 m exposures	116	888	850	1211	OK	surplus = 361 GPM
2	Lake Bottom @ Packing House	Industrial area RFF = 3500 gpm	105	904	3500	1875	Inadequate	Deficiency = 1625 GPM
2b	Lake Bottom @ Packing House		106	1501	3500	4000	OK	surplus = 500 GPM
3	Main street	Commercial area RFF = 2500 gpm	110	1061	2500	2119	Inadequate	Deficiency = 381 GPM
3b	Main street		113	1404	2500	2456	Inadequate	Deficiency = 44 GPM
4	Woodsdale rd	MFR and SFR - RFF=2200 gpm	95	1021	2200	1847	Inadequate	Deficiency = 353 GPM
4b	Woodsdale rd		96	1321	2200	3065	OK	surplus = 865 GPM
5	Pretty and Oceola Road	Beaver Lake System: SFR; RFF=800 gpm	74	949	800	1471	OK	surplus = 671 GPM
6	Oyama Road at Packing House	Industrial Wareouses, etc. (and SFR) ; RFF = 4000 GPM	102	1138	4000	1892	Inadequate	Deficiency = 2108 GPM
6b	Oyama Road at Packing House		126	1592	4000	3816	Inadequate	Deficiency = 184 GPM
7	Trewlitt Road	Rural farms + SFR; RFF = 600	144	888	600	2883	OK	surplus = 2283 GPM
7b	Trewlitt Road		166	1210	600	4292	OK	surplus = 3692 GPM

Appendix B
Hazen Williams Nomograph



Wood Lake System notes:

Main diameter = 500 mm = 19.7"
Internal Diameter ~ 18"
Roughness Coefficient = 100
Max. Pipe velocity = 5 fps

Figure 8-2. Nomograph for Hazen-Williams formula in which C = 100.

Appendix C

Fire Underwriters Survey – Water Supply for Public Fire Protection 1999

WATER SUPPLY

FOR

PUBLIC FIRE PROTECTION

1999

FIRE UNDERWRITERS SURVEY
A SERVICE TO INSURERS AND MUNICIPALITIES

FIRE UNDERWRITERS SURVEY is financed by the Canadian Insurance Industry and utilizes technical staff of Insurers' Advisory Organization Inc. Its purpose is to survey fire protection conditions in Canadian municipalities, providing data and advisory services to fire insurance underwriters and public officials concerned.

TABLE OF CONTENTS

WATER SUPPLY FOR PUBLIC FIRE PROTECTION

PREFACE

This guide summarizes the more significant recommendations of Fire Underwriters Survey with respect to fire protection requirements in municipal water works system design. It reflects the manner in which FUS assesses the water supply aspect of a municipality's fire risk potential during surveys on behalf of the Canadian property insurance industry and represents the accumulated experience of many years study of actual fires. Water supply is one of a number of components evaluated by FUS in the municipal fire protection system. Recommendations applying to the fire departments and code enforcement are covered in other publications of Fire Underwriters Survey. FUS local offices are prepared to assist municipal officials or their consultants with advice on specific problems, as time limits permit, in accordance with the intent of this guide. The minimum size water supply credited by FUS must be capable of delivering not less than 1000 L/min for two hours or 2000 L/min for one hour in addition to any domestic consumption at the maximum daily rate. Static suction supplies to fire department pumpers are recognized as a supplement to the piped system.

In the FUS assessment of a water supply system, the major emphasis is placed upon its ability to deliver **adequate** water to control major fires throughout the municipality on a **reliable** basis via sufficient and suitable **hydrants**. What is ultimately available to the fire department is the critical test in this fire protection evaluation.

Rates of flow for firefighting purposes are expressed in litres per minute as this is the adopted unit for the firefighting field.

In this edition all quantities are specified in S.I. units.

PART I

GENERAL

ADEQUACY AND RELIABILITY. An adequate and reliable water supply for firefighting is an essential part of the fire protection system of a municipality. This is normally a piped system in common with domestic potable water service for the community.

A water supply system is considered to be fully adequate if it can deliver the necessary fire flow at any point in the distribution gridiron for the applicable time period specified in the table "Required Duration of Fire Flow" with the consumption at the maximum daily rate (average rate on maximum day of a normal year). When this delivery is also possible under certain emergency or unusual conditions as herein specified, the system is considered to be reliable. In cities of population in excess of 250,000 (or smaller places with high fire incidence and severe hazard conditions) it is usually necessary to consider the possibility of two simultaneous major fires in the area served by the system.

Fire flows are amounts of water necessary to control fires. These are determined as shown in Part II. System design should contemplate meeting the required fire flows existing or probable with the possible exception of gross anomalies where there is no fire threat to the remainder of the community. In these cases, the properties should preferably be modified in hazard to reduce the required flow as part of a coordinated community fire protection system.

The protection of buildings by automatic sprinkler systems is a significant contribution to the fire protection of the community and should be encouraged, not penalized by onerous service charges or metering requirements.

In order to provide reliability, duplication of some or all parts of the system will be necessary, the need for duplication being dependent upon the extent to which the various parts may reasonably be expected to be out of service as a result of maintenance and repair work, an emergency or some unusual condition. The introduction of storage, either as part of the supply works or on the distribution system, may partially or completely offset the need for duplicating various parts of the system, the value of the storage depending upon its amount, location and availability.

STORAGE. In general, storage reduces the requirements of those parts of the system through which supply has already passed. Since storage usually fluctuates, the normal daily minimum maintained is the amount that should be considered as available for fires. Because of the decrease in pressure when water is drawn down in standpipes, only the portion of this normal daily minimum storage that can be delivered at a residual pressure of 150 kPa at the point of use is considered as available. As well as the quantity available, the rate of delivery of water to the system from storage for the fire flow period is critical to this consideration.

PRESSURE. The principal requirement to be considered is the ability to deliver water in sufficient quantity to permit fire department pumpers to obtain an adequate supply from hydrants. To overcome friction loss in the hydrant branch, hydrant and suction hose, a minimum residual water pressure of 150 kPa in the street main is required during flow. Under conditions of exceptionally low suction losses a lower residual may be possible. This includes the use of 100 mm and larger outlets for fire department pumper use and hydrants with large waterways.

Higher sustained pressure is of importance in permitting direct continuous supply to automatic sprinkler systems, to building standpipe and hose systems, and in maintaining a water plan so that no portion of the protection area is without water, such as during a fire at another location. Residual pressures that exceed 500 kPa during large flows are of value as they permit short hose-lines to be operated directly from hydrants without supplementary pumping.

SUPPLY WORKS

NORMAL ADEQUACY OF SUPPLY WORKS. The source of supply, including impounding reservoirs, and each part of the supply works should normally be able to maintain the maximum daily consumption rate plus the maximum required fire flow. Each distribution service within the system should similarly support its own requirements. In large cities where fire frequency may result in simultaneous fires, additional flow must be considered in accordance with the potential. Filters may be considered as capable of operating at a reasonable overload capacity based upon records and experience. In general, overload capacity will not exceed 25 percent, but may be higher in well designed plants operating under favourable conditions.

The absolute minimum supply available under extreme dry weather conditions should not be taken as the measure of the normal ability of the source of supply such as supply from wells. The normal or average capacity of wells during the most favourable nine month period should be considered, or the normal sustained flow of surface supplies to the source.

RELIABILITY OF SOURCE OF SUPPLY. The effect on adequacy must be considered for such factors as frequency, severity and duration of droughts, physical condition of dams and intakes; danger from earthquakes, floods, forest fires, and ice dams or other ice formations; silting-up or shifting of channels; possibility of accidental contamination of the watershed or source; absence of watchmen or electronic supervision where needed; and injury by physical means. Where there is a risk of disruption, special precautions or alternate supplies should be arranged.

Where the supply is from wells, some consideration should be given to the absolute minimum capacity of the wells under the most unfavourable conditions; also to the length of time that the supply from the wells would be below the maximum daily consumption rate, and the likelihood of this condition recurring every year or only at infrequent intervals. It should be recognized that some water is generally available from wells and that the most extreme conditions are not as serious as a total interruption of the supply, as would be the case in the breaking of a dam or shifting of a channel. The possibility of clogging, salinity, and the need for periodic cleaning and overhauling must be considered. Dependence upon a single well, even where records are favourable, may be considered a feature of unreliability.

Frequent cleaning of reservoirs and storage tanks may be considered as affecting reliability.

Continuity of and delay in implementing water supplies obtained from systems or sources not under the control of the municipality or utility should be considered also from these aspects.

GRAVITY SYSTEMS. A gravity system delivering supply from the source to distribution directly without the use of pumps is advantageous from a fire protection point of view because of its inherent reliability, but a pumping system can also be developed to a high degree of reliability.

PUMPING

RELIABILITY OF PUMPING CAPACITY. Pumping capacity, where the system or service supplied by pumps, should be sufficient, in conjunction with storage when the two most importa pumps are out of service, to maintain the maximum daily consumption rate plus the maximum required fire flow at required pressure for the required duration. For smaller municipalities (usually up to about 25,000 population) the relative infrequency of fires is assumed as largely offsetting the probability of a serious fire occurring at times when two pumps are out of service. (The most important pump is normally, but not always, the one of largest capacity, depending upon how vital is its contribution to maintaining flow to the distribution system.)

To be adequate, remaining pumps in conjunction with storage should be able to provide required fire flows for the specified durations at any time during a period of five days with consumption at the maximum daily rate. Effect of normal minimum capacity of elevated storage located on the distribution system and storage of treated water above low lift pumps should be considered. The rate of flow from such storage must be considered in terms of any limitation of water main capacity. The availability of spare pumps or prime movers that can quickly be installed may be credited, as may pumps of compatible characteristics which may be valved from another service.

POWER SUPPLY FOR PUMPS. Electric power supply to pumps should be so arranged that a failure in any power line or the repair or replacement of a transformer, switch, control unit or other device will not prevent the delivery, in conjunction with elevated storage, of required fire flows for the required durations at any time during a period of two days with consumption at the maximum daily rate.

Power lines should be underground from the station or substation of the power utility to wat plants and pumping stations and have no other consumers enroute. The use of the same transmission lines by other consumers introduces unreliability because of the possibility of interruption of power or deterioration of power characteristics.

Overhead power lines are more susceptible to damage and interruption than underground lines and introduce a degree of unreliability that depends upon their location and construction. In connections with overhead lines, consideration should be given to the number and duration of lightning, wind, sleet, and snow storms in the area; the type of poles or towers and wires; the nature of the country traversed; the effect of earthquakes, forest fires, and floods; the lightning and surge protection provided; the extent to which the system is dependent upon overhead lines; and the ease of and facilities for repairs.

The possibility of power systems or network failures affecting large areas should be considered. In-plant auxiliary power or internal combustion driver standby pumping are appropriate solutions to these problems in many cases, particularly in small plants where high pumping capacity is required for fire protection service. When using automatic starting, prime 'movers' for auxiliary power supply and pumping should have controllers labelled or listed by Underwriters' Laboratories of Canada to establish their reliability.

FUEL SUPPLY. At least a five day supply of fuel for internal combustion engines or boilers used for regular domestic supply should be provided. Where long hauls, condition of roads, climatic conditions, or other circumstances could cause interruptions of delivery longer than five days, a greater storage should be provided. Gas supply should be from two independent sources or from duplicate gas-producer plants with gas storage sufficient for 24 hours. Unreliability of regular fuel supply may be offset in whole or in part by suitable provisions for the use of an alternate fuel or power supply.

BUILDINGS AND PLANT

BUILDINGS AND STRUCTURES. Pumping stations, treatment plants, control centres and other important structures should be located, constructed, arranged, and protected so that damage by fire, flooding, or other causes will be held to a minimum. They should contain no combustible material in their construction, and, if hazards are created by equipment or materials located within the same structure, the hazardous section should be suitably separated by fire-resistive partitions or fire walls.

Buildings and structures should have no fire exposures. If exposures exist, suitable protection should be provided. Electrical wiring and equipment should be installed in accordance with the Canadian Electrical Code. All internal hazards should be properly safeguarded in accordance with good practice. Private in-plant fire protection should be provided as needed.

MISCELLANEOUS SYSTEM COMPONENTS, PIPING AND EQUIPMENT. Steam piping, boiler-feed lines, fuel-piping (gas or oil lines to boilers as well as gas, oil or gasoline lines to internal-combustion engines), and air lines to wells or control systems should be so arranged that a failure in any line or the repair or replacement of a valve, fuel pump, boiler-feed pump, injector, or other necessary device, will not prevent the delivery, in conjunction with storage, of the required fire flows for the specified duration at any time during a period of two days with consumption at the maximum daily rate.

Plants should be well arranged to provide for effective operation. Among the features to be considered are: ease of making repairs and facilities for this work, danger of flooding because of broken piping; susceptibility to damage by spray; reliability of priming and chlorination equipment; lack of semi-annual inspection of boilers or other pressure vessels; dependence upon common non-sectionalized electric bus bars; poor arrangement of piping; poor condition or lack of regular inspections of important valves; and factors affecting the operation of valves or other devices necessary for fire service such as design, operation, and maintenance of pressure regulating valves, altitude valves, air valves, and other special valves or control devices, provision of power drives, location of controls, and susceptibility to damage.
Reliability of treatment works is likely to be influenced by the removal from service of at least one filter or other treatment unit; the reduction of filter capacity by turbidity, freezing or other conditions of the water; the need for cleaning basins; and the dependability of power for operating valves, wash-water pumps, mixers and other appurtenances.

OPERATIONS. Reliability in operation of the supply system and adequate response to emergency or fire demands are essential. Instrumentation, controls and automatic features should be arranged with this in mind. Failure of an automatic system to maintain normal conditions or to meet unusual demands should result in the sounding of an alarm where remedial action will be taken.

The operating force should be competent, adequate, and continuously available as may be required to maintain both the domestic and fire services.

EMERGENCY SERVICES. Emergency crews, provided with suitable transportation, tools and equipment, should be continuously on duty in the larger systems and be readily available upon call in small systems. Spare pipe and fittings and construction equipment should be readily available. Alarms for fires in buildings should be received by the utility at a suitable location where someone is always on duty who can take appropriate action as required, such as placing additional equipment in operation, operating emergency or special valves, or adjusting pressures. Receipt of alarms may be by fire alarm circuit, radio, outside alerting device, or telephone, but where special operations are required, the alarm service should be equivalent to that needed for a fire station.

Response of an emergency crew should be made to major fires to assist the fire department in making the most efficient use of the water system and to ensure the best possible service in the event of a water main break or other emergency. The increase of pressures by more than 25 percent for fires is considered to increase the possibility of breaks.

PIPING

RELIABILITY OF SUPPLY MAINS. Supply mains cut off for repair should not drastically reduce the flow available to any district. This includes all pipe lines or conduits on which supply to the distribution system is dependent, including intakes, suction or gravity lines to pumping stations, flow lines from reservoirs, treatment plant piping, force mains, supply and arterial mains, etc. Consideration should be given to the greatest effect that a break, joint separation or other failure could have on the delivery of the maximum daily consumption rate plus required fire flow at required pressure over a three day period. Aqueducts, tunnels or conduits of substantial construction may be considered as less susceptible to failure and equivalent to good mains with a long history of reliability.

INSTALLATION OF PIPE. Mains should be in good condition and properly installed. Pipe should be suitable for the service intended. Asbestos-cement, poly-vinyl chloride (PVC), cast and ductile iron, reinforced concrete and steel pipe manufactured in accordance with appropriate Canadian Standards Association or ANSI/AWWA standards, or any pipes listed by Underwriters' Laboratories of Canada for fire service are considered satisfactory. Normally, pipe rated for a maximum working pressure of 1000 kPa is required. Service records, including the frequency and nature of leaks, breaks, joint separations, other failures and repairs, and general conditions should be considered as indicators of reliability. When mains are cleaned they should be lined.

Mains should be so laid as not to endanger one another, and special construction should be provided to prevent their failure at stream crossings, railroad crossings, bridges, and other points where required by physical conditions; supply mains should be valved at one and one half kilometre intervals and should be equipped with air valves at high points and blow offs at low points. Mains should not be buried extremely deep or be unusually difficult to repair, though depths to ten feet may be required because of frost conditions.

The general arrangement of important valves, of standard or special fittings, and of connections at cross-overs, intersections, and reservoirs, as well as at discharge and suction headers, should be considered with respect to the time required to isolate breaks. The need for check valves on supply or force mains and for other arrangements to prevent flooding of stations or emptying of reservoirs at the time of a break in a main should also be considered, as well as the need for relief valves or surge chambers. Accessibility of suitable material and equipment and ease of making repairs should be considered.

Arterial feeder mains should provide looping throughout the system for mutual support and reliability, preferably not more than 1000 metres between mains. Dependence of a large area on a single main is a weakness. In general the gridiron of minor distributors supplying residential districts should consist of mains at least 150mm in size and arranged so that the lengths on the long sides of blocks between intersecting mains do not exceed 200 metres. Where longer lengths of 150mm pipe are necessary 200mm or larger intersecting mains should be used. Where initial pressures are unusually high, a satisfactory gridiron may be obtained with longer lengths of 150mm pipe between intersecting mains.

Where deadends and a poor gridiron are likely to exist for a considerable period or where the layout of the streets and the topography are not well adapted to the above arrangement, 200mm pipe should be used. Both the ability to meet the required fire flows and reliability of a reasonable supply by alternate routing must be taken into account in this consideration.

VALVES. A sufficient number of valves should be installed so that a break or other failure will not affect more than 400 metres of arterial mains, 150 metres of mains in commercial districts, or 250 metres of mains in residential districts. Valves should be maintained in good operating condition. The recommended inspection frequency is once a year, and more frequently for larger valves and valves for critical applications.

A valve repair that would result in reduction of supply is a liability, but because of the probable infrequency of occurrence, it might be considered as introducing only a moderate degree of unreliability even if it resulted in total interruption. The repair of a valve normally should be accomplished in two days. Valves opening opposite to the majority are undesirable and when they do occur they should be clearly identified.

HYDRANTS

SIZE, TYPE AND INSTALLATION. Hydrants should conform to American Water Works Standard for Dry Barrel Fire Hydrants or Underwriters' Laboratories of Canada listing. Hydrants should have at least two 65mm outlets. Where required fire flows exceed 5000 L/min or pressures are low there should also be a large pumper outlet. The lateral street connection should not be less than 150mm in diameter. Hose threads, operating and cap nuts on outlets should conform to Provincial Standard dimensions. A valve should be provided on lateral connections between hydrants and street mains.

Hydrants that open in a direction opposite to that of the majority are considered unsatisfactory. Flush hydrants are considered undesirable because of delay in getting into operation; this delay is more serious in areas subject to heavy snow storms. Cisterns are considered unsatisfactory as an alternative to pressure hydrants. The number and spacing of hydrants should be as indicated in the table titled "Standard Hydrant Distribution".

INSPECTION AND CONDITION. Hydrants should be inspected at least semi-annually and after use. The inspection should include operation at least once a year. Where freezing temperatures occur, the semi-annual inspections should be made in the spring and fall of each year. Because of the possibility of freezing they should be checked frequently during extended periods of severe cold. Hydrants should be kept in good condition and suitable records of inspections and repairs be maintained. Hydrants should be painted in highly visible colours so that they are conspicuous and be situated with outlets at least twelve inches above the grade. There should be no obstruction that could interfere with their operation. Snow should be cleared promptly after storms and ice and snow accumulations removed as necessary.

HYDRANT DISTRIBUTION. Hydrant locations and spacing should be convenient for fire department use. Hydrants should be located at intersections, in the middle of long blocks and at the end of long deadend streets. To allow for convenient utilization of water supplies, distribution density of hydrants should be in accordance with the required fire flows indicated in the table titled "Standard Hydrant Distribution" (page 16). The maximum recommended spacing of hydrants in commercial, industrial, institutional and multi-family residential areas is 90 metres; in single family residential areas 180 metres is recommended. In areas where fire apparatus have access (eg. large properties, private developments, etc.), hydrants should be required by bylaw. The planning of hydrant locations should be a cooperative effort between the water utility and fire department.

RECORDS

PLANS AND RECORDS. Complete, up-to-date plans and records essential for the proper operation and maintenance of the system should be available in a convenient form, suitably indexed and safely filed. These should include plans of the source as well as records of its yield and a reliable estimate of the safe yield; plans of the supply works including dams, intakes, wells, pipelines, treatment plants, pumping stations, storage reservoirs and tanks; and a map of the distribution system showing mains, valves, and hydrants. Plans and maps should be in duplicate and stored at different locations.

Detailed distribution system plans, in a form suitable for field use, should be available for maintenance crews. Records of consumption, pressures, storage levels, pipes, valves, hydrants, and of the operations of the supply works and distribution system, including valve and hydrant inspections and repairs should be maintained.

TABLES

STANDARD HYDRANT DISTRIBUTION	
Fire Flow Required (litres per minute)	Average Area per Hydrant -(m^2)
2,000	16,000
4,000	15,000
6,000	14,000
8,000	13,000
10,000	12,000
12,000	11,000
14,000	10,000
16,000	9,500
18,000	9,000
20,000	8,500
22,000	8,000
24,000	7,500
26,000	7,000
28,000	6,500
30,000	6,000
32,000	5,500
34,000	5,250
36,000	5,000
38,000	4,750
40,000	4,500
42,000	4,250
44,000	4,000
46,000	3,750
48,000	3,500

REQUIRED DURATION OF FIRE FLOW	
Fire Flow Required (litres per minute)	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.50
5,000	1.75
6,000	2.0
8,000	2.0
10,000	2.0
12,000	2.5
14,000	3.0
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

Interpolate for intermediate figures

Area refers to surface area of blocks and bounding streets. For a street without adjacent streets, a depth of one-half block is used.

A water supply system is considered to be adequate for fire protection when it can supply water as indicated above with consumption at the maximum daily rate. Certain types of emergency supplies may be included where reasonable conditions for their immediate use exist. Storage on the system is credited on the basis of the normal daily minimum maintained insofar as pressure permits its delivery at the rate considered.

PART II

GUIDE FOR DETERMINATION OF REQUIRED FIRE FLOW
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N.B. It should be recognized that this is a "guide" in the true sense of the word, and requires a certain amount of knowledge and experience in fire protection engineering for its effective application. Its primary purpose is for the use of surveyors experienced in this field, but it is made available to municipal officials, consulting engineers and others interested as an aid in estimating fire flow requirements for municipal fire protection.

Required Fire Flow may be described as the amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure. This may include as much as a city block.

1. An estimate of the fire flow required for a given area may be determined by the formula:

$$F = 220\, C \sqrt{A}$$

where

F = the required fire flow in litres per minute.

C = coefficient related to the type of construction.
- = 1.5 for wood frame construction (structure essentially all combustible).
- = 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
- = 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
- = 0.6 for fire-resistive construction (fully protected frame, floors, roof).

Note: For types of construction that do not fall within the categories given, coefficients shall not be greater than 1.5 nor less than 0.6 and may be determined by interpolation between consecutive construction types as listed above. Construction types are defined in the Appendix.

A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

For fire-resistive buildings, consider the two largest adjoining floors plus 50 percent of each of any floors immediately above them up to eight, when the vertical openings are inadequately protected. If the vertical openings and exterior vertical communications are properly protected (one hour rating), consider only the area of the largest floor plus 25 percent of each of the two immediately adjoining floors.

For one family and two family dwellings not exceeding two storeys in height, see **Note J.**

2. The value obtained in No. 1 may be reduced by as much as 25% for occupancies having a low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard. Those may be classified as to contents as follows:

Non-Combustible	-25%	Free Burning	+15%
Limited Combustible	-15%	Rapid Burning	+25%
Combustible	No Charge		

As guide for determining low or high fire hazard occupancies, see the list in the Appendix. The fire flow determined shall not be less than 2,000 L/min.

3. The value obtained in Number 2 above may be reduced by up to 50% for complete automatic sprinkler protection depending upon adequacy of the system. The credit for the system will be a maximum of 30% for an adequately designed system conforming to NFPA 13 and other NFPA sprinkler standards. Additional credit of up to 10% may be granted if the water supply is standard for both the system and fire department hose lines required. The percentage reduction made for an automatic sprinkler system will depend upon the extent to which the system is judged to reduce the possibility of fires spreading within and beyond the fire area. Normally this reduction will not be the maximum allowed without proper system supervision including water flow and control valve alarm service. Additional credit may be given of up to 10% for a fully supervised system.

4. To the value obtained in No. 2 above a percentage should be added for structures exposed within 45 metres by the fire area under consideration. This percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s), and the effect of hillside locations on the possible spread of fire.

The charge for any one side generally should not exceed the following limits for the separations shown:

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

The total percentage shall be the sum of the percentages for all sides, but shall not exceed 75%.

The fire flow shall not exceed 45,000 L/min nor be less than 2,000 L/min.

Note A: The guide is not expected to necessarily provide an adequate value for lumber yards, petroleum storage, refineries, grain elevators, and large chemical plants, but may indicate a minimum value for these hazards.

Note B: Judgement must be used for business, industrial, and other occupancies not specifically mentioned.

Note C: Consideration should be given to the configuration of the building(s) being considered and accessibility by the fire department.

Note D: Wood frame structures separated by less than 3 metres shall be considered as one fire area.

Note E: Fire Walls: - In determining floor areas, a fire wall that meets or exceeds the requirements of the current edition of the National Building Code of Canada (provided this necessitates a fire resistance rating of 2 or more hours) may be deemed to subdivide the building into more than one area or may, as a party wall, separate the building from an adjoining building.

Normally any unpierced party wall considered to form a boundary when determining floor areas may warrant up to a 10% exposure charge.

Note F: High one storey buildings: When a building is stated as 1=2, or more storeys, the number of storeys to be used in the formula depends upon the use being made of the building. For example, consider a 1=3 storey building. If the building is being used for high piled stock, or for rack storage, the building would probably be considered as 3 storeys and, in addition, an occupancy percentage increase may be warranted. However, if the building is being used for steel fabrication and the extra height is provided only to facilitate movement of objects by a crane, the building would probably be considered as a one storey building and an occupancy credit percentage may be warranted.

Note G: If a building is exposed within 45 metres, normally some surcharge for exposure will be made.

Note H: Where wood shingle or shake roofs could contribute to spreading fires, add 2,000 L/min to 4,000 L/min in accordance with extent and condition.

Note I: Any non-combustible building is considered to warrant a 0.8 coefficient.

Note J: Dwellings: For groupings of detached one family and small two family dwellings not exceeding 2 stories in height, the following short method may be used. (For other residential buildings, the regular method should be used.)

Exposure distances	Suggested required fire flow	
	Wood Frame	Masonry or Brick
Less than 3m	See Note "D"	6,000 L/min
3 to 10m	4,000 L/min	4,000 L/min
10.1 to 30m	3,000 L/min	3,000 L/min
Over 30m	2,000 L/min	2,000 L/min

If the buildings are contiguous, use a minimum of 8,000 L/min. Also consider Note H.

OUTLINE OF PROCEDURE

A. Determine the type of construction.

B. Determine the ground floor area.

C. Determine the height in storeys.

D. Using the fire flow formula, determine the required fire flow to the nearest 1,000 L/min.

E. Determine the increase or decrease for occupancy and apply to the value obtained in D above. Do not round off the answer.

F. Determine the decrease, if any, for automatic sprinkler protection. Do not round off the value.

G. Determine the total increase for exposures. Do not round off the value.

H. To the answer obtained in E, subtract the value obtained in F and add the value obtained in G.

The final figure is customarily rounded off to the nearest 1,000 L/min.

APPENDIX

TYPES OF CONSTRUCTION

For the specific purpose of using the Guide, the following definitions may be used:

Fire-Resistive Construction - Any structure that is considered fully protected, having at least 3-hour rated structural members and floors. For example, reinforced concrete or protected steel.

Non-combustible Construction - Any structures having all structural members including walls, columns, piers, beams, girders, trusses, floors, and roofs of non-combustible material and not qualifying as fire-resistive construction. For example, unprotected metal buildings.

Ordinary Construction - Any structure having exterior walls of masonry or such non-combustible material, in which the other structural members, including but not limited to columns, floors, roofs, beams, girders, and joists, are wholly or partly of wood or other combustible material.

Wood Frame Construction - Any structure in which the structural members are wholly or partly of wood or other combustible material and the construction does not qualify as ordinary construction.

OCCUPANCIES

Examples of Low Hazard Occupancies:

- Apartments
- Asylums
- Churches
- Clubs
- Colleges & Universities
- Dormitories
- Dwellings
- Hospitals
- Hotels
- Institutions
- Libraries, except Large Stack Room Areas
- Museums
- Nursing, Convalescent and Care Homes
- Office Buildings
- Prisons
- Public Buildings
- Rooming Houses
- Schools
- Tenements

Generally, occupancies falling in National Building Code Groups A, B, C and D are of this class.

Examples of High Hazard Occupancies:

Aircraft Hangars
Cereal, Feed, Flour and Grist Mills
Chemical Works - High Hazard
Cotton Picker and Opening Operations
Explosives & Pyrotechnics Manufacturing
Shade Cloth Manufacturing
Foamed Plastics, Storage or use in Manufacturing
High Piled Combustibles Storage in excess of 6.5 metres high
Linseed Oil Mills
Match Manufacturing
Oil Refineries
Paint Shops
Pyroxylin Plastic Manufacturing & Processing
Solvent Extracting
Varnish and Paint Works
Woodworking with Flammable Finishing
Linoleum and Oilcloth Manufacturing

Other occupancies involving processing, mixing storage and dispensing flammable and/or combustible liquids. Generally, occupancies falling in National Building Code Group F, Divisions 1 and 2 would be in this class.

For other occupancies, good judgement should be used, and the percentage increase will not necessarily be the same for all buildings that are in the same general category - for example "Colleges and Universities": this could range from a 25% decrease for buildings used only as dormitories to an increase for a chemical laboratory. Even when considering high schools, the decrease should be less if they have extensive shops.

It is expected that in commercial buildings no percentage increase or decrease for occupancy will be applied in most of the fire flow determinations. In general, percentage increase or decrease will not be at the limits of plus or minus 25%.

EXPOSURES

When determining exposures it is necessary to understand that the exposure percentage increase for a fire in a building (x) exposing another building (y) does not necessarily equal the percentage increase when the fire is in building (y) exposing building (x). The Guide gives the maximum possible percentage for exposure at specified distances. However, these maximum possible percentages should not be used for all exposures at those distances. In each case the percentage applied should reflect the actual conditions but should not exceed the percentage listed.

The maximum percentage for the separations listed generally should be used if the exposed building meets all of the following conditions:

a. Same type or a poorer type of construction than the fire building.
b. Same or greater height than the fire building.
c. Contains unprotected exposed openings.
d. Unsprinklered.

CONVERSION FACTORS

Multiply	By	To Obtain
Centimetre	0.3937	Inches
Cubic Foot	0.0283	Cubic Metres
Cubic Metre	35.3145	Cubic Feet
Cubic Metre	219.97	Imperial Gallons
Cubic Metre	1.000	Litres
Foot	0.3048	Metres
Horsepower	0.7457	Kilowatt
Imperial Gallon	4.546	Litres
Inch	2.54	Centimetres
Kilogram	2.2046	Pounds
Kilogram of Water	1	Litres
Kilopascal	0.1450	Pounds per sq. inch
Kilowatt	1.341	Horsepower
Litre	0.21997	Imperial Gallons
Litre of Water	1	Kilograms
Metre	3.281	Feet
Metre of Water	10	Kilopascals
Pound	0.4536	Kilograms
Pound per sq. inch	6.89476	Kilopascals
U.S. Gallons	0.8327	Imperial Gallons
Imperial Gallons	1.201	U.S.Gallons

FIRE UNDERWRITERS SURVEY
COST BENEFIT OF
IMPROVING FIRE INSURANCE GRADING

Fire Underwriters Survey was originally developed after a number of communities across North America had massive conflagration losses. The fire insurance grading system was developed to provide insurers with information related to the levels of fire risk and fire protection within each community in Canada. The system is designed to provide a cost benefit to communities for providing fire protection. Communities that have effective and appropriate levels of fire protection for the level of fire risk within their protection areas, will receive lower fire insurance grades, which in turn will result in lower insurance rates for property owners. This memo gives an overview of the factors that affect a community's fire insurance grading and how these ratings affect insurance premiums.

Fire Underwriters Survey (FUS) is a national organization financed and directed by CGI Insurance Business Services (formerly I.A.O.) and the Insurance Bureau of Canada (IBC). The organization assesses, evaluates and grades the quality of public fire defences maintained in Canadian municipalities and communities. This technical information is conveyed to FUS subscribers for use in their fire insurance statistical, rating and underwriting programs. FUS member companies provide approximately 85 percent of the private general insurance written each year in Canada.

Major features assessed during fire protection surveys include:

1) Water supply systems
2) Fire department administration and operations
3) Fire service communications
4) Fire safety control including building and fire prevention codes and their enforcement.

These functions are measured against recognized standards of fire protection.

The grading system has two components, the Dwelling Protection Grade and Public Fire Protection Classification. Both grading systems begin with a community risk assessment.

Dwelling Protection Grades (D.P.G)
The first fire insurance classification we establish and convey to FUS member companies is the Dwelling Protection Grade. The D.P.G. is a numerical system scaled from 1 to 5. One (1) is the highest grading possible and 5 indicates little or no public fire protection. This grading reflects the ability of a community to effectively respond to fires in small buildings (single family dwellings). An effective response requires adequate manpower (with appropriate training and equipment), apparatus, water supply and response time must be reasonably fast.

Public Fire Protection Classification
The P.F.P.C. is a sophisticated grading system scaled from 1 to 10. One (1) represents the ultimate degree of protection and 10 indicates little or no fire protection. This system evaluates the ability of a community's fire defences to prevent and control major fires that may occur in commercial, industrial and institutional buildings. This grading system includes a comprehensive analysis of the community's fire defences and risks.

Most insurance companies across Canada use the fire insurance grades (DPG and PFPC) as a factor in setting the premiums they charge for property insurance; the better the community's fire insurance grade, the lower the premiums the insurance company would charge for property insurance in that community.

How do fire insurance grading results affect insurance premiums? Table 2 shows how the premiums would vary for some typical single family dwellings under several example insurance companies' current rating schedules. It is important to note that every insurance company sets its own rates. While these figures are reasonably representative of how much difference the fire insurance grading can make in an insurance buyer's premiums, the amounts and percentages of the premium credits for the various fire classes will vary among insurance companies.

The first grade that communities are interested in is the Dwelling Protection Grade. The Fire Underwriters Survey method of assessment utilizes a 1-5 grading scale. Many insurers have simplified this scale into a "3 tier" system as shown in Table 1.

Table 1 Simplified 3 Tier System for Single Family Dwellings

Insurance Bureau of Canada Dwelling Protection Grades. Statistical "5 tier" System.	System Used by Many Insurance Companies Underwriting "3 tier" system.	Insurance Companies refer to this grade as :
1 2 3A 3B (S)	Table I	Protected
3B 4	Table II	Semi - Protected
5	Table III	Unprotected

Insurers typically provide a reduction of approximately 60% when communities fire insurance grading DPG is changed from unprotected to semi-protected. Note that different insurers have different policies and rating systems in many areas. Common examples of such differences include but are not limited to:

- Some insurers will treat communities with DPG 4 as Table III – Unprotected
- Some insurers may not accept 3B (S) as Table I - Protected

Insurers typically provide a reduction of approximately 32% when communities fire insurance grading DPG is changed from unprotected to semi-protected.

The following table shows average insurance premiums as they relate to different valued single family dwellings in typical Canadian communities.

Table 2 Example Insurance Premiums for Single Family Dwellings by Fire Insurance Classification[1]

Replacement Value $	Unprotected Rate $	60± % reduction	Semi Protected Rate $	32± % reduction	Fully Protected Rate $
100,000	1165		465		315
125,000	1470		585		400
150,000	1750		700		475
175,000	2040		815		555
200,000	2300		915		625
250,000	2790		1110		755
300,000	3290		1310		890
350,000	3750		1495		1015
400,000	4200		1675		1140
450,000	4655		1855		1260

The second grade that communities are interested in is the Public Fire Protection Classification. This grade is calculated from a comprehensive evaluation of the community and fire defense capabilities. This grade is a number between 1 and 10 with 1 being superior fire protection and 10 being unprotected. The PFPC grade of a community is a significant factor that most insurance companies use to set insurance premium rates for all buildings that are not single family dwellings. All such buildings are referred to as "commercial". This includes assembly, institutional, industrial, multi-family residential and all others.

Many factors affect "commercial" property insurance premium rates. The Public Fire Protection Classification is significant, however it is important to note that there are many other significant factors that will affect insurance premiums in commercial properties. Such factors include but are not limited to: construction (combustible, noncombustible, etc.); building size; building value; type of occupancy; type of business; etc.

For information purposes, several insurance companies were contacted and quoted rates for commercial insurance were provided to illustrate the influence the Public Fire Protection Classification System has on insurance premiums.

Table 3 - Example Commercial Insurance Premiums at varying PFPC Classifications[1]

	Public Fire Protection Classification										
Commercial Building	Building Value	10	9	8	7	6	5	4	3	2	1
		Annual Premiums ($)									
Office	$ 100,000	621	571	538		504					
Church	$ 200,000			2,440			1,680			1,260	
Warehouse	$ 274,000	2,504	2,331	2,033	1,997	1,964	1,915	1,857	1,830	1,808	1,783

[1] Note that Fire Underwriters Survey does not set rates for insurance. The values shown are based on data collected from a number of insurance companies quoted rates.

For further information, the following table was developed to forecast what insurance premium savings would be if a community improved its Public Fire Protection Classification from PFPC 8 to PFPC 7. Additionally, the insurance savings were forecast for a community that improved its Public Fire Protection Classification from PFPC 7 to PFPC 4, and for PFPC 8 to PFPC 4. The cost savings were forecast over a 10 year period.

Table 4 Cost Benefit Forecast (10 year) of Varying Improvements to PFPC[1]

	Total Commercial Property Values						
PFPC Class Improvement	$5 Million	$10 Million	$25 Million	$50 Million	$100 Million	$250 Million	$500 Million
	Estimated total insurance premiums for all commercial properties forecast over 10 years						
8 to 7	$19,000	$38,000	$ 95,000	$190,000	$380,000	$ 950,000	$1,900,000
7 to 4	$10,500	$21,000	$525,000	$105,000	$210,000	$ 525,000	$1,050,000
8 to 4	$29,500	$59,000	$147,500	$295,000	$590,000	$1,475,000	$2,950,000

As can be seen, the cost benefit of achieving a lower fire insurance grading can be significant. Communities can achieve lower fire insurance grades by providing an improved level of fire protection and reducing their fire risk.

The first and most important reason to provide improved levels of fire protection is to protect lives. However the cost of providing fire protection can be significant and in some cases communities find it is difficult to convince constituents and other stakeholders of the merits of providing an effective and up to date fire protective service program.

Communities that develop their fire protective services effectively can offset the cost of improved levels of fire protection with reduced property insurance rates.

For further information on the fire insurance grading process, potential benefits and information about your community's fire insurance grades, please contact:

Michael Currie, AScT.
Fire Protection Specialist
Western Canada

Telephone: (604) 609-4125
Toll Free in BC: 1-800-665-5661
Fax: (604) 688-6986

Fire Underwriters Survey
3999 Henning Drive, Suite 101
Burnaby, BC
V5C 6P9