



***FINAL***

City of Fort Saskatchewan  
Fire Insurance Grade Update Report

2013

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# 1. SCOPE OF OUR ENGAGEMENT

Fort Saskatchewan Fire Department contracted the services of Opta Information Intelligence Inc. (formerly IAO) to update the Fire Insurance Grades within the community and provide recommendations for Grade improvement.

The findings were requested to be outlined within a report format. The report will provide an update on the City of Fort Saskatchewan's Fire Insurance Grading assignments and make recommendations aimed at improving the level of public fire protection and improving fire insurance grading classifications of the City of Fort Saskatchewan.

## 1.1. Acknowledgement

Opta Information Intelligence Inc. wishes to thank Fort Saskatchewan Fire Department and City of Fort Saskatchewan Public Works.

## 1.2. Distribution of Use

This report, along with the findings and conclusions, contained herein, is intended for the sole use of Fort Saskatchewan Fire Department to assist in the public fire protection planning needs of the community.

Judgements about the conclusions drawn, and opinions presented in this report should be made only after considering the report in its entirety. This report is Private and Confidential and is intended for the exclusive use of Fort Saskatchewan Fire Department.

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## 1.3. Reliance and Limitation

We have relied on the general accuracy of information provided by stakeholders without independent verification. However we have reviewed this information for consistency and reasonableness. The accuracy of our conclusions is dependent upon the accuracy and completeness of this underlying data. Therefore, any discrepancies discovered in this data by the reader should be reported to us and this report amended accordingly, as warranted.



## 2. EXECUTIVE SUMMARY

This report covers a Fire Insurance Grading review update for City of Fort Saskatchewan. The results of the updated Fire Insurance Grading are summarized below for general commercial and residential classifications:

| Fire Insurance Grade                                             | 2005 | 2013 |
|------------------------------------------------------------------|------|------|
| PFPC - Public Fire Protection Classification System (Commercial) | 4    | 4    |
| DPG - Dwelling Protection Grading System (Residential)           | 3A   | 3A   |

The PFPC and DPG Grades have been maintained as a result of this assessment. These results will be published on the Canadian Fire Insurance Grading Index for the City of Fort Saskatchewan.

All items assessed during the Fire Insurance Grading review are discussed throughout the report with recommendations provided considering improving credit within the grading. Overall the level of public fire protection provided within the City of Fort Saskatchewan has graded well. The fire department is well administered and has put many programs in place that provide a good level of public fire protection within the community.

The community should further develop its fire prevention programs as these contribute 20% to the overall PFPC grade for the community and as such have a heavy weighting within the final grade calculation.

Summary tables of credit scores have been provided in section 11. Recommendations are summarized below.

| <b>Recommendations Summary</b>                                                                                         |
|------------------------------------------------------------------------------------------------------------------------|
| Recommendation 1 Acquire Additional Apparatus                                                                          |
| Recommendation 2 Qualify Mechanics to NFPA 1071, Standard for Emergency Vehicle Technician Professional Qualifications |
| Recommendation 3 Annual Ground Ladder Testing                                                                          |
| Recommendation 4 Conduct Site Specific Training and Drills                                                             |
| Recommendation 5 Work with Industrial Sites to Develop Clear Understanding of the Risk Levels for these Sites          |
| Recommendation 6 Implement Complete Pre-Incident Plan Program                                                          |
| Recommendation 7 Develop Fire Prevention Bylaw                                                                         |
| Recommendation 8 Acquire Additional Staff as Needed to Meet Frequency of Inspections                                   |
| Recommendation 9 Implement Software Database for Fire Prevention Inspections                                           |
| Recommendation 10 Develop and Implement Public Education Programs                                                      |
| Recommendation 11 Train Public Educators to NFPA 1035                                                                  |
| Recommendation 12 Implement Sprinkler Bylaw                                                                            |
| Recommendation 13 Improve Redundant Pump Capacity                                                                      |
| Recommendation 14 Improve Reliability of Pumping Capacity                                                              |
| Recommendation 15 Improve Reliability of System through Main Looping                                                   |
| Recommendation 16 Frequency of Available Fire Flow Testing                                                             |



### 3. TERMS OF REFERENCE

| Term                       | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aerial Fire Apparatus.     | A vehicle equipped with an aerial ladder, elevating platform, aerial ladder platform, or water tower that is designed and equipped to support fire fighting and rescue operations by positioning personnel, handling materials, providing continuous egress, or discharging water at positions elevated from the ground.                                                                                                                                                                                                                                                                             |
| Aid - Automatic Aid        | A plan developed between two or more fire departments for immediate joint response on first alarms. This process is accomplished through simultaneous dispatch, documented in writing, and included as part of a communication center's dispatch protocols.                                                                                                                                                                                                                                                                                                                                          |
| Aid - Mutual Aid           | Reciprocal assistance by emergency services under a prearranged plan. This is part of the written deployment criteria for response to alarms, as dispatched by the communications center.                                                                                                                                                                                                                                                                                                                                                                                                            |
| Basic Fire Flow            | The benchmark required fire flow for a community, typically the 95 <sup>th</sup> percentile of calculated required fire flow of all areas within the community. The Basic Fire Flow is the benchmark against which all protective facilities are measured.                                                                                                                                                                                                                                                                                                                                           |
| Building                   | Any structure used or intended for supporting or sheltering any use or occupancy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Building area              | The greatest horizontal area of a building above grade within the outside surface of exterior walls or within the outside surface of exterior walls and the centre line of firewalls.                                                                                                                                                                                                                                                                                                                                                                                                                |
| Building height            | The number of storeys contained between the roof and the floor of the first storey.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Built Environment          | Buildings and structures: human-made buildings and structures, as opposed to natural features.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Combustible                | A material fails to meet the acceptance criteria of CAN4-S114, "Determination of Non-Combustibility in Building Materials."                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Commercial Lines Insurance | A distinction marking property and liability coverage written for business or entrepreneurial interests (includes institutional, industrial, multi-family residential and all buildings other than detached dwellings that are designated single family residential or duplex) as opposed to Personal Lines.                                                                                                                                                                                                                                                                                         |
| Community - Major or Large | An incorporated or unincorporated community that has:<br>• a populated area (or multiple areas) with a density of at least 400 people per square kilometre;<br>AND<br>• a total population of 100,000 or greater.                                                                                                                                                                                                                                                                                                                                                                                    |
| Community - Medium         | An incorporated or unincorporated community that has:<br>• a populated area (or multiple areas) with a density of at least 200 people per square kilometre;<br>AND/OR<br>• a total population of 1,000 or greater.                                                                                                                                                                                                                                                                                                                                                                                   |
| Community - Small          | An incorporated or unincorporated community that has:<br>• no populated areas with densities that exceed 200 people per square kilometre; AND<br>• does not have a total population in excess of 1,000.                                                                                                                                                                                                                                                                                                                                                                                              |
| Company                    | A group of members that is<br>(1) under the direct supervision of an officer or leader;<br>(2) trained and equipped to perform assigned tasks;<br>(3) usually organized and identified as engine companies, ladder companies, rescue companies, or squad companies;<br>(4) usually operates with one piece of fire apparatus (pumper, ladder truck, elevating platform, rescue, squad, ambulance); and<br>(5) arrives at the incident scene on fire apparatus or assembles at the scene prior to assignment.<br>The term company is synonymous with company unit, response team, and response group. |



|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Demand Zone Levels                        | An area used to define or limit the management of a risk situation. A demand zone can be a single building or a group of buildings. It is usually defined in terms of geographical boundaries, called fire management areas or fire management zones.                                                                                                                                                                                                                                                                                                                           |
| Detached Dwelling                         | Buildings containing not more than two dwelling units in which each dwelling unit is occupied by members of a single family with not more than three outsiders, if any, accommodated in rented rooms. Aka. One- and Two-Family Dwelling                                                                                                                                                                                                                                                                                                                                         |
| Dwelling Protection Grade (DPG)           | The fire insurance grade or grades utilized by Personal Lines Insurers in Canada. The DPG is a number between 1 and 5 that is calculated by comparing the fire risk in terms of required fire flows to available resources. Unlike the PFPC system, within the DPG system, the benchmark required fire flow is a constant, and is typical for a Detached Dwelling. The DPG for communities across Canada is determined from a basic survey of the available resources related to fire risk reduction and fire protection capacity.                                              |
| Dwelling, Typical                         | Refers to One- and Two-Family Detached Dwellings:<br>- with no structural exposures (buildings with an area exceeding 9.3 sq.m) within 3 m;<br>- with no unusual fire risks (such as wood shake roofs); AND<br>- with an effective area (all storeys excluding basements) not exceeding 334 sq.m (3,600 sq.ft).                                                                                                                                                                                                                                                                 |
| Emergency Dispatch Protocol               | A standard sequence of questions used by telecommunicators that provides post-dispatch or pre-arrival instructions to callers.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Emergency Incident                        | Any situation to which the emergency services organization responds to deliver emergency services, including rescue, fire suppression, emergency medical care, special operations, law enforcement, and other forms of hazard control and mitigation.                                                                                                                                                                                                                                                                                                                           |
| Emergency Response Facility (ERF)         | A structure or a portion of a structure that houses emergency response agency equipment or personnel for response to alarms. Examples of ERFs include a fire station, a police station, an ambulance station, a rescue station, a ranger station, and similar facilities.                                                                                                                                                                                                                                                                                                       |
| Emergency                                 | A condition that is endangering or is believed to be endangering life or property; an event that requires the urgent response of an emergency response agency.                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Engine                                    | A fire department pumper having a rated capacity of 2840 L/min (625 Igpm) or more.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Exposing building face                    | That part of the exterior wall of a building which faces one direction and is located between ground level and the ceiling of its top storey or, where a building is divided into fire compartments, the exterior wall of a fire compartment which faces one direction.                                                                                                                                                                                                                                                                                                         |
| Exposure                                  | The heat effect from an external fire that might cause ignition of, or damage to, an exposed building or its contents.                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Fire Apparatus                            | A fire department emergency vehicle used for rescue, fire suppression, or other specialized functions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Fire Department Vehicle                   | Any vehicle, including fire apparatus, operated by a fire department.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Fire Department                           | A fire department is a group of persons formally organized as an authorized service of a municipal or other local government having a sustainable source of funding, which could include taxation, fees for services provided, contracts, permit fees or other reliable sources of revenue which will support the cost of services provided. A minimum number of trained persons able and equipped to respond with motorized fire fighting apparatus to extinguish fires or to respond to other classes of circumstances which may occur within a designated geographical area. |
| Fire Department. - Public Fire Department | A legally formed organization providing rescue, fire suppression, emergency medical services, and related activities to the public.                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Fire Force, Available                     | A measure of the human resources that are available to participate in fire fighting operations on the fire ground or an equivalent measure.                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Fire Force, Required                      | A measure of the human resources that are needed to participate in fire fighting operations on the fire ground (or an equivalent measure) for an ideal response based on the required fire flow, number of companies and average response time as specified in the Table of Effective Response.                                                                                                                                                                                                                                                                                 |





|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fire Flow                        | The flow rate of a water supply, measured at 20 psi (137.9 kPa) residual pressure that is available for fire fighting.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Fire Growth Potential            | The potential size or intensity of a fire over a period of time based on the available fuel and the fire's configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Fire Hall                        | An "emergency response facility" where fire department apparatus and equipment are housed, protected against harm, and made readily accessible for use in emergencies. The fire hall is normally the location where fire fighters respond from. Other primary purposes include training and administration of the fire department.                                                                                                                                                                                                                                                                                                           |
| Fire Hydrant                     | A reliable connection to a water main for the purpose of supplying water efficiently and reliably to fire hose or other fire protection apparatus. To be recognized for fire insurance grading purposes, the device shall be designed and installed in accordance with CAN/ULC S520, UL 246 and/or AWWA C502/C503 and listed for use as a fire hydrant by UL and/or ULC.                                                                                                                                                                                                                                                                     |
| Fire Hydrant – Public            | A fire hydrant situated and maintained for public use on a public right-of-way (or easement) to provide water for use by the fire department in controlling and extinguishing fires. The location of a public fire hydrant is such that it is accessible for immediate and unrestricted use by the fire department at all times. Public fire hydrants are owned and maintained by the government entity (ex. city, village, etc.) which is responsible for maintaining the hydrants and water supply distribution system in operating condition at all times and is authorised to levy taxes to fund the operation and maintenance programs. |
| Fire Hydrant – Private           | A fire hydrant located on privately owned property, or on streets not dedicated to public use. Although a private fire hydrant may be connected to a public water supply system, maintenance of the hydrant and access to the hydrant are the responsibility of the property owner. Private hydrants are normally required where buildings are so located on the property or are of such size and configuration that a normal hose lay from a public hydrant would not reach all points on the outside of the building.                                                                                                                      |
| Fire load                        | (as applying to an occupancy) The combustible contents of a room or floor area expressed in terms of the average weight of combustible materials per unit area, from which the potential heat liberation may be calculated based on the calorific value of the materials, and includes the furnishings, finished floor, wall and ceiling finishes, trim and temporary and movable partitions.                                                                                                                                                                                                                                                |
| Fire Protection                  | Methods of providing fire detection, control, and extinguishment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Fire Suppression                 | The activities involved in controlling and extinguishing fires. Fire suppression includes all activities performed at the scene of a fire or training exercise that expose fire department members to the dangers of heat, flame, smoke, and other products of combustion, explosion, or structural collapse.                                                                                                                                                                                                                                                                                                                                |
| First Responder (EMS)            | Functional provision of initial assessment (airway, breathing, and circulatory systems) and basic first aid intervention, including CPR and automatic external defibrillator (AED) capability.<br>A first responder assists higher level EMS providers.                                                                                                                                                                                                                                                                                                                                                                                      |
| First Storey                     | The uppermost storey having its floor level not more than 2 m above grade                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Grade                            | (as applying to the determination of building height) The lowest of the average levels of finished ground adjoining each exterior wall of a building, except that localized depressions such as for vehicle or pedestrian entrances need not be considered in the determination of average levels of finished ground.                                                                                                                                                                                                                                                                                                                        |
| Hazard                           | The potential for harm or damage to people, property, or the environment. Hazards include the characteristics of facilities, equipment systems, property, hardware, or other objects, and the actions and inactions of people that create such hazards.                                                                                                                                                                                                                                                                                                                                                                                      |
| Hazardous Material               | A substance (solid, liquid, or gas) that when released is capable of creating harm to people, the environment, and property.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Incident Commander.              | The person who is responsible for all decisions relating to the management of the incident and is in charge of the incident site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Incident Management System (IMS) | An organized system of roles, responsibilities, and standard operating procedures used to manage emergency operations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |





|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                     | Such systems are also referred to as incident command systems (ICS).                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Initial Attack                      | An aggressive suppression action consistent with fire fighter and public safety and values to be protected.                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Initial Attack Apparatus            | Fire apparatus with a permanently mounted fire pump of at least 250 USgpm (950 L/min) capacity, water tank, and hose body whose primary purpose is to initiate a fire suppression attack on structural, vehicular, or vegetation fires, and to support associated fire department operations.                                                                                                                                                                                                                                                 |
| Ladder Company                      | A fire department company that is provided with an aerial fire apparatus and is trained and equipped to support fire fighting and rescue operations by positioning personnel, handling materials, providing continuous egress, or discharging water at positions elevated from the ground.                                                                                                                                                                                                                                                    |
| Ladder Truck                        | An alternate name for Aerial Fire Apparatus.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Master Stream                       | A portable or fixed fire fighting appliance supplied by either hose lines or fixed piping and that has the capability of flowing in excess of 300 USgpm (1140 L/min) of water or water based extinguishing agent.                                                                                                                                                                                                                                                                                                                             |
| Member                              | A person involved in performing the duties and responsibilities of a fire department, under the auspices of the organization. A fire department member can be a full-time or part-time employee or a paid or unpaid volunteer, can occupy any position or rank within the fire department, and can engage in emergency operations.                                                                                                                                                                                                            |
| Mobile Water Supply (Tanker)        | A vehicle designed primarily for transporting (pickup, transporting, and delivery) water to fire emergency scenes to be applied by other vehicles or pumping equipment.                                                                                                                                                                                                                                                                                                                                                                       |
| Non-combustible                     | A material that meets the acceptance criteria of CAN4-S114, "Determination of Non-Combustibility in Building Materials."                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Non-combustible construction        | The type of construction in which a degree of fire safety is attained by the use of non-combustible materials for structural members and other building assemblies.                                                                                                                                                                                                                                                                                                                                                                           |
| Non-combustible Material            | A material, as defined in NFPA 220, Standard on Types of Building Construction, that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapours when subjected to fire or heat. Materials reported as non-combustible, when tested in accordance with ASTM E 136, Standard Test Method for Behaviour of Materials in a Vertical Tube Furnace at 750°C, are considered non-combustible materials.                                                          |
| Officer                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Officer - Company Officer           | A supervisor of a crew/company of personnel. This person could be someone appointed in an acting capacity. The rank structure could be either sergeant, lieutenant, or captain.                                                                                                                                                                                                                                                                                                                                                               |
| Officer - Incident Safety Officer   | An individual appointed to respond or assigned at an incident scene by the incident commander to perform the duties and responsibilities of that position as part of the command staff.                                                                                                                                                                                                                                                                                                                                                       |
| Officer - Supervisory Chief Officer | A member whose responsibility is above that of a company officer, who responds automatically and/or is dispatched to an alarm beyond the initial alarm capabilities, or other special calls. In some jurisdictions, this is the rank of battalion chief, district chief, deputy chief, assistant chief, or senior divisional officer (UK fire service). The purpose of their response is to assume command, through a formalized transfer-of-command process, and to allow company officers to directly supervise personnel assigned to them. |
| One- and Two-Family Dwelling        | Buildings containing not more than two dwelling units in which each dwelling unit is occupied by members of a single family with not more than three outsiders, if any, accommodated in rented rooms.                                                                                                                                                                                                                                                                                                                                         |
| Optimum Level of Fire Protection    | The combination of fire fighting staff and apparatus that delivers a suppression effort commensurate with the fire demand faced, yet representing the most efficient use of resources in a safe and effective manner.                                                                                                                                                                                                                                                                                                                         |
| Peak Fire Flow                      | All buildings and building groups within a District or Municipality, the highest calculated required fire flow.                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Personal Lines Insurance            | Insurance covering the liability and property damage exposures of private individuals and                                                                                                                                                                                                                                                                                                                                                                                                                                                     |



|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                           | their households as opposed to Commercial Lines. Typically includes all detached dwellings that are designated single family residential or duplex.                                                                                                                                                                                                                                                                                                                                         |
| Personal Protective Clothing              | The full complement of garments fire fighters are normally required to wear while on emergency scene, including turnout coat, protective trousers, fire-fighting boots, fire-fighting gloves, a protective hood, and a helmet with eye protection.                                                                                                                                                                                                                                          |
| Personal Protective Equipment             | Consists of full personal protective clothing, plus a self-contained breathing apparatus (SCBA) and a personal alert safety system (PASS) device.                                                                                                                                                                                                                                                                                                                                           |
| Public Fire Department                    | An organization providing rescue, fire suppression, emergency medical services, and related activities to the public.                                                                                                                                                                                                                                                                                                                                                                       |
| Public Fire Protection Classification     | The fire insurance grade or grades utilized by Commercial Lines Insurers in Canada. The PFPC is a number between 1 and 10 that is calculated by comparing the fire risk in terms of required fire flows to available resources. The PFPC for communities across Canada is determined from an extensive survey and analysis of the fire risk in the built environment and the available resources related to fire risk reduction and fire protection capacity.                               |
| Public Fire Service Communications Center | The building or portion of the building used to house the central operating part of the fire alarm system; usually the place where the necessary testing, switching, receiving, transmitting, and power supply devices are located.                                                                                                                                                                                                                                                         |
| Public Safety Answering Point             | A facility in which 9-1-1 calls are answered.                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Pumper                                    | Fire apparatus with a permanently mounted fire pump of at least 750 USgpm (2850 L/min or 625 Igpm) capacity, water tank, and hose body whose primary purpose is to combat structural and associated fires.                                                                                                                                                                                                                                                                                  |
| Quint                                     | Fire apparatus with a permanently mounted fire pump, a water tank, a hose storage area, an aerial ladder or elevating platform with a permanently mounted waterway, and a complement of ground ladders. The primary purpose of this type of apparatus is to combat structural and associated fires and to support fire-fighting and rescue operations by positioning personnel-handling materials, providing continuous egress, or discharging water at positions elevated from the ground. |
| Required Fire Flow                        | The rate of water flow, at a residual pressure of 20 psi (138 kPa) and for a specified duration, that is necessary to confine and control a major fire in a specific 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.                                                                                                                                                                |
| Storey                                    | That portion of a building which is situated between the top of any floor and the top of the floor next above it, and if there is no floor above it, that portion between the top of such floor and the ceiling above it.                                                                                                                                                                                                                                                                   |
| Wildland/Urban Interface                  | The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.                                                                                                                                                                                                                                                                                                                                                     |



## 4. FIRE UNDERWRITERS SURVEY

Fire Underwriters Survey is a national organization that represents more than 85 percent of the private sector property and casualty insurers in Canada. Fire Underwriters Survey provides data to program subscribers regarding public fire protection for fire insurance statistical and underwriting evaluation. It also advises municipalities if they desire to review the current levels of fire defence in the community and provide direction with recommendations where improvements will enable them to better deal with fire protection problems.

Fire Underwriters Survey offices maintain data from surveys on fire protection programs throughout all municipalities across Canada. The results of these surveys are used to establish the Public Fire Protection Classification (PFPC) and Dwelling Protection Grade (DPG) for each community. The PFPC and DPG is also used by underwriters to determine the amount of risk they are willing to assume in a given community or section of a community.

The overall intent of the grading systems is to provide a measure of the ability of the protective facilities within a community to prevent and control the major fires that may be expected to occur by evaluating in detail the adequacy, reliability, strength and efficiency of these protective facilities.

### 4.1. Fire Insurance Grading Classifications

Public Fire Protection Classification:

The PFPC is a numerical grading system scaled from 1 to 10. Class 1 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 multifamily residential, commercial, industrial, and institutional buildings and course of construction developments.

Fire Underwriters Survey also assigns a second grade for community fire protection, referred to as the Dwelling Protection Grade (DPG), which assesses the protection available for small buildings such as single-family dwellings.

Dwelling Protection Grade:

The DPG is a numerical grading system scaled from 1 to 5. One (1) is the highest grading possible and five (5) indicates little or no fire protection is provided. This grading reflects the ability of a community to handle fires in small buildings such as single family residences.

### 4.2. Public Fire Protection Classification System

The Public Fire Protection Classification grading system is a measure of a community's overall programs of fire protection. The ability of a community's fire defences are measured against recognized standards of fire protection relative to fire hazard and the fire/life safety risk present within the community. The following areas of fire protection are reviewed in the survey and have the following weights within the PFPC grading system:

- Fire Department 40%
- Water Supply 30%
- Fire Safety Control 20%
- Fire Service Communications 10%

The above classifications are conveyed to subscribing companies of Fire Underwriters Survey. FUS subscribers represent approximately 85-90% of the fire insurance underwriters in Canada. Subscribers use this information as a basis in their fire insurance underwriting programs to set limits in the amount of risk they are willing to assume within a given 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, PFPC classifications are a measure of the level of fire protection within a community. Many progressive communities use the classification system to assess the performance of their fire protection programs, and to plan the direction of fire protective services for the future of the community.

It should be noted that PFPC Grades do not apply beyond 5km road response distance from a recognized fire hall.

### 4.3. Dwelling Protection Grading System

Dwelling Protection Grades are based on a 1 to 5 grading system; DPG 5 indicates little or no fire protection being available. Most small and midsize communities that have a gradable emergency water supply are assigned a DPG 3A rating, which the insurance industry has termed fully protected. DPG 3B refers to communities, or portions of communities, that have a recognized fire department but are not protected with a recognized water supply. The insurance industry has termed this ‘semi-protected’. Within the Fire Underwriters Survey grading, a grade of 3B indicates that the fire department is equipped, trained, prepared and adequately staffed to provide “Standard Shuttle Service” to a fire event within a reasonable response time (i.e. utilize a pumper, tender and various related equipment to deliver water to a fire site and provide structural fire fighting at the fire event).

The protected assignment refers to DPG 1 to DPG 3A. An unprotected designation refers to DPG 5. DPG 3B and 4 are given the semi-protected designation. The lower the DPG assignment is, the larger the discount given in fire insurance rates. The discounts given for an identical property considered fully-protected over those considered unprotected can be approximately 60%. Where there is sufficient population and sufficient taxation base, the savings generated can more than offset the operating and capital costs of an effective fire service.

A summary of the requirements for the Dwelling Protection Grade system is provided in APPENDIX A Dwelling Protection Grade Summary of Basic Requirements.

Many insurers have simplified the Dwelling Protection Grading system to a simple three tier system. This is typical for setting insurance premium rates for detached single family residences only.

Different insurers utilize the Dwelling Protection Grades differently to set their own rates based on the marketplace and their own loss experiences. The three tier system that is typically used by many insurers is shown in Table 1 FUS Grades Correlation to Commonly used Insurance Terminology and Simplified Grades.

Table 1 FUS Grades Correlation to Commonly used Insurance Terminology and Simplified Grades

| Fire Underwriters Survey<br>Dwelling Protection Grades | System Used by Many Insurance<br>Companies<br>“3 tier” system | Insurance Companies typically refer to this<br>grade as |
|--------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------|
| 1                                                      | Table I                                                       | Fully Protected, Career                                 |
| 2                                                      | Table I                                                       | Fully Protected, Composite                              |
| 3A                                                     | Table I                                                       | Fully Protected, Volunteer                              |
| 3B <sup>1</sup>                                        | Table II                                                      | Semi-Protected, Volunteer (Shuttle)                     |
| 4                                                      | Table II or III                                               | Limited-Protection, Volunteer                           |
| 5                                                      | Table III                                                     | Unprotected                                             |

The fire insurance industry has minimum requirements that communities must meet in order for their fire protection program to receive recognition.

It should be noted that DPG Grades do not apply beyond 8km road response distance from a recognized fire hall.

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<sup>1</sup> Note that communities qualifying for Dwelling Protection Grade of 3B may also be able to achieve an equivalency to 3A through Superior Tanker Shuttle Service Accreditation.



## 4.4. Measuring Fire Risk in This Review

The strength of fire defence within a community depends largely on the will and financial ability of the community to support this emergency service. Fire Underwriters Survey and the National Fire Protection Association statistics indicate that the larger the population of a community, the higher the level of fire protection, when measured against the risk of fires within the community. The best scenario for the level of fire protection occurs when expectations of fire suppression and prevention match the community's willingness to pay for this expectation.

Community growth resulting from capital developments increases the level of fire risk; however, the development of fire protective services often falls behind the developments, particularly in communities where growth happens quickly. If the community expectation levels are constant and the fire protective service level is also constant, then as the fire risk level increases the fire protection level relative to the fire risk level decreases and community expectation (for a reasonable level of fire protection) may no longer be met.

### *Optimum Level of Fire Protection*

The combination of fire fighting staff and apparatus that delivers a suppression effort commensurate with the fire demand faced, yet representing the most efficient use of resources in a safe and effective manner.

## 4.5. Overview of the Assessment Process

There is no 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 the community's fire loss experience. Fire defences should be tailored with these issues in mind. 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 the financial acceptability of the community paying for the service.

Fire Underwriters Survey 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 on 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 of controlling and extinguishing most fires that may occur.

In the case of the City of Fort Saskatchewan, the fire protective service was measured in its ability to provide public fire protection to the 90<sup>th</sup> percentile Required Fire Flow calculated within the community when considering the fire department response. These risks included (but were not limited to): single family residential, multiple family residential and commercial buildings.

Fire Underwriters Survey examines the entire program of the community's fire defence in order to assess and grade the overall program. There are some areas within a FUS grading that carry substantial weight, such as:

- Type and number of apparatus
- The condition and age of fire apparatus and fire suppression equipment
- The type of apparatus and ancillary equipment for the hazards present
- Pumping capacity
- The type of staffing (i.e. career firefighters vs. volunteers)
- The distribution of companies relative to fire risk
- Response to alarm protocols
- Response times to critical risks
- Management of emergency services



- The quality of training programs for the fire fighter including specialized training
- The availability, adequacy and reliability of emergency water supplies.
- Fire prevention inspections
- Public education programs
- Building controls (application of Building Codes and related standards; plan review process; effective construction inspection and permit process)
- Automatic fire protection systems
- Emergency communication systems



## 5. PROJECT SCOPE AND METHODOLOGY

### 5.1. Project Objectives

The scope of this project is as follows:

- Update the Fire Insurance Grades for the City of Fort Saskatchewan and provide recommendations aimed at improving the Fire Insurance Grading assignments.

The tasks and methodology used to conduct the assessment are listed below:

- Community Risk and Hazard Assessment including
  - Assessment of community profile
  - Required Fire Flow Calculations
  - Profile and quantify hazard and risk
- Fire Department Assessment of
  - Fire Department Profile
  - Apparatus and equipment
  - Distribution of resources
  - Pumping capacity
  - Maintenance programs
  - Staffing and personnel
  - Training programs
  - Administration
  - Pre-Incident Planning Program
- Water Supplies for Public Fire Protection Assessment
- Fire Safety Control Assessment
- Fire Service Communications Assessment
- Complete a Fire Insurance Grading Review

The following key contacts were made and provided information throughout the survey and development of the report:

- James Clark, Fire Chief
- Betty-Lynne Akins, Deputy Chief and Safety Codes Officer
- Shawn Calder, Fire Services Officer
- Tammy Wiltzen, Fire Services Assistant
- Bradley McDonald, Engineering Coordinator
- Public Works Staff



## 6. COMMUNITY RISK AND HAZARD ASSESSMENT

### 6.1. Background

A fire hazard and risk assessment was conducted throughout the City of Fort Saskatchewan to aid in determining the community's fire protection needs and to assist in assessing the adequacy of the current fire hall location and distribution of apparatus. A risk and hazard assessment, along with a response distance review, lays the groundwork for determining fire protection needs within a community. This assessment is important in ascertaining organizational structure, personnel requirements, training requirements, fire apparatus and fire equipment needs, response time requirements and adequacy of fire hall locations.

The "Risk and Hazard Assessment" is an evaluation of the fire loading and risk present in a given area.

### 6.2. Measuring Fire Risk

Adequate response to a fire emergency is generally measured by the speed with which a responding fire fighting crew(s) can arrive at the fire emergency with the correct type and amount of resources, to have a reasonable degree of opportunity to control or extinguish a fire. Simply put, the response provided by a fire fighting crew should equal the potential severity of the fire or fire emergency.

The potential severity of a fire event is generally associated with the fuel load present and exposures to the fire. Factors such as building construction materials; quality of construction; building renovation history; building size, height and age; occupancy and hazards associated with the occupancy, will all contribute to the potential severity of a fire. In addition, other buildings sufficiently exposed to a burning building can contribute to the magnitude of a fire and the resources necessary to be in place to control or extinguish a given fire. Alternatively, building controls and automatic fire protection systems (both active and passive) that limit fire spread will reduce the potential severity of a fire. For building controls to be considered effective, their design, installation and maintenance must also be reviewed as any weak link may result in the system being ineffectual.

Much of the research into fire protection requirements for individual buildings and communities and the corresponding number of pumper companies and response times has been conducted by Fire Underwriters Survey and the National Fire Protection Association (NFPA). Fire Underwriters Survey evaluates adequacy of response by comparing the potential severity of fires that may occur with a rating of the ability of fire crews and their resources responding within a specified time period relative to the fire and life safety risk potential that may be needed.

The base point for measuring fire risk and the resultant available and adequate response is the determination of Required Fire Flows.

### 6.3. Required Fire Flows

Required fire flows may be described as the amount and rate of water application, and company response, 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 exposures. Required Fire Flows within the Fire Insurance Grading consider property protection.

Required Fire Flows were calculated for buildings throughout the City of Fort Saskatchewan using the methodology described in the Fire Underwriters Survey 1999 Guideline "Water Supply for Public Fire Protection" (refer to APPENDIX B Fire Underwriters Survey – 1999 – Water Supply for Public Fire Protection). The calculation takes into account the construction type, occupancy, exposures, total effective area, and the fire protection systems in place for each risk. The Required Fire Flow calculation is based on the following formula:



$$F = 220C\sqrt{A} \text{ .....see additional notes}^2$$

Where:

- C=coefficient related to the type of construction
- A=total effective building area

14 Required Fire Flows were calculated as shown in Table 2 Specific Required Fire Flow Calculations with values additionally assigned based on anticipated need of resources for various industrial resources, see Table 5 Fire Underwriters Survey - Table of Effective Response (Fire Underwriters Survey methodology for the calculation of Required Fire Flows would not apply to some industrial facilities with response resources needing to be determined through a facility specific risk assessment which is beyond the scope of this report). The Required Fire Flows are shown in Figure 1.

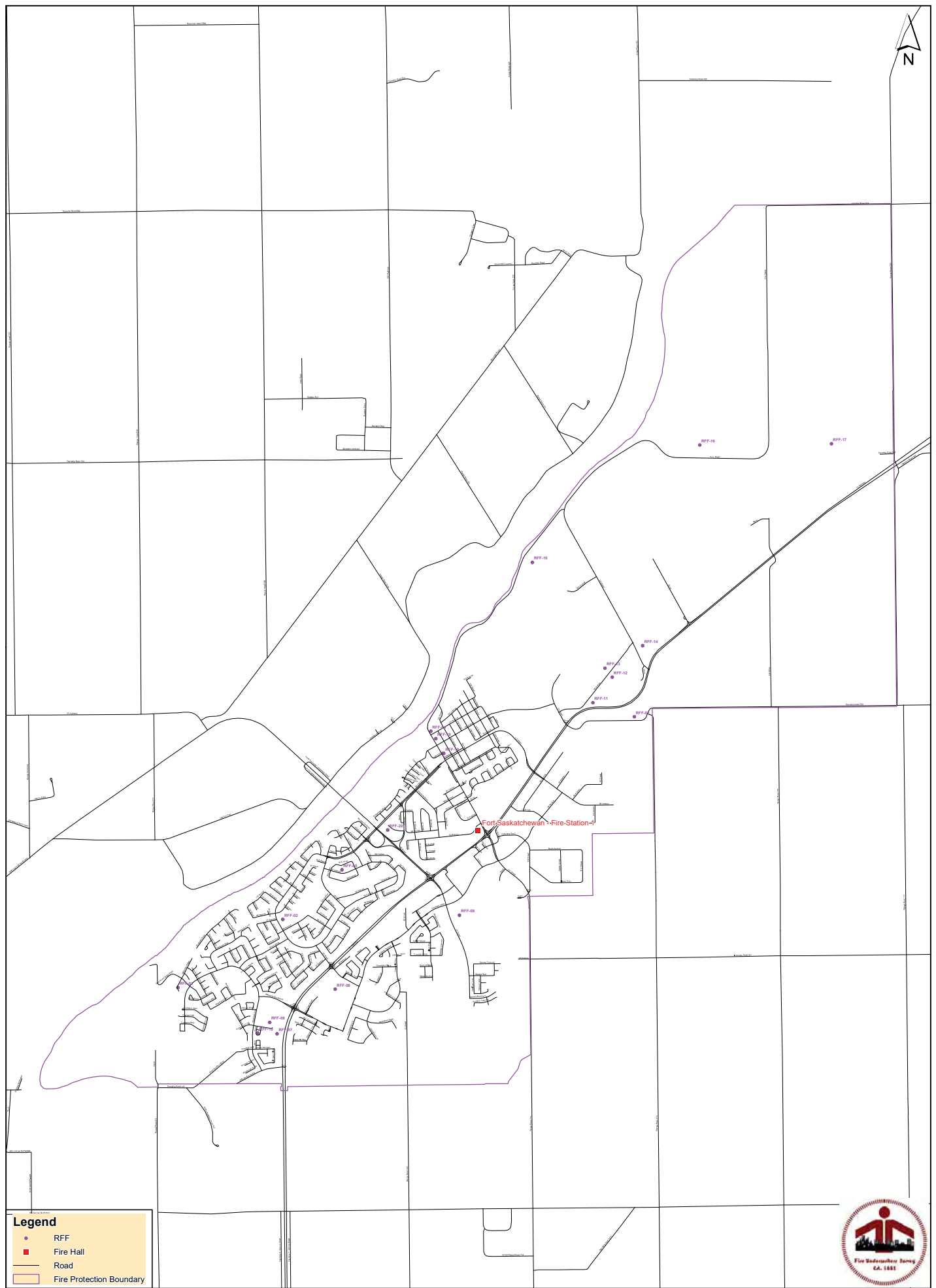
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<sup>2</sup> Adjustments for occupancy, automatic fire protection systems, exposures are detailed in Fire Underwriters Survey 1999 Guideline "Water Supply for Public Fire Protection".



Table 2 Specific Required Fire Flow Calculations

| RFF # | Address | Building Name      | Footprint Area<br>$m^2$ | Number of<br>Storeys | Effective<br>Total<br>Area<br>$m^2$ | Building<br>Construction | Coeff | Occupancy<br>Charge | Sprinkler<br>Protection<br>Reduction | Exposure<br>Charge | F <sub>3</sub><br>LPM | F <sub>3</sub><br>IGPM | Comments            |
|-------|---------|--------------------|-------------------------|----------------------|-------------------------------------|--------------------------|-------|---------------------|--------------------------------------|--------------------|-----------------------|------------------------|---------------------|
| 1     | RFF-01  | SFR                | 241                     | 2.0                  | 482                                 | Woodframe                | 1.5   | -20%                | 0%                                   | 70%                | 10,000                | 2,200                  |                     |
| 2     | RFF-02  | James Mowat School | 3,430                   | 1.0                  | 3,430                               | Ordinary                 | 1     | -15%                | -30%                                 | 18%                | 10,000                | 2,200                  |                     |
| 3     | RFF-03  |                    | 4,855                   | 2.0                  | 9,710                               | Non-combustible          | 0.8   | -10%                | -40%                                 | 5%                 | 10,000                | 2,200                  |                     |
| 4     | RFF-04  | MFR                | 900                     | 4.0                  | 3,600                               | Woodframe                | 1.5   | -15%                | 0%                                   | 10%                | 19,000                | 4,200                  |                     |
| 5     | RFF-05  | MFR                | 865                     | 2.0                  | 1,730                               | Woodframe                | 1.5   | -15%                | 0%                                   | 34%                | 16,000                | 3,500                  |                     |
| 6     | RFF-06  | Dow Centre         | 11,203                  | 2.0                  | 22,406                              | Non-combustible          | 0.8   | -15%                | -40%                                 | 5%                 | 14,000                | 3,100                  |                     |
| 7     | RFF-07  | MFR                | 4,139                   | 4.0                  | 16,556                              | Woodframe                | 1.5   | -20%                | -40%                                 | 5%                 | 22,000                | 4,800                  |                     |
| 8     | RFF-08  | MFR                | 2,508                   | 4.0                  | 10,032                              | Woodframe                | 1.5   | -20%                | -40%                                 | 8%                 | 18,000                | 4,000                  |                     |
| 9     | RFF-09  | Hospital           | 9,027                   | 2.0                  | 18,054                              | Non-combustible          | 0.8   | -15%                | -50%                                 | 0%                 | 10,000                | 2,200                  |                     |
| 10    | RFF-10  | MFR                | 506                     | 2.0                  | 1,012                               | Woodframe                | 1.5   | -20%                | 0%                                   | 40%                | 11,000                | 2,400                  |                     |
| 11    | RFF-11  | ATCO Midstream     | N/A                     | N/A                  | N/A                                 | N/A                      | N/A   | N/A                 | N/A                                  | N/A                | N/A                   | 5,000                  | Demand<br>node only |
| 12    | RFF-12  | Ferus              | N/A                     | N/A                  | N/A                                 | N/A                      | N/A   | N/A                 | N/A                                  | N/A                | N/A                   | 3,000                  | Demand<br>node only |
| 13    | RFF-13  | Chemtrade          | N/A                     | N/A                  | N/A                                 | N/A                      | N/A   | N/A                 | N/A                                  | N/A                | N/A                   | 3,000                  | Demand<br>node only |
| 14    | RFF-14  | Praxair            | N/A                     | N/A                  | N/A                                 | N/A                      | N/A   | N/A                 | N/A                                  | N/A                | N/A                   | 3,000                  | Demand<br>node only |
| 15    | RFF-15  | Agrium             | 4,594                   | 1.5                  | 6,891                               | Non-combustible          | 0.8   | 25%                 | 0%                                   | 0%                 | 19,000                | 3,000                  |                     |
| 16    | RFF-16  | Petrogas storage   | N/A                     | N/A                  | N/A                                 | N/A                      | N/A   | N/A                 | N/A                                  | N/A                | N/A                   | 5,000                  | Demand<br>node only |
| 17    | RFF-17  | Scotford refinery  | N/A                     | N/A                  | N/A                                 | N/A                      | N/A   | N/A                 | N/A                                  | N/A                | N/A                   | 5,000                  | Demand<br>node only |
| 18    | RFF-18  | MFR                | 633                     | 4.0                  | 2,532                               | Woodframe                | 1.5   | -15%                | 0%                                   | 35%                | 20,000                | 4,400                  |                     |
| 19    | RFF-19  | MFR                | 552                     | 4.0                  | 2,208                               | Woodframe                | 1.5   | -15%                | 0%                                   | 25%                | 17,000                | 3,700                  |                     |
| 20    | RFF-20  | MFR                | 1,261                   | 3.0                  | 3,783                               | Woodframe                | 1.5   | -15%                | 0%                                   | 30%                | 22,000                | 4,800                  |                     |



## 7. FIRE UNDERWRITERS SURVEY – Fire Department Assessment

### 7.1. Fire Department Grading Items

The following items are assessed as part of this study and as part of the fire insurance grading process.

Areas analyzed in the assessment of the Fire Department are as follows:

- FD – 1: Engine Service
- FD – 2: Ladder Service
- FD – 3: Distribution of Companies
- FD – 4: Engine and Ladder Pump Capacity
- FD – 5: Design, Maintenance and Condition of Apparatus
- FD – 6: Number of Line Officer – Fire Suppression
- FD – 7: Total Fire Force Available
- FD – 8: Engine and Ladder Company Unit Manning
- FD – 9: Master and Special Stream Devices
- FD – 10: Equipment for Engines and Ladder Apparatus
- FD – 11: Fire Hose
- FD – 12: Condition of Fire Hose
- FD – 13: Training and Qualifications
- FD – 14: Response to Alarms
- FD – 15: Fire Ground Operations
- FD – 16: Special Protection Required
- FD – 17: Miscellaneous Factors and Conditions
- FD – 18: Pre-Incident Planning
- FD – 19: Administration

### 7.2. Setting the Basic Fire Flow for the City of Fort Saskatchewan

The Basic Fire Flow is determined from the analysis of the Required Fire Flows. It is important to stress that the Basic Fire Flow assigned is not the peak Required Fire Flow and is intended to be adequate for approximately 90 - 95 percent of the typical structure fires that are expected to occur based on the Required Fire Flows calculated during the risk assessment.

The Basic Fire Flow for the City of Fort Saskatchewan has been set at 4,100 Igpm in 2013.

Required Fire Flows calculated that were higher than the Basic Fire Flow are not excluded from fire insurance grading. They are still utilized under specific items of the grading. Additional resources and planning may be required to adequately provide protection to peak Required Fire Flow risks.

### 7.3. Engine Service

Fire departments are evaluated for the number of engine companies in service relative to the overall fire potential and the area being protected. Engine apparatus are required to be adequately housed and staffed in order to receive full credit.

The engine service grading item refers to the amount of credit received for each of the department's engines. Recognition and credit for engines may be reduced or withheld based upon the measured reliability of the pumps and the apparatus upon which they are installed (ex. factors such as age, listing, testing, etc.).

Fire apparatus that serve dual purposes are evaluated based on the primary duty it serves on the fire ground. For example, a ladder apparatus with a fire pump may be credited in one of two ways.

- 100 percent credit as a ladder apparatus and 50 percent credit as an engine, or
- 100 percent credit as an engine apparatus and 50 percent credit as a ladder apparatus.

This depends upon the number of apparatus a department has available and where credit should be distributed properly in the grading depending on the primary use of the fire apparatus.

The maximum acceptable age of apparatus specified in the fire insurance grading index is 20 years to receive maximum credit. Refer to Appendix D for Insurance Grading Recognition of Used and Rebuilt Fire Apparatus.

The benchmark number of Engine Companies that the City of Fort Saskatchewan can receive credit for based on the Basic Fire Flow of 4,100 IGPM is four engine companies. Values are cross referenced with Table 5 Fire Underwriters Survey - Table of Effective Response.

Additionally, credit can be received for one reserve engine company in this grading item. For fire insurance grading, a fire department should have one reserve engine for each eight engines in service. A fire department even with a single engine company should have a reserve engine.

The Total Credited Engine Companies calculated by summing the Primary Engine Company Credit and the Support Engine Company Credit. The calculation is as follows:

$$CEC_{Total} = ECC_{Primary} + ECC_{Support}$$

|                 |   |                                                               |
|-----------------|---|---------------------------------------------------------------|
| $CEC_{Total}$   | = | Total Credited Engine Company                                 |
| $ECC_{Primary}$ | = | Primary Engine Company Credit (local Fire Halls)              |
| $ECC_{Support}$ | = | Support Engine Company Credit (coming from other areas/halls) |

Primary Engine Company Credit ( $ECC_{Primary}$ ) is set by taking the sum of the number of in service engine apparatus in the hall and downgrading from 100 percent based on reliability factors (including but not limited to age, quality, listing and pump test results).

Support Engine Company Credit ( $ECC_{Support}$ ) is set by taking the sum of the number of support engine apparatus and giving a specified percentage based on the aid being automatic or mutual. If aid is automatic a maximum of 90 percent of the engine company may be credited. If aid is mutual a maximum of 33 percent of the engine company is credited if responding fire apparatus are within 25 kilometres. The credit received is shown in Table 3.

Table 3 Credited In-Service Engine Summary

| Unit #                                       | Vehicle Type | Apparatus Credit | Engine Credit | Reserve Engine Credit |
|----------------------------------------------|--------------|------------------|---------------|-----------------------|
| P9                                           | Engine       | Engine Credit    | 1             | 0                     |
| P8                                           | Engine       | Engine Credit    | 1             | 0                     |
| L1                                           | Quint        | Quint Credit     | 0.5           | 0                     |
| P3                                           | Engine       | Engine Credit    | 1             | 0                     |
| Total Engine/Reserve Engine Credit Received: |              |                  | 3.5           | 0                     |
| Maximum Credit Receivable (BFF 4,100 IGPM):  |              |                  | 4             | 1                     |

City of Fort Saskatchewan received **192** points of credit out of a maximum possible **240** for this grading item.

4 engine apparatus are required for a Basic Fire Flow of 4,100IGPM with the Fort Saskatchewan being credited with 3.5 engine apparatus. Due to the age of apparatus all are credited as engines as opposed to reserve engines. Further credit was received for mutual aid response from both Strathcona County and the City of Edmonton.

#### Recommendation 1 Acquire Additional Apparatus

Further credit is available within the Fire Insurance Grading by acquiring additional apparatus/reserve apparatus.

## 7.4. Ladder Service

Fire departments are evaluated for the number of ladder companies in service relative to the overall fire potential and the area being protected. Ladder apparatus are required to be adequately housed and staffed in order to receive full credit.

The ladder service grading item refers to the amount of credit received for each of the department's ladder apparatus. Recognition and credit for ladders may be reduced or withheld based upon the measured reliability of the apparatus upon which they are installed (ex. factors such as age, listing, testing, etc.).

Fire apparatus that may serve dual purposes are evaluated based on the primary duty it serves on the fire scene. As previously stated, a ladder apparatus with a fire pump may be credited in one of two ways.

- 100 percent ladder credit as a ladder apparatus and 50 percent credit as an engine, or
- 100 percent credit as an engine apparatus and 50 percent credit as a ladder apparatus.

This all depends upon the number of apparatus a department has available and where credit should be distributed properly in the grading depending on the primary use of the fire apparatus.

Response areas with five buildings that are 3 storeys or 10 m (35 ft) or more in height, or districts that have a Basic Fire Flow greater than 3,300 Igpm (250 L/s), or any combination of these criteria, should have a ladder company. The height of all buildings in the community, including those protected by automatic sprinklers, is considered when determining the number of needed ladder companies for fire insurance grading to receive maximum credit. Refer to Appendix E for Requirements for Aerial Apparatus.

The benchmark number of ladder companies that the City of Fort Saskatchewan can receive credit for based on the Basic Fire Flow of 4,100 Igpm is 1. Values are cross referenced with Table 5 Fire Underwriters Survey - Table of Effective Response.

The Total Credited Ladder Companies calculated by summing the Primary Ladder Company Credit and Support Ladder Company Credit. The calculation is as follows:

$$CLC_{Total} = LCC_{Primary} + LCC_{Support}$$

|                 |   |                                                                          |
|-----------------|---|--------------------------------------------------------------------------|
| $CLC_{Total}$   | = | Total Credited Ladder Company                                            |
| $LCC_{Primary}$ | = | Primary Ladder Company Credit (local to the Fort Saskatchewan Fire Hall) |
| $LCC_{Support}$ | = | Support Ladder Company Credit (coming from other areas/halls)            |

Primary Ladder Company Credit ( $LCC_{Primary}$ ) is set by taking the sum of the number of in service ladder apparatus in the hall and downgrading from 100 percent based on reliability factors (including but not limited to age, quality, listing and ladder test results). Credit for ladder apparatus may be given depending on the use of the apparatus.

Support Ladder Company Credit ( $LCC_{Support}$ ) is set by taking the sum of the number of support ladder apparatus and giving a specified percentage based on the aid being automatic or mutual. If aid is automatic a maximum of 90 percent of the ladder company may be credited. If aid is mutual a maximum of 33 percent of the ladder company is credited if responding fire apparatus are within 25 kilometres. The credit received is shown in Table 4.

Table 4 Credited In-Service Ladder Summary

| Unit #                                       | Vehicle Type | Apparatus Credit | Ladder Credit | Reserve Engine Credit |
|----------------------------------------------|--------------|------------------|---------------|-----------------------|
| Ladder                                       | Ladder       | Ladder Credit    | 1             | 0                     |
| Total Ladder/Reserve Ladder Credit Received: |              |                  | 1             | 0                     |
| Maximum Credit Receivable (BFF 4,100 Igpm):  |              |                  | 1             | 1                     |

City of Fort Saskatchewan received **150** points of credit out of a maximum possible **170** for this grading item.

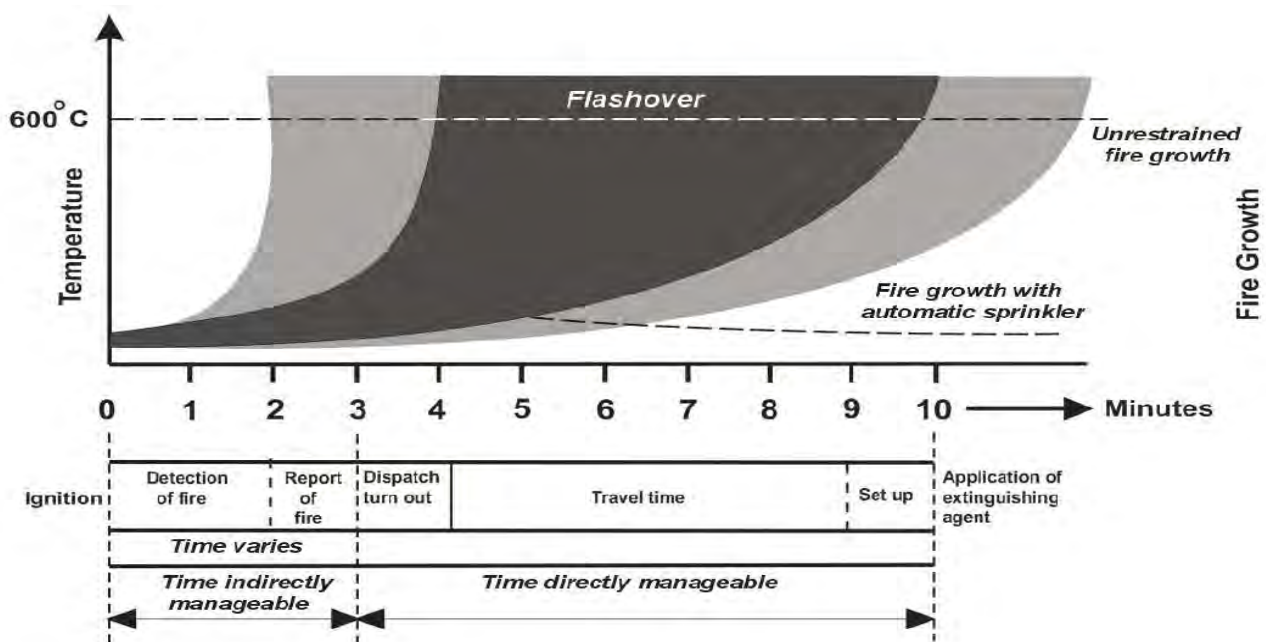
The City of Fort Saskatchewan received near maximum credit in this item of the grading. 1 ladder apparatus is required for a Basic Fire Flow of 4,100IGPM with credit being given for 1 ladder apparatus.

## 7.5. Distribution of Companies

### 7.5.1. Response Assessment

The intent of response assessment and service level policies is to arrive at a fire scene with the necessary resources before the point of flashover, see Figure 2. Beyond the point of flashover, it can become very difficult to combat a fire as fire growth increases exponentially as can be seen.

Figure 2 Fire Propagation Curve



It can be seen from the above that in order for a fire department to arrive with the necessary resources at a specific point of fire growth would require knowledge/control of all aspects of two systems: the fire and the response. In both cases neither system is completely controllable and as such most response standards are based on empirical data and research from mutual agencies. Response standards form the basis of fire hall location/staffing/apparatus.

## 7.5.2. Response Assessment – Fire Underwriters Survey

For response assessment, the Table of Effective Response is used as the benchmark; see Table 5 Fire Underwriters Survey - Table of Effective Response. The following is provided as an example to illustrate how the Table of Effective Response is interpreted:

- A sample building has a Required Fire Flow of 2200 IGPM (167 L/s)
- The requirements for Pumper and Ladder companies is read from the Table of Effect Response as follows:
- Initial response to alarms for Pumper companies is 2, i.e. 1 Pumper company in a first due response time of 3.5 minutes and 1 Pumper company in a second due response time of 5 minutes.
- The total number of Pumper companies required is 3 in 6 minutes.
- In the case of 2200 IGPM (167 L/s) a Ladder company is required only if the building is 3 stories or greater. The total number of Ladder companies that would be required in this case (3 storeys) would be 1 in 4 minutes.
- The response times are then converted into distance using the following formula:

$$D = \frac{T - 0.65}{1.065}$$

Where

- D=distance in kilometres
- T=time in minutes

Individual property response is measured against these benchmarks with 100% credit being applied where the requirements are met. The distance/time formula used here takes into account acceleration/road travel/deceleration and is found to be generally indicative of actual travel response times.





Table 5 Fire Underwriters Survey - 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.

| RISK RATING | BUILDING EXAMPLES                                                                                           | DISTRICT | L/min X1000       | Approx. Igpm Range                   | INITIAL RESPONSE TO ALARMS |                           |                         |                         | FIRE FLOW               |                     |                     |        |
|-------------|-------------------------------------------------------------------------------------------------------------|----------|-------------------|--------------------------------------|----------------------------|---------------------------|-------------------------|-------------------------|-------------------------|---------------------|---------------------|--------|
|             |                                                                                                             |          |                   |                                      | Pumper Companies           | Ladder Companies          | Engine Company, Minutes | Pumper Company, Minutes | Ladder Company, Minutes | 1 <sup>st</sup> DUE | 2 <sup>nd</sup> DUE | TOTAL  |
|             |                                                                                                             |          |                   |                                      |                            |                           |                         |                         |                         |                     |                     |        |
| 1 (a)       | Very small buildings, widely detached buildings.                                                            |          | 2                 | 400                                  | 1                          | 0                         | 7.5                     | -                       | *9                      | 1                   | 7.5                 | *1 9   |
| (b)         | Scattered development (except where wood roof coverings).                                                   |          | 3                 | 600                                  | 1                          | 0                         | 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               | 800-1,000                            | 2                          | 0                         | 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         | 1,200-2,000 2,200-2,800              | 2 2                        | 1(if required by Hazards) | 3.5                     | 5                       | *4                      | 2                   | 5                   | *1 4   |
|             |                                                                                                             |          |                   |                                      |                            |                           | 3.5                     | 5                       | *4                      | 3                   | 6                   | *1 4   |
| 3 (b)       | Seriously exposed tenements. Institutional. Shopping Centres Fairly large areas, fire loads, and exposures. |          | 14-16 17-19       | 3,000-3,600 3,800-4,200              | 2 2                        | 1 1                       | 3.5                     | 5                       | 4                       | 4                   | 7                   | 1 4    |
|             |                                                                                                             |          |                   |                                      |                            |                           | 3.5                     | 5                       | 4                       | 5                   | 7                   | **1 4  |
| 4 (a)       | Large combustible institutions, commercial buildings, multi-storey and with exposures.                      |          | 20-23 24-27       | 4,400-5,000 5,200-6,000              | 2                          | 1                         | 2.5                     | 4                       | 3.5                     | 6                   | 7.5                 | 2 5    |
|             |                                                                                                             |          |                   |                                      |                            |                           | 2.5                     | 4                       | 3.5                     | 7                   | 7.5                 | 2 5    |
| 4 (b)       | High fire load warehouses and buildings like 4(a).                                                          |          | 28-31 32-35       | 6200-6800 7000-7600                  | 3                          | 1                         | 2.5                     | 3.5                     | 3.5                     | 8                   | 8                   | 3 7    |
| 5           | Severe hazards in large area buildings usually with major exposures. Large congested frame districts.       |          | 36-38 39-42 43-46 | 7,800-8,400 86,00-9,200 9,400-10,000 | 3                          | 3                         | 2                       | 3.5                     | 2.5                     | 10                  | 8                   | 4 7.5  |
|             |                                                                                                             |          |                   |                                      |                            |                           | 2                       | 3.5                     | 2.5                     | 12                  | 9                   | 5 8    |
|             |                                                                                                             |          |                   |                                      |                            |                           | 2                       | 3.5                     | 2.5                     | 14                  | 9                   | 6 9    |

Notes to Table of Effective Response

\* A ladder company is required here only when exceptional conditions apply, such as 3 storey heights, significant life hazards.



\*\* For numerous or large single buildings over three stories use two ladder companies in 5 minutes.

When unsprinklered buildings over six stories have fire flow requirements less than Group 4, the number of Pumper and Ladder Companies under “Total Availability Needed” should be increased at least to the next group to provide the additional manpower required except where this additional manpower regularly responds in the time allotted, as occurs in some volunteer or composite fire departments.

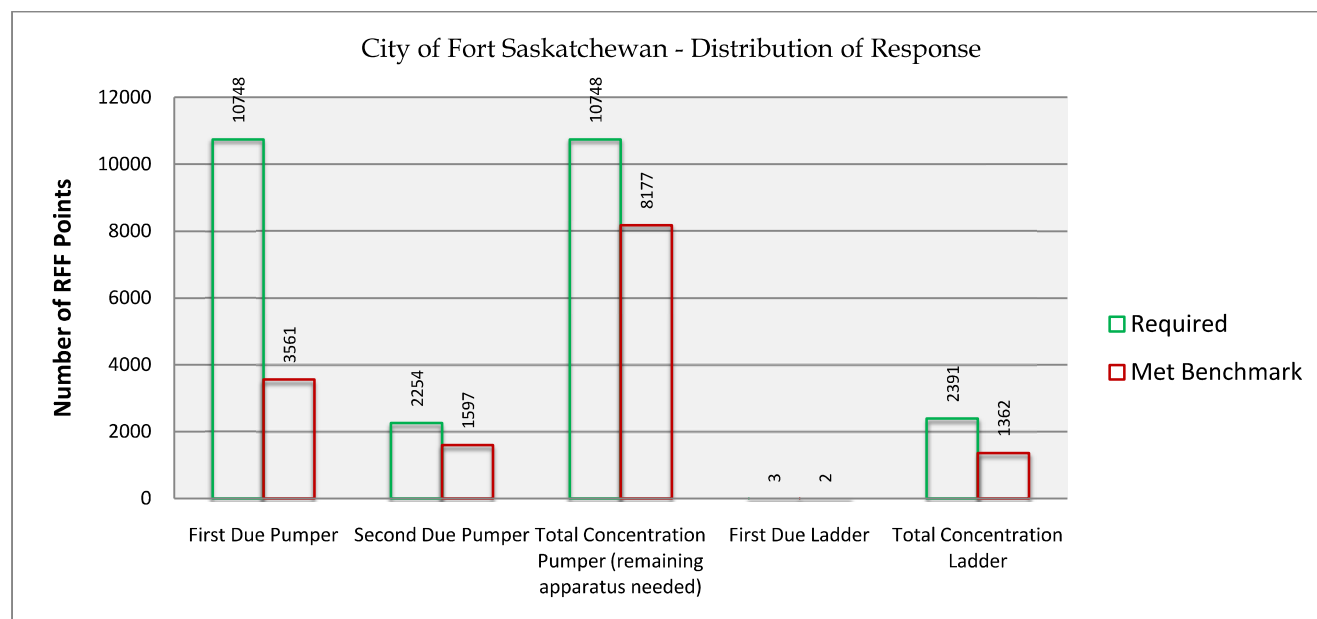
The table gives travel times for apparatus AFTER dispatch and turn-out. Under very exceptional conditions affecting total response time, these nominal figures should be modified.



### 7.5.3. FUS – Distribution of Companies

This is a highly weighted portion of the grading as it identifies the actual response available to each building in the community. As already outlined, Required Fire Flow are assigned to each building (or group of buildings depending on separations) based on base GIS and zoning data and the resultant response is read from Table 5 Fire Underwriters Survey - Table of Effective Response. The response to the building (Required Fire Flow) is then measured against what is actually available using GIS analysis and a percentage credit is applied to the response area. The results of this analysis are shown in Figure 3. Note that the analysis is based on travel time, i.e. after turnout time.

Figure 3 City of Fort Saskatchewan – Distribution of Response



City of Fort Saskatchewan received **123** points of credit out of a maximum possible **200** for this grading item.

The City of Fort Saskatchewan should complete a study concerning the benefits of moving to 2 fire halls in order to reduce road response travel times and obtain further credit within this portion of the Fire Insurance Grading.

## 7.6. Engine and Ladder Pump Capacity

The Engine and Ladder Pump Capacity grading item refers to the capacity of credited, recognized pumps located on fire apparatus. Recognition and credit for pumps on fire apparatus may be reduced or withheld based upon the measured reliability of the pumps and the apparatus upon which they are installed (ex. factors such as age, listing, testing, etc.).

Fire apparatus that may serve dual purposes are evaluated based on the primary duty the apparatus serves on the fire scene (ladder or pump). As previously stated, a ladder apparatus with a fire pump may be credited in one of two ways.

- 100 percent credit as a ladder apparatus and 50 percent credit of the pump on the apparatus, or
- 100 percent for the pump on the ladder and 50 percent credit as a ladder apparatus.



This all depends upon the number of apparatus a department has available and where credit should be distributed properly in the grading depending on the primary use of the fire apparatus.

The benchmark pumping capacity that the City of Fort Saskatchewan can receive credit for is based on the Basic Fire Flow of 4,100 IGPM.

The Total Credited Pump Capacity is calculated by summing the Primary Pump Capacity and Support Pump Capacity. The calculation used is:

$$PC_{Total} = PC_{Primary} + PC_{Support}$$

$PC_{Total}$  = Total Credited Pump Capacity  
 $PC_{Primary}$  = Primary Pump Capacity (local to the specific hall)  
 $PC_{Support}$  = Support Pump Capacity (coming from other areas/halls)

Primary Pump Capacity ( $PC_{Primary}$ ) is set by taking the sum of the rated capacities of the engines or ladders in the hall and downgrading from 100 percent of the rated capacities based on reliability factors (including but not limited to age, quality, listing and pump test results).

Support Pump Capacity ( $PC_{Support}$ ) is set by taking the sum of the rated capacities of the support engines or ladders and giving a specified percentage of the rated capacity based on the aid being automatic or mutual. If aid is automatic a maximum of 90 percent of the pump capacity may be received. If aid is mutual a maximum of 33 percent of the pump capacity is received. The credit received is shown in Table 6.

Table 6 Credited In-Service Engine Summary

| Unit #                        | Vehicle Type | Pump (IGPM) | Tank Imp. Gal | Pump Capacity Credit % | Credited Pump Capacity (IGPM) |
|-------------------------------|--------------|-------------|---------------|------------------------|-------------------------------|
| P9                            | Engine       | 1320        | 500           | 100                    | 1320                          |
| P8                            | Engine       | 1100        | 500           | 100                    | 1100                          |
| L1                            | Quint        | 1500        | 250           | 50                     | 750                           |
| P3                            | Engine       | 1250        | 500           | 100                    | 1250                          |
| Total Credited Pump Capacity: |              |             |               |                        | 4420                          |
| Maximum Credit Receivable:    |              |             |               |                        | 4100                          |

City of Fort Saskatchewan received **165** points of credit out of a maximum possible **170** for this grading item.

The Total Credited Pump Capacity for the City of Fort Saskatchewan is 4420 IGPM for Fort Saskatchewan Fire Department apparatus. Further credit is received for apparatus available under mutual aid with the City of Edmonton and Strathcona County.

A secondary analysis occurs in this grading item that analyzes the Total Credited Pump Capacity to meet the Basic Fire Flow benchmark with the most significant pumper out of service.

## 7.7. Design, Maintenance and Condition of Fire Apparatus

Fire Department apparatus should be of suitable design and well maintained for the emergency service that is to be performed. A breakdown en route to, or on the fire ground could result in loss of life and greater damage to property. Maintenance facilities, quality of maintenance programs, qualifications of maintenance personnel, apparatus suitability and apparatus age are considered in this item.

### Maintenance Facilities



Fort Saskatchewan Fire Department's fire apparatus are maintained at the City Public Works Yard. Mechanics are not trained to NFPA 1071 - Standard for Emergency Vehicle Technician Professional Qualifications. Major pump repairs are completed by Rocky Mountain Phoenix where mechanics are trained as NFPA 1071 Emergency Vehicle Technicians.

### **Engine and Ladder Testing**

Engine and ladder service tests including but not limited to pump testing are valuable in assessing the effectiveness of the preventive maintenance program. Service tests of pumps and ladders on apparatus are generally conducted to show whether the equipment is working correctly.

Annual pump testing on apparatus is completed by Rocky Mountain Phoenix. Aerial testing is also completed annually. Weekly inspections are completed on all vehicles by Fire Department staff.

### **Age, Obsolescence and Condition of Apparatus**

The age of fire apparatus is reviewed within the fire insurance grading system relative to age benchmarks of 15 and 20 years for first line and second line fire apparatus. Fort Saskatchewan Fire Department has an apparatus replacement schedule of 15 years for pumper apparatus and 20 years for aerial apparatus.

City of Fort Saskatchewan received **145** points of credit out of a maximum possible **150** for this grading item.

### **Recommendation 2 Qualify Mechanics to NFPA 1071, Standard for Emergency Vehicle Technician Professional Qualifications**

Again, while it is not required for fire insurance grading purposes, all mechanics working on Fire Department apparatus should be qualified to NFPA 1071, Standard for Emergency Vehicle Technician Professional Qualifications. Again, further credit in the fire insurance grading is available should mechanics working on fire apparatus qualify to NFPA 1071.

## **7.8. Number of Line Officers – Fire Suppression**

The number of Chief Officers and Company Officer positions is reviewed and graded under this item. The number of Chief Officers and Company Officers required to receive maximum credit for this grading item is determined from the Basic Fire Flow and the resulting number of engine and ladder companies associated with the benchmark.

### **Chief Officers**

For fire insurance grading the maximum credit the City of Fort Saskatchewan can receive for Chief Officers is two. Full credit is received for each career Chief or career Deputy Chief on the department. An Auxiliary Chief or Auxiliary Deputy Chief is credited at 50 percent.

Additional credit can be received up to the maximum if there were more individuals assigned and trained to provide duties of the Fire Chief and or Deputy Chief. Credit can be received through a combination of career and auxiliary Chief Officer positions.

The City of Fort Saskatchewan has a career fire chief, 2 career deputy fire chief positions, and a part-time deputy fire chief position.

### **Company Officers**

The number of Company Officers that the City of Fort Saskatchewan can receive maximum credit for fire insurance grading is determined by the total number of engine and ladder companies based on the Basic Fire Flow benchmark and an on duty shift factor. Credit can be received through a combination of career and auxiliary officers on the fire department. Full credit is received for each career officer on the department. Auxiliary officers are credited at 50 percent.

The Fort Saskatchewan Fire Department has 4.5 career officer positions and 14 Paid-on-Call officers.



City of Fort Saskatchewan received **82** points of credit out of a maximum possible **100** for this grading item.

## 7.9. Total Fire Force Available

Under this grading item, a fire department is measured in its ability to meet the staffing requirements as determined by the Basic Fire Flow benchmark from the Table of Effective Response. For the grading of this item there should be at least six competent career fire fighters available and assigned to respond to fire for duty with each required engine and ladder company. The number of these fire fighters that should be on-duty with the apparatus of these companies at all times should be appropriate to the fire risk and fire incidence load.

For the purposes of fire insurance grading, the maximum creditable number of career fire fighters per company is six (including officers). Therefore, the maximum credit that the City of Fort Saskatchewan can receive for this grading item is 30 career fire fighters based on 4 engine companies and 1 ladder company.

The total maximum creditable number of firefighters is based on the number of companies (total concentration) and the maximum creditable number of career fire fighters per company (six) per shift (including officers), available continuously year round (day and night) for fire insurance grading.

Credit for available fire force may be received according to the:

- minimum career fire fighters on duty,
- minimum regular vol. and off shift response of career fire fighters on 1st alarms,
- police officer/fire fighter and ambulance attendant/fire fighter,
- minimum automatic aid response,
- minimum mutual aid response, and
- minimum response of off-shift career fire fighters on multiple alarms.

Note that probationary fire fighters (incomplete training) and junior fire fighters (under age) are not credited due to lack of active fire ground duties.

### **Minimum Career Fire Fighters on Duty**

The minimum number of career fire fighters on duty is determined by reviewing the fire departments records. Records are reviewed to determine the number of fire fighters on duty as during normal vacation periods and sick leaves, but not the absolute minimum that may occur only one or two days a year. This includes career company officers and fire fighters. For fire insurance grading, career fire fighters on duty are equal to one Fire Fighter Equivalent Unit (FFEU).

### **Minimum regular vol. and off shift response of career fire fighters on first alarms**

Fire departments having off duty career members or auxiliary members responding on first alarms may receive credit. Typically three off duty or auxiliary members responding on first alarm are considered as one FFEU for grading purposes. Consideration for credit is based on records being available indicating response statistics. If no records are kept of response, credit for FFEU is limited to one FFEU for each six off duty or auxiliary members claimed to respond.

### **Police and Ambulance Personnel**

Fire Departments may receive credit within the grading of this item for police and ambulance personnel responding and performing fire ground duties. The amount of credit depends upon the extent to which they are available and are used for response to fire alarms. Records of response and training are reviewed to determine that amount of credit that can be received. Each ambulance attendant/fire fighter or police officer/fire fighter on duty in a radio equipped vehicle and responding on first alarm equals 0.5 FFEU.

### **Automatic Aid**

Fire departments that have formal contracts for automatic aid response may receive credit for the personnel responding for this grading item. For personnel to be credited for automatic aid the responding fire department should be within 8 km in road travel



distance to built-up areas of the community or municipality. Each career fire fighter from the responding fire department may be credited as one FFEU and each volunteer fire fighter from the responding fire department may be credited as 0.33 FFEU.

#### **Mutual Aid**

Fire departments that have formal contracts for mutual aid response may receive some credit for the personnel responding for this grading item. For personnel to be credited for mutual aid the responding fire department should be within 25 km of travel distance to built-up areas of the community or municipality. Each career fire fighter from the responding fire department may be credited as one FFEU and each volunteer fire fighter from the responding fire department may be credited as 0.33 FFEU.

#### **Off shift Response on Multiple Alarms**

Fire departments that have formal agreements for career members to respond off shift on multiple alarms may receive credit for members responding within this grading item. Career members responding on multiple alarms are credited on the basis of four off duty career members being equal to one FFEU. Auxiliary members are credited the same as on first alarm as 1/3 if statistical records of response are available or 1/6 if no records of response are available.

City of Fort Saskatchewan received **264** points of credit out of a maximum possible **400** for this grading item.

Fort Saskatchewan Fire Department has a 5 career staff on duty available for response during normal working hours Monday through Friday, 2 career staff are available to respond outside of normal working hours, 44 Paid-on-Call staff were credited under this item with the remaining credit being received through outside aid credit through the Municipal Services Mutual Aid Agreement.

### **7.10. Engine and Ladder Company Unit Manning**

This grading item measures the company unit strength of on-duty paid personnel responding on in-service apparatus. A maximum manning of six can be credited for each in service engine and ladder company.

The number of members credited on-duty and on first alarm response determined from section 7.9 is used in the analysis of this grading item. The number of in-service engines and ladder apparatus is determined from sections 7.3 and 7.4.

The amount of credit received in this grading item is as follows:

| Average Company Staffing | Credit |
|--------------------------|--------|
| 6 members                | 240    |
| 5 members                | 230    |
| 4 members                | 225    |
| 3 members                | 210    |
| 2 members                | 180    |
| 1 member                 | 120    |
| 0 members                | 0      |

The Fort Saskatchewan Fire Department received credit for 15.86 FFEU credited on-duty. The Fire Department has 3 apparatus credited in-service. Fort Saskatchewan Fire Department has an Average Company Staffing of 3.964. Amount of credit received is interpolated between the values indicated in the table above.

City of Fort Saskatchewan received **225** points of credit out of a maximum possible **240** for this grading item.

### **7.11. Master and Special Stream Devices**

This grading item considers the equipment fire fighters would use to be effective in combating large fires and fires in upper storey's or hard to reach locations. Equipment considered under this grading item are fixed and portable turrets, large spray nozzles, distributing nozzles, foam equipment, and elevated master stream devices.





City of Fort Saskatchewan received **48** points of credit out of a maximum possible **50** for this grading item.

## 7.12. Equipment for Engines and Ladder Apparatus, General

This grading item considers the general equipment for engine and ladder apparatus. Equipment includes, but is not limited to, rope, cutters, fire extinguishers, nozzles, first aid equipment, wrenches, generators, salvage tarps, etc.

Inventories have been developed by the fire department to keep track of equipment stored on its fire apparatus. SAF-015-C – Fire Department Service Level identifies NFPA 1931, 1932, 1936, 1961, 1962, 1963, 1964 and 1965 as the standards to use when purchasing, maintaining and testing general equipment.

### **Personal Protective Clothing and Equipment**

All of the fire department members have a set of PPC. There are some spare sets of PPC available (approximately 8). Washing and air drying facilities are in place at the Fort Saskatchewan Fire Hall. Members are responsible for cleaning, care and maintenance of their PPC. An annual PPC inspection program is in place which is conducted in the first quarter of each year. The Deputy Chief of Training and Emergency Management is responsible for the inspection program (Chapter 7, Section 3 – Standard Operational Guidelines). PPC is replaced every 8 years or as required.

A refill station is provided in the fire station for filling of SCBA bottles. SCBA masks and bottles are inspected monthly and records kept in a software database. There is one member on the fire department trained as an SCBA technician.

SAF-015-C – Fire Department Service Level identifies NFPA 1500, 1851, 1852, and 1971 as the standards to use when purchasing, maintaining and replacing PPC.

### **Ground Ladders**

The fire department was reviewed for the number and length of ground ladders carried on fire apparatus and maintenance. Fire Department ground ladders are reported to be tested every 2 years. SAF-015-C – Fire Department Service Level identifies NFPA 1932 for maintenance and testing of ground ladders. NFPA 1932 – 7.1.6 states that ground ladders shall be tested annually.

City of Fort Saskatchewan received **98** points of credit out of a maximum possible **100** for this grading item.

### **Recommendation 3 Annual Ground Ladder testing**

Fire Department ground ladders should be tested annually in accordance with NFPA 1932 – Standard on Use, Maintenance, and Service Testing of In-Service Fire Department Ground Ladders.

## 7.13. Fire Hose

Fire hose used by the fire department should be distributed so that each engine company carries a minimum of at least 360 m (1,200 ft) of 65 mm (2 ½ in) (or larger), 180 m (600 ft) of 38 mm (1 ½ in), and 60 m (200 ft) of 25 mm (1 in) booster hose (or equivalent hose). A fire department should maintain a complete reload or spare hose at the fire hall. Maximum credit for this grading item is given if the fire department meets or exceeds the minimum hose totals. Larger hose may be credited in the place of smaller hose.





City of Fort Saskatchewan received **173** points of credit out of a maximum possible **180** for this grading item.

## 7.14. Condition of Fire Hose

This grading item reviews the condition and maintenance of the fire department's fire hose. Fire hose should be properly cared for. Fire hose failure on the fire ground can lead to injury or death of building occupants or to fire fighters, and result in unnecessary property damage. Suitable facilities should be provided for washing, drying, and storing of fire hose. Fire hose should be maintained in good condition and tested annually to at least 1,700 kPa (250 psi) pressure.

### Testing Program and Age of Fire Hose

A portion of this grading item reviews the testing procedures and frequency of testing of the fire department fire hose. Fire hose should be maintained in accordance with NFPA 1962, *Standard for the Inspection, Care, and Use of Fire Hose, Couplings, and Nozzles and the Service Testing of Fire Hose*, recent edition.

SAF-015-C – Fire Department Service Level identifies NFPA 1962 as the standards to use when purchasing, maintaining and testing fire hose. Chapter 7, Section 1 of the Standard Operational Guidelines covers fire hose maintenance and testing.

### Drying Facilities

Facilities and equipment for cleaning and drying of fire hose are reviewed in this portion of the grading item. There are no hose drying facilities at the Fort Saskatchewan Fire Hall.

City of Fort Saskatchewan received **49** points of credit out of a maximum possible **50** for this grading item.

## 7.15. Training and Qualifications

Fire Department training is commensurate with fire potential in the community or municipality which facilitates the effective handling of fires through provision of a competent force of personnel. The objective of this grading item is to measure qualifications of the members of the department through the results of the training programs, not simply the programs and facilities themselves. The training and qualifications grading item is separated into five areas for review and grading.

Facilities should be provided, sufficient in size and number and suitably equipped, for the proper instruction of all members. There should be a complete, uniform training program under the close supervision of a competent officer; the program should include the study and development of modern practices, including standard operational procedures. There should be a comprehensive schedule of regular classes and drills at the training facility and at fire halls. Special classes for new members, officers, operators, and drivers should be held.

### Quality of Basic Recruit Training

This portion of the grading item reviews the basic recruit training program used by the fire department. The fire department's probation period is considered. Ideally a fire fighter should serve a probation period of up to one year in training status in which thorough training is provided in safe and efficient fire fighting and the probationer is assessed in actual fire service performance.

Training should produce, for most of the force, an all around fire fighter/fire prevention inspector. This allows the fire fighting force to complement the fire prevention staff in the total fire department objective. Recruit training should be separate from the routine drill program.

Fire fighters are selected through an application process as set out in Chapter 1, Section 15 of the Standard Operational Guidelines.

Recruit fire fighters complete 72 hours of basic training which produces a Fire Fighter 4<sup>th</sup> Class and involves:



- Familiarization of equipment
- Personal protection gear
- Fire department response protocols
- Breathing apparatus
- Hose procedures
- Ropes and knots
- Ladders
- Fire behaviour
- Rescue operations
- Fire suppression
- Hostile environment (smoke/training tower)

IFSTA Essentials of Fire Fighting 5<sup>th</sup> edition is used as well as other material deemed applicable.

### **Quality of On-going Drills and Training**

This portion of the grading reviews a fire departments on-going drill and training program. A fire department training program should include practise evolutions, classroom work, firefighting, prevention and other areas, all to be contained in a department manual; as well as inter-company and building familiarization exercises. This program should be under the supervision of an officer in charge with developing, coordinating and evaluating the results.

The Deputy Chief of Operations identifies the core competency skills that must be completed annually. Platoon Captains ensure these skills are maintained. Members must meet a minimum of 50% attendance of skills maintenance training. Completion of skills training is reviewed by the Deputy Chief of Operations. If members do not complete required skills maintenance they are removed from active roster. Training attendance is covered in Chapter 1, Section 13 of the Standard Operational Guidelines. 46 Members are currently trained to NFPA 1001 Level 1 with 31 of these having NFPA 1001 Level 2; the remainder are in various stages of completion of Level 2. Pay scale benchmarks are associated with increasing levels of training. Live Fire training is provided as per NFPA 1403 (Standard on Live Fire Training Evolutions) as per SAF-015-C – Fire Department Service Level.

The Deputy Chief of Operations is trained to NFPA 1041, Level 2 (Standard for Fire Service Instructor Professional Qualifications).

All training is tracked in a software database with gap analysis reports readily available.

### **Qualifications of Line Officers**

A portion of the grading item reviews the fire departments qualifications of line officers and promotion of its members. Within the fire insurance grading, promotions should be carried out under a documented system providing job related criteria for each rank for internal and lateral entry. Written and oral examinations, in-service training, programs directed toward particular job positions, and evaluation by superiors as well as training ground tests should be used for the selection of candidates for fire suppression officer positions. Career, on-call and auxiliary members of the same fire department should be trained to identical qualification levels. (NFPA Standards for Professional Qualifications, 1001, 1002, 1021, 1031 and 1041 are indicative of good practice.)

There are specific requirements for promotion to an officer position. Chapter 1, Section 10 of the fire department's Standard Operational Guidelines covers the promotion to officer position which includes an application review committee and a selection committee. Officer training curriculum is towards NFPA 1021, Level 1.

There are 14 different positions on the fire department each with its own levels of training as specified in Chapter 1, Section 5 of the Standard Operating Guidelines.

### **Qualification of Specialists**

A portion of the grading item reviews the specialized training and qualifications of members of the fire department. Training and education of members of the department on the job or by outside resources should provide personnel with the abilities to perform their manual rescue firefighting, fire fighting or specialist functions effectively in a manner commensurate with the size



of the fire department and the fire potential of the community or municipality, including pump and ladder operators, mechanics, communications and any other fire suppression specialized personnel.

The City of Fort Saskatchewan has various industrial facilities and is experiencing fast growth. Currently 27 members of the Fire Department are certified to NFPA 1081 - Standard for Industrial Fire Brigade Member Professional Qualifications. 4 of these are training as Industrial Fire Brigade Leader and 4 as Advanced Exterior Industrial Fire Brigade Member. Technical rescue is cross trained with the industrial fire brigades currently in place. Site specific response drills for fire are not conducted; however, the Northeast Region CAER association meets on a regular basis to discuss changes at facilities. Site specific emergency response plans are in place for some of the facilities; however, due to the size of the plans it is difficult for the fire department to have good knowledge of scenarios.

### **Facilities for Training**

Facilities for drill and training should be readily available for these purposes and include necessary buildings or structures for ladder work, smoke and breathing apparatus training, use of pumpers and hose lines, lecture space, are all in keeping with the size of the fire department. Larger fire departments should have full training facilities capable of duplicating or simulating a variety of fire types and situations using real fires. Smaller departments may use provincial, regional or cooperative training facilities according to need, but in any case should provide for a broad range of realistic training exercises. Training facilities should always work towards meeting the needs of the potential fires. When a ladder company is required, the tower should be at least 4 stories.

The Fire Department has a training site located at one of the industrial facilities. Live-Fire training is conducted outside of the community and anticipated that every member will complete this training every 2 years.

City of Fort Saskatchewan received **391** points of credit out of a maximum possible **400** for this grading item.

### **Recommendation 4 Conduct Site Specific Training and Drills**

Site specific training and drills should be conducted and pre-incident/facility response plans established that may incorporate portions or all of the site specific emergency response plans.

## **7.16. Response to Alarms**

An adequate initial response of apparatus and personnel upon receipt of an alarm of fire is essential to provide for prompt control of what is generally an escalating emergency. This is required to be pre-arranged in nature as far as possible to ensure reliability. Efficient advance plans should be made for developing a maximum concentration of forces including reserve apparatus and outside assistance for the largest fires. Response should be commensurate with the hazard of the location responded to, with due consideration for the likelihood of other simultaneous fires. Minimum responses to fires in buildings considered reasonable are set out in the Table 7, which is based off the Table of Effective Response.

### **First Alarm Response to Commercial Districts**

The Basic Fire Flow Benchmark of 4,100 Igpm is used to determine the response on first alarm to commercial districts.

### **First Alarms Response to Residential Districts**

An average required fire flow for residential districts was determined and used for the first alarm response for residential districts.

### **Suitable Pre-arranged responses (Running Cards)**

When a fire department requires the response of more than three engine companies determined by the Basic Fire Flow Benchmark, the means of which a fire department has developed pre-arranged responses (running cards) is reviewed.

Running cards should set fourth assignments of specific companies to respond to locations throughout the community or municipality on first and succeeding alarms, even though specific assistance is frequently specified by the officer requesting it. Running cards should call for relocation of companies on second alarms and succeeding alarms may be necessary for the purpose of equalizing depleted coverage of the community or municipality during large fires.



Fort Saskatchewan Fire Department has detailed response guidelines in place as shown in Chapter 4 of the Standard Operational Guidelines. The guidelines were created through critical tasking which was used in developing the Fort Saskatchewan Fire Department Service Level Policy.

Table 7 Initial Response to Alarms of Fire

| Group | General Examples Description                                                                              | Fire Flow     |                    | Response to First Alarm |                            | Add for Severe Life Hazard: Engine, Ladder or Rescue Company, at Least |
|-------|-----------------------------------------------------------------------------------------------------------|---------------|--------------------|-------------------------|----------------------------|------------------------------------------------------------------------|
|       |                                                                                                           | L./min x 1000 | Approx. Igpm range | Engine Companies        | Ladder Companies           |                                                                        |
| 1 (a) | Minor fires not in buildings, very small buildings, widely detached                                       | 1             | 200                | 1                       |                            |                                                                        |
|       |                                                                                                           | 2             | 400                |                         |                            |                                                                        |
| 1 (b) | Scattered development (except wood covered roofs)                                                         | 3             | 600                | 1                       |                            |                                                                        |
| 2     | Typical modern, 1-2 storey residential subdivision, 3-6 m (10-20 ft.) detached.                           | 4-5           | 800 - 1,000        | 2                       |                            |                                                                        |
| 3 (a) | Close 3-4 storey residential & row housing, small mercantile and industrial                               | 6-13          | 1,200 - 2,800      | 2                       | 1 (if required by hazards) |                                                                        |
| 3 (b) | Seriously exposed tenements. Institutional. Shopping Centres. Fairly large areas & fire loads, exposures. | 14-19         | 3,000 - 4,200      | 2                       | 1                          | 1                                                                      |
| 4 (a) | Large combustible institutions, commercial buildings, multi-storey and with exposures.                    | 20-27         | 4,400 - 6,000      | 2                       | 1                          | 1                                                                      |
| 4 (b) | High fire load warehouses and buildings like 4 (a).                                                       | 28-35         | 6,200 - 7,600      | 3                       | 1                          | 1                                                                      |
| 5     | Severe hazards in large area buildings usually with major exposures. Large congested frame districts.     | 36-46         | 7,800 - 10,000     | 3                       | 2                          | 1                                                                      |

#### Suitable Covering-in and 2<sup>nd</sup> Alarm Responses

When a fire department requires the response of more than three engine companies determined by the Basic Fire Flow Benchmark, the means of which a fire department has capacity to provide cover-in and 2<sup>nd</sup> alarm response is reviewed.

If 4 apparatus are committed to a structure call the mutual aid agreement in place with surrounding municipalities would need to be used.

City of Fort Saskatchewan received **96** points of credit out of a maximum possible **100** for this grading item.



## 7.17. Fire Ground Operations

Good results at the fire scene depend on the use of effective and efficient fire suppression methods and standard operating procedures, involving the laying of 65 mm (2 ½ inch) or larger hose lines, connecting pumpers to hydrants, connecting to and supplying sprinkler and standpipe systems in buildings so equipped and the efficient use of breathing equipment and tools and other devices as may be called for by the conditions encountered.

Fire ground operations will also be influenced (favourably or unfavourably) by the adequacy of department manpower, sufficiency of pumper and ladder companies, quality of training and other factors.

Detailed Standard Operating Guidelines are in place and are updated.

### **Initial Available Fire Force Response to Commercial Districts**

This portion of the grading item reviews fast response call members that includes individuals who are specifically designated to be available for first alarms for a given period and are able to respond immediately by motor vehicle, receiving the alarm call by vehicle radio, personal radio, or pager. These may include off shift career fire fighters, volunteers, ambulance attendants and police officers.

As previously discussed Fort Saskatchewan Fire Department has detailed response guidelines in place as shown in Chapter 4 of the Standard Operational Guidelines.

City of Fort Saskatchewan received **291** points of credit out of a maximum possible **300** for this grading item.

## 7.18. Special Protection Required

Some municipalities have particular fire hazards within areas they protect requiring specialized apparatus or equipment which should be provided either by the fire department, individual property owners, or both together. These hazards, including waterfront port and marina facilities, large petrochemical installations or brush and grass fire potentials should be provided for.

As already discussed in section 7.1.15 Fort Saskatchewan Fire Department provides primary/secondary response to various industrial facilities in the community. Site specific emergency response plans are in place for some of the facilities; however, due to the size of the plans it is difficult for the fire department to have good knowledge of scenarios. The City of Fort Saskatchewan will rely on industrial facility contacts to maintain incident command and direct the fire department during a fire scenario. It is unclear if the Fort Saskatchewan Fire Department has a clear understanding of industry expectations during an event and if these expectations are reasonable or whether further gap analysis is needed. It does not appear that the Fort Saskatchewan Fire Department has reviewed a building risk assessment/credible scenarios for the facilities requiring response whether it is primary or secondary. There does not appear to be a memorandum of understanding in place between the facility owners and the fire department. As already discussed various members of the fire department are trained to NFPA 1081 and various members work at the industrial facilities.

City of Fort Saskatchewan received **149** points of credit out of a maximum possible **200** for this grading item.

### **Recommendation 5 Work with Industrial Sites to Develop Clear Understanding of the Risk Levels for these Sites**

Fort Saskatchewan Fire Department should work with the industrial sites to develop a clear understanding of the risk levels present and to create pre-incident plans for these sites. Building fire risk assessments would aid in identifying risks and planning for response. These plans should include available resources from the sites and should be practised with the site personnel.



## 7.19. Miscellaneous Factors and Conditions

### **Records (For Effective Operations, Planning)**

Suitable records of fires, fire operations, personnel, training, fire hose and other essential matters should be kept. Records should be maintained as they are essential to effective and responsible management of a fire department. Daily, monthly, and annual reports are useful management tools for the Fire Chief.

Records of fires, training, tests, attendance and activities in the department should be developed to aid in planning future activity and policy as well as the assessment of performance. Good records of performance evaluations, work record and training should be maintained for each member.

All records are stored in a software database and updated regularly.

### **Fire Halls (Suitability)**

All halls should be of substantial construction, suitable for the service, and located and arranged for ease and quickness of response. Proper safeguards against internal hazards should be provided. Construction of fire halls should be substantial, non-combustible, preferably fire resistive and protected from exposures, with internal and external hazards minimized. Halls should be equipped with adequate heating and lighting with consideration of the need to dry or thaw wet or frozen equipment and perform maintenance on apparatus.

The Fort Saskatchewan Fire Hall is 1.5 storeys with 10 bays and adequate administration and classroom training space. Back-up power supplies are provided and are tested monthly. No major issues were noted.

### **Apparatus Refuelling**

Fuel should be available in sufficient quantities at convenient points within the community or municipality. Suitable arrangements should be made for delivery of fuel to apparatus at fires of long duration.

### **Response Delays (Exceptional)**

Every fire department may have delays in response for personnel or when on route to an emergency. The possibility of delays due to poor condition of roads, including inadequate snow removal and sanding, steep grades, vehicle parking, traffic, railroad crossing, and other similar features should be considered.

No exceptional response delays were noted. The fire hall is well placed in the community. A large amount of residential development is taking place in the south west portion of the community. The Fire Department conducts monthly reviews of response times against their service delivery policy.

City of Fort Saskatchewan received **189** points of credit out of a maximum possible **200** for this grading item.

## 7.20. Pre-Incident Planning

Pre-incident planning is one of the most effective tools a fire department has in controlling or reducing the damage caused by fire. Planning for fires in industrial and commercial occupancies increases the confidence and ability of the fire department in handling the fires and reduces the risk to the life safety of the fire fighters involved.

This grading item reviews the fire departments pre-incident planning program. Review of this grading item looks at the pre-incident plan inspection program, preparation of plans, quality of data, and the use of pre-incident plans in training. This item is connected with a prevention program and looks at the number of inspectable properties receiving inspections with the dual purpose of updating the pre-incident plans.

City of Fort Saskatchewan received **33** points of credit out of a maximum possible **200** for this grading item.





Some pre-incident plans for properties have been created and are available digitally in the apparatus. Plans are created on a high occupancy priority basis; new construction is also being pre-planned. There is no defined program in place for the pre-incident planning of all inspectable properties. There is no update process for the pre-incident plans. Pre-plans are occasionally used in training sessions.

Site specific emergency response plans are in place for some of the industrial facilities; however, due to the size of the plans it is difficult for the fire department to have good knowledge of scenarios.

#### Recommendation 6 Implement Complete Pre-Incident Plan Program

Pre-incident plans can dramatically improve the effectiveness of fire fighting operations and improve safety on the fire ground. Comprehensive pre-incident plans should be developed for all commercial, institutional, industrial and multi-family residential occupancies. These pre-incident plans should be part of training evolutions, desk top exercises and partnership training with large industrial sites which may have some resources (ex. private fire brigades).

Pre-incident plans should ideally be created according to NFPA 1620, Standard for Pre-Incident Planning and updated as needed.

Pre-incident plans for industrial facilities will be similar to a complete emergency manual for the facility. These should include at least the following:

- Life Safety Hazards
- Command structure to be used and key personnel to be consulted
- Structure (facility size and complexity)
- Building Construction
- Occupancy
- Industry-specific common hazards
- Fire protection systems
- Access to facility and process areas
- Presence and location of hazardous materials
- Susceptibility to natural or man-made disasters
- Additional resources
- Staging areas and incident command post locations
- Communications plan
- Special firefighting tactics
- Review, training, and drill cycle
- Recovery of fire protection systems

Emergency response plans and emergency operations plans for the facilities should be consulted. Portions of these plans will be copied into the Fire Department pre-incident response plan. The facilities should be aware of the fire department's ability to respond and the response plan in place. All other agencies involved in emergency response should also be familiar with the plans.

Pre-incident response plans should be regularly updated through site visits, communication with facilities and drill operations. Regular site visits and updating are important during course of construction.

## 7.21. Administration

Fire departments should be administrated and managed by qualified and progressive leadership with adequate authority to carry out its mandate. Adequate procedures should be established to govern the administration and operation of the organization. The fire department should be organized with appropriate staff for routine management and operational fire fighting and emergency command.

The Fort Saskatchewan Fire Department is organized with career administration and is well managed.



City of Fort Saskatchewan received **200** points of credit out of a maximum possible **200** for this grading item.





## 8. FIRE UNDERWRITERS SURVEY – Fire Safety Control Assessment

### 8.1. Fire Safety Control Grading Items

The sections below cover the four grading items that pertain to Fire Safety Control. Twenty percent of the Public Fire Protection Classification for the City of Fort Saskatchewan comes from the grading of Fire Safety Control. Fire Safety Control has become an increasingly heavily weighted portion of the fire insurance grading system. This is as a result of statistical data showing that communities employing effective programs in these areas have significantly reduced fire related losses.

A substantial degree of safety to life and protection of property from fire should be provided by provincial and municipal control of hazards. Control can be best accomplished by the adoption and enforcement of appropriate codes and standards for manufacture, storage, and use of hazardous materials and for building construction, as well as through training, advisory and education programs for the public.

### 8.2. General Program

This grading item reviews the general fire prevention, inspection and investigation activities of the fire department. The official in charge of fire prevention activities, in cooperation with the chief of the fire department, should establish an inspection procedure for correction of: obstructions to exits which interfere with emergency egress or with fire department operations, inadequate or defective automatic or other fire alarm equipment or fire extinguishing equipment or conditions in buildings or other structures which create a severe life hazard potential. Provisions should be made for the investigation of fires.

The fire prevention program should include visiting and inspecting of dwellings on an occupant voluntary basis and the continuous education of the public. The fire department should maintain a highly visible profile in enforcement, education, training, and advisory services.

Fort Saskatchewan Fire Department has one member of the fire department assigned to fire prevention and public education activities (Deputy Chief and Fire Safety Codes Officer). Fire prevention inspections are only completed on complaint or request. There is no fire prevention bylaw in place covering frequency of inspections by occupancy type.

The Deputy Chief and Fire Safety Codes Officer is trained to NFPA 1031, Standard for Professional Qualifications for Fire Inspector and Plan Examiner., Fire Inspector 2 and certified as a Safety Codes Officer with the Safety Codes Council of Alberta. The Deputy Chief is also trained to NFPA 1033, Standard for Professional Qualifications for Fire Investigator.

Fire Safety plans are reviewed for approval.

Public education is mainly through school tours and the PARTY program. Community events and local media are also used for public education. No members are trained to NFPA 1035, Standard for Professional Qualifications for Fire and Life Safety Educator, Public Information Officer, and Juvenile Firesetter Intervention Specialist.

#### Recommendation 7 Develop a Fire Prevention Bylaw/Quality Management Plan Concerning Prevention Inspection Frequency

A fire prevention bylaw/quality management plan should be developed for the City of Fort Saskatchewan with target hazard priority programming. The fire prevention bylaw should address inspections in occupancy types and a course of construction fire risk program which includes regular site inspections during construction facilities. A sample inspection frequency is provided in APPENDIX E FUS Technical Bulletin - Frequency of Inspections.



#### Recommendation 8 Acquire Additional Staff as Needed to Meet Frequency of Inspections

Additional staff should be acquired to meet the frequency of inspections. For maximum credit these positions should be trained to NFPA 1031, Standard for Professional Qualifications for Fire Inspector and Plan Examiner, other required safety codes certifications, and ideally have an industrial background.

#### Recommendation 9 Implement Software Database for Fire Prevention Inspections

A software database (backed-up) solution should be implemented for fire prevention inspection data.

#### Recommendation 10 Develop and Implement Public Education Programs

The Public Education Program should include promotion and development of various elements such as:

Smoke Alarm Installation Program

Hold Regular Fire Department Open Houses

Host Regular Community-Wide Fire Drills

The Program should also include promotion of Educational Programs/Materials such as, but not limited to:

Fire Smart

Fire Prevention Canada

Fire Safety Information

Home Fire Escape Plan Worksheet

Learn Not to Burn® (LNTB®)

Older & Wiser

Kitchen Care Fire Safety Program

"Use Candles with Care"

The Arson Prevention Program for Children (TAPP-C)

FNESS

#### Recommendation 11 Train Public Educators to NFPA 1035

For maximum credit Public Educators should be trained to NFPA 1035, Standard for Professional Qualifications for Fire and Life Safety Educator, Public Information Officer, and Juvenile Firesetter Intervention Specialist.

City of Fort Saskatchewan received **271** points of credit out of a maximum possible **500** for this grading item.

## 8.3. Fire Safety Laws and Enforcement

This grading item reviews the fire safety laws in use and the enforcement of those laws within a community or municipality. Adequate laws or ordinances should be enacted to properly regulate the manufacture, storage, transportation and use of hazardous liquids, gases, and other combustible materials, including the handling of combustible waste, and to properly control building construction and electrical, heating, and ventilating installations. The National Fire and Building Codes of Canada and the Canadian Electrical Codes are accepted as the minimum standard regulation.

For enforcement purposes, inspections shall be made by personnel having specialized knowledge of special hazards by fire company members. Inspections should be made as frequently as may be necessary for the proper enforcement of fire prevention regulations.

Proper records of permits (licenses if required by local regulation), inspections, violations and their correction, and of all other important matters should be kept and analyzed.



The AB Fire Code is used in the City of Fort Saskatchewan. This item looks further at the inspection program in place which has been discussed in the previous section. Recommendations made in the previous section equally apply. Again the main issue is frequency, enforcement of the AB Fire Code, and meeting the frequency.

City of Fort Saskatchewan received **52** points of credit out of a maximum possible **350** for this grading item.

## 8.4. Building Construction Laws and Enforcement

This grading item reviews the building construction laws in use and the enforcement of those laws within a community or municipality. An adequate building construction code and enforcement program should be provided in the municipality, using a code equal to or better than the National Building Code of Canada.

Automatic fire protection sprinklers are installed in some buildings throughout the City of Fort Saskatchewan; however, automatic sprinkler protection systems are typically only installed where required by the AB Building Code. The AB Building Code is a minimum standard and does not require sprinkler systems to be installed in many occupancies that contain high occupant densities and increased life safety risks<sup>3</sup>. Additionally, the AB Building Code does not require pre-existing buildings to be brought up to meet current code requirements.

Sprinkler protection (when designed and installed in accordance with NFPA 13 and maintained in accordance with NFPA 25) is widely accepted as one of the most effective methods of reducing fire risk in buildings and communities. Statistically properly designed, installed and maintained sprinkler systems have been shown to reduce fire losses significantly and reduce the number of lives lost to fire.

City of Fort Saskatchewan received **76** points of credit out of a maximum possible **100** for this grading item.

### Recommendation 12 Implement Sprinkler Bylaw

Credit can be received in the area of fire safety control through implementing a sprinkler bylaw that requires all buildings other than detached dwellings to be sprinkler protected. Furthermore, additional credit could also be received if the City extended this bylaw to include detached dwellings and/or developed a retrofit requirement for the existing building stock.

Implementing a sprinkler bylaw, positively affects Required Fire Flow calculations for sprinklered buildings by reducing the Required Fire Flow if the sprinkler system is properly designed, maintained and tested according to NFPA 13. This also results in lowering the benchmark Basic Fire Flow of the community if implemented in buildings with high Required Fire Flows.

While it was not further reviewed, it is understood that the City of Fort Saskatchewan explored (and continues to) options around a sprinkler bylaw; however, found that the Safety Code Act may make this inoperative.

## 8.5. Electrical Code and Inspections

This grading item reviews the extent of electrical code inspections and enforcement. An electrical code should be applicable and equivalent to the Canadian Electrical Code and be enforced by an inspection and permits program.

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<sup>3</sup> Note: many municipalities now require sprinkler systems (by Bylaw) in many occupancies not specifically required by the National Building Code of Canada or British Columbia Building Code.



City of Fort Saskatchewan received **43** points of credit out of a maximum possible **50** for this grading item.

## 9. FIRE UNDERWRITERS SURVEY - Fire Service Communications Assessment

### 9.1. Fire Service Communications Grading Items

Ten percent of the Public Fire Protection Classification of the City of Fort Saskatchewan comes from the grading of Fire Service Communications. Fire Department dispatch for the City of Fort Saskatchewan is done by Strathcona County. Strathcona County recently completed a Fire Insurance Grading review. Final points in each item are not provided here but are summarized in section 11.



## 10. FIRE UNDERWRITERS SURVEY - Water Supply Assessment

### 10.1. System Description

The City of Fort Saskatchewan Water Distribution System Master Plan, completed by Associated Engineering April 2009, was used as a reference for system details and description as well as further details provided by City of Fort Saskatchewan Engineering.

Water is supplied to the City of Fort Saskatchewan by the Capital Region Northeast Water Services Commission (CRNWSC) from 2 sources: one source is from the City of Edmonton and the second is from Strathcona County. These 2 supply lines combine into one prior to entering the main reservoir. Water is then pumped into the distribution system and fills the elevated water tank and the Westpark reservoir.

Water systems at the industrial sites were not considered as part of this grade update.

#### 10.1.1. Main Pumphouse and Reservoir (M-PR)

The main reservoir has a capacity of 13,640 m<sup>3</sup> (3,000,377 Imp gal.). The pumphouse has 2 distribution pumps (P-2 and P-3) and one standby pump (P-1):

- Electric motor driven service pump P-2 is rated at 94.7 L/s (1250IGPM)
- Electric motor driven service pump P-3 is rated at 94.7 L/s (1250IGPM)
- Diesel engine driven standby pump P-1 is rated at 189.4 L/s (2500IGPM)

#### 10.1.2. Westpark Pumphouse and Reservoir (WP-PR)

The Westpark reservoir has a capacity of 5,000 m<sup>3</sup> (1,099,845 Imp gal.). The pumphouse has 2 distribution pumps (P-10 and P-11) and one fire pump (P-12).

- Electric motor driven service pump P-10 is rated at 50.5 L/s (667IGPM)
- Electric motor driven service pump P-11 is rated at 50.5 L/s (667IGPM)
- Diesel engine driven fire pump P-12 is rated at 303 L/s (4000IGPM)

#### 10.1.3. Elevated Storage Tank

The Tower storage tank has a capacity of 946 m<sup>3</sup> (208090 Imp gal.). The tank has a 250mm inlet and outlet pipe.

### 10.2. Water Supply Grading Items

The sections below cover the 15 grading items that pertain to the water supply. Thirty percent of the Public Fire Protection Classification of the City of Fort Saskatchewan comes from the grading of the water supply.

An adequate and reliable water supply is an essential part of the fire fighting facilities of a community or municipality. A water supply is considered to be adequate if it can deliver the Required Fire Flow for the appropriate duration while simultaneously providing domestic water supply at the max day demand; if this delivery is possible under certain emergency or unusual conditions, the water supply is also considered to be reliable.



In most municipalities, due to structural conditions in some areas, the possibility exists that a combination of unfavourable factors, such as the delayed receipt of an alarm of fire, high winds, or an explosion, will result in a fire becoming large enough to tax the ability of the fire service to confine the fire using the normally available water supply.

If, at the same time, the water supply is lacking or is considerably curtailed due to the failure of essential equipment (reliability), any fire, even if relatively small upon the arrival of the fire department, could rapidly expand and extend to adjoining buildings, becoming a conflagration.

In order to provide reliability, duplication of some or all parts of a water supply system is important, 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, emergencies, 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 depends upon its amount, location and availability.

### **Gravity Systems and Pumping Systems**

Gravity systems delivering supply from the source directly to the community or municipality without the use of pumps is advantageous from a fire protection standpoint because of its reliability, but the reliability of a pumping system can be developed to such a high degree through redundancies and back-up power supplies that no distinction is made between the two types.

### **Storage**

In general, storage reduces the requirements of those parts of the system through which supply has already passed. Since storage usually fluctuates, the total normal daily minimum maintained or 80 percent of capacity is the amount that is considered as available. 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 the required residual pressure at the point of use is considered as available.

### **Pump Capacities**

As part of the grading analysis of pumps for fire insurance grading the capacities of pumps are de-rated by 25 percent to factor in age and reliability.

## **10.3. Normal Adequacy of Supply Works**

The first grading item of the water system considers the ability of the supply works to deliver water at a rate equal to the maximum day demand plus the Basic Fire Flow rate for the time duration specified in APPENDIX B Fire Underwriters Survey – 1999 Water Supply for Public Fire Protection under normal conditions. Credit may be given for the permissible overload rate of delivery from a filtration plant. If the supply works, alone or in conjunction with storage, can deliver the needed quantities to the distribution system, maximum credit will be received for this grading item.

This grading item reviews the supply works for possible limitations. Limitations may be in the intake main size(s), low-lift pumping capacity, raw water main size(s), settling capacity, settled water mains, filter capacity including allowable overload, filtered water main size, high-lift pumping capacity or the transmission main size to the community or municipality.

City of Fort Saskatchewan received **293** points of credit out of a maximum possible **300** for this grading item.

At a Basic Fire Flow of 4100 IGPM, the fire flow duration is 4.125 hours. The Maximum Day Demand for the system is taken as 3.017 MGD (Average Day Demand from AE report is 360L/c/day with peak factor of 2; population in 2011 from Statistics Canada). When considering the supply to the system and storage on the system no major issues were expected under normal conditions.

## **10.4. Reliability of Sources of Supply**

This grading item considers the effect on adequacy of the source of supply. Factors considered for adequacy may include the 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 on the watershed; absence of watchmen where needed; and injury by physical means.

This item considers the miscellaneous factors in the source of supply, especially those due to natural causes that could result in partial or complete interruption of the delivery.

The North Saskatchewan River is the water source for the City of Fort Saskatchewan. The River is susceptible to both drought and flooding.

City of Fort Saskatchewan received **157** points of credit out of a maximum possible **200** for this grading item.

## 10.5. Reliability of Pumping Capacity

The ability of the water supply system to maintain the maximum day demand concurrently with the Basic Fire Flow with one and two pumps out of service is considered under this grading item. The pumps considered out of service are those which would cause a maximum reduction in service delivery to the system. To receive maximum credit, the remaining system capacity in conjunction with available storage, should be able to provide the Basic Fire Flow for the specified duration of the design fire at any time during a period of five days concurrently with consumption at the maximum day demand.

For this grading item a single failure and dual point failure analysis is conducted for the pumps considered as having the greatest impact being out of service.

City of Fort Saskatchewan received **90** points of credit out of a maximum possible **150** for this grading item.

The fire pump P-12 at the Westpark reservoir was considered as being out of service for a period of 5 days and the capacity of the system was considered. With this pump out of service it was found that the system could not provide the maximum day demand plus the Basic Fire Flow rate for the time duration.

The fire pump P-12 and the electric driven service pump P-11 was considered as being out of service for a period of 5 days and the capacity of the system was considered. With this pump out of service it was found that the system could not provide the maximum day demand plus the Basic Fire Flow rate for the time duration.

### Recommendation 13 Improve Redundant Pump Capacity

Further credit is available for Fire Insurance Grading purposes by increasing the redundant pump capacity to provide the maximum day demand plus the Basic Fire Flow considering pumps being out-of-service.

## 10.6. Reliability of Power Supply

The ability of the system to maintain the maximum day demand concurrently with the Basic Fire Flow for the specified duration at any time when considering power interruption that may affect internal or external lines or devices is considered under this grading item.

Electric power supply 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 available storage, of the Basic Fire Flow for the specified duration of the design fire.

Two situations are considered for the reliability of power supply, one with an internal line or device affected, and the second a full grid outage.





City of Fort Saskatchewan received **135** points of credit out of a maximum possible **182** for this grading item.

#### **Internal**

Considering a failure in the diesel driven fire pump the remaining capacity of the system is not adequate for a 2 day outage.

#### **External**

Considering a total power outage P-12 and P-1 are available. The remaining capacity of the system is slightly inadequate for a 2 day outage.

#### **Recommendation 14 Improve Reliability of Pumping Capacity**

Further credit is available for Fire Insurance Grading purposes by having back-up power supply available for pumps.

## **10.7. Reliability, Condition, Arrangement, Operation, and Maintenance of System Components**

This grading item considers the condition of all necessary equipment that is not evaluated in other items which can also include pumps. This evaluation includes equipment such as pressure regulating valves or altitude valves that may be in the distribution system. The capability of personnel to operate the equipment credited under both normal operation and emergency conditions is also considered.

Overall, the Fort Saskatchewan water system graded well in this item.

City of Fort Saskatchewan received **181** points of credit out of a maximum possible **200** for this grading item.

## **10.8. Fire Flow Delivery by Mains**

This item is concerned with the actual rate of delivery of water from hydrants for use in combating fires. Credit is calculated by comparing the Required Fire Flows to Available Fire Flows as determined through actual flow tests conducted in accordance with the procedure specified in NFPA 291, *Recommended Practice for Fire Flow Testing and Marking of Hydrants, recent Edition*. Available fire flows are calculated through interpolation of data to determine the capacity of the water system when flows bring the residual pressure in the system to 20 psi, which is the minimum pressure that is required within the system for fire fighting. It should be noted that FUS makes an assumption that the theoretical value calculated at 20 psi is the available flow, i.e. the system can be drawn down to 20 psi. In areas of the system it may not be possible to draw the pressure down to 20 psi. Additionally, more accurate results on theoretical flows are achieved with a 25% drop in pressure at the static (gauge) hydrant during flow testing. In order to achieve the drop it may be necessary to open various hydrants; however, built and environmental conditions may not allow for this as in the case of some flow testing on the Fort Saskatchewan water system.

Flow test results may be influenced by various factors that may positively or negatively influence the result such as seasonal fluctuations in demand and time of day demand. For this reason, it is important to regularly test water supplies to ensure adequate fire flows can be provided when compared to the Required Fire Flows.

It is important to note that although in some cases Available Fire Flows may be adequate, if hydrant distribution is inadequate it may not be possible to deliver the water at the fire flow rate that is available. Adequate distribution of hydrants is important, particularly when dealing with larger flows. Hydrant distribution is analyzed in section 10.13.

6 flow tests were conducted throughout the City of Fort Saskatchewan with the aid of Public Works staff. In-depth flow testing and comparison with Required Fire Flows was not considered as part of this grade update with only a sample being complete for Fire Insurance Grading purposes. Flow test results are provided in APPENDIX F Flow Test Results. Actual flow testing should be completed at for each non-sprinklered multi-family residential building and compared against a Required Fire Flow calculation





for the building as these building types typically have high Required Fire Flow values. Ideally physical flow testing and Required Fire Flow calculations should be completed for every building in the community.

City of Fort Saskatchewan received **640** points of credit out of a maximum possible **700** for this grading item.

## 10.9. Reliability of Principal Mains

This grading item reviews any and all pipe lines, aqueducts, tunnels, or conduits upon which service is dependent. This includes intakes, suction or gravity lines to pumping stations, flow lines from reservoirs, treatment plant piping, force mains, supply and arterial mains, etc.

In this grading item the ability of the supply works or main arteries in the distribution system to deliver the maximum day demand plus the Basic Fire Flow with the most critical length of main shut off due to a break in the pipe, was analysed. The time duration used in this item is three (3) days which should normally be sufficient to locate the break, isolate it, excavate to the main, make the necessary repairs, sterilize the main, verify the sanitary condition of the main and return the main to service.

Depending on the complexity of the supply works and distribution, the reliability of principal mains may be analyzed for a single main break or several main breaks across the water system. The mains that are analyzed are typically chosen on the basis of causing the most reduction in service.

City of Fort Saskatchewan received **41** points of credit out of a maximum possible **100** for this grading item.

The following mains were considered and the ability of the system was analysed:

- Main from Main reservoir (M-PR)
- Main from Westpark reservoir (WP-PR)

### Recommendation 15 Improve Reliability of System through Main Looping

Further credit is available for Fire Insurance Grading purposes by improving the reliability of the system to provide the maximum day demand plus the Basic Fire Flow with critical lengths of mains shut off.

## 10.10. Installation of Pipes

The Installation of Pipes grading item reviews the installation of mains throughout the water distribution system. The type of water main used, the provision of proper main appurtenances and the manner of installation is evaluated.

Mains should be in good condition and properly installed. Water mains 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, water mains rated for a maximum working pressure of 1,000 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.

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.



The age of water mains in the distribution varies with age and construction. As the water system continues to age water mains should be continually reviewed for reliability and replacement.

City of Fort Saskatchewan received **31** points of credit out of a maximum possible **100** for this grading item.

This item of the grading is linked to areas already considered in the previous item (reliability of principal mains). This item looks at a valve being out-of-service interrupting the main supply line to the system and is a similar analysis to that previous.

## 10.11. Arrangement of Distribution System

The reliability of the arrangement of the mains in the distribution system is reviewed under this grading item. The supply mains, arteries, and secondary feeders should extend throughout the system, should be properly spaced, and looped for mutual support and reliability of service; dependence of relatively large areas upon single mains may constitute a reduction in credit.

This grading item is intended to review the amount of the community that is not serviced by arterial mains and arterial main looping. Also the overall distribution grid is reviewed for dead end mains and the amount of mains that are smaller than 150 mm (6 inch).

The City of Fort Saskatchewan has a minimum standard watermain size of 200mm for single family residential and multi-family residential; and 250mm for industrial/commercial. There is a minor portion of the community not serviced with hydrants.

City of Fort Saskatchewan received **83** points of credit out of a maximum possible **100** for this grading item.

## 10.12. Additional Factors and Conditions Relating to Supply and Distribution

Water Supply grading items 1, 3, 4, 5, and 7 consider the adequacy and the reliability of the supply facility to deliver the maximum day demand concurrently with the Basic Fire Flow. This grading item evaluates, for the same items, the ability of the supply facilities to deliver the maximum day demand concurrently with the peak Required Fire Flow obtained from the risk assessment. It also covers any factors or conditions that will occasionally reduce the fire protection credited in the other items. Additional factors that are considered when analyzing the distribution system include built on areas that are not served, localized weakness, and service levels that are not considered.

City of Fort Saskatchewan received **147** points of credit out of a maximum possible **200** for this grading item.

## 10.13. Distribution of Hydrants

The ability of the distribution system to deliver adequate rates of flow for fire protection to various locations of a community or a municipality does not alone provide good fire protection. There should be sufficient hydrants to allow the required rate of flow to be delivered to fire department engines and these hydrants should be well spaced in order to keep the length of fire department hose lines short. This grading item compares the existing hydrant spacing with the hydrant spacing needed for the various districts within a community or municipality. Hydrant distribution was determined using the Standard Hydrant Distribution table listed in Appendix B, FUS – 1999 Water Supply for Public Fire Protection.

To determine the average area served by each hydrant, representative districts are selected based on being primarily commercial or primarily residential. As part of the analysis for hydrant distribution two items are used in determining the distribution of hydrants:



- Representative areas are determined by the total area in square metres. Green space, unused land, or undeveloped land (no infrastructure developed ex. water mains or road ways) is subtracted from the total area being considered.
- Fire hydrants within the representative area are counted.

City of Fort Saskatchewan received **602** points of credit out of a maximum possible **650** for this grading item.

## 10.14. Fire Hydrants – Size, Type, and Installation

Fire 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 65 mm outlets. Where Required Fire Flows exceed 1,100 Igpm (5,000 LPM) or pressures are low there should also be a large pumper outlet. The lateral street connection should not be less than 150 mm 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.

Fire 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.

City of Fort Saskatchewan received **99** points of credit out of a maximum possible **100** for this grading item.

## 10.15. Fire Hydrants – Condition and Inspection

For fire hydrants to be useful in combating fires, hydrants must be in good operating condition. This grading item considers the condition and inspection of hydrants.

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. Hydrants should be kept in good condition and suitable records of inspections and repairs be maintained. Fire 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 are removed as necessary.

Inspections are necessary to ensure that all hydrants in a community or municipality are in good condition. Full operation of the hydrant is necessary during inspections in order to check all features of the hydrant.

No serious concerns or problems were evident with the condition of hydrants that were tested during the field survey. Regular fire flow testing is not completed.

City of Fort Saskatchewan received **80** points of credit out of a maximum possible **100** for this grading item.

### Recommendation 16 Frequency of Available Fire Flow Testing

Routine available fire flow testing should be completed on water supply systems that provide public fire protection. Ideally, available fire flow tests should be conducted every 5 years on a representative sampling of hydrants throughout the City in accordance with *NFPA 291: Recommended Practice for Fire Flow Testing and Marking of Hydrants, recent edition*.



## 10.16. Other Conditions Affecting Adequacy and Reliability

This grading item covers pertinent factors or conditions not considered in other grading items. Specifically this grading item reviews:

- plans and records of the water system
- emergency provisions, and
- construction and hazards of buildings.

### **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.

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 the operations of the supply works and distribution system, including valve and hydrant inspections and repairs should be maintained.

Plans and records of the distribution system are readily available. The system is well mapped.

### **Emergency Provisions**

Emergency crews, provided with suitable transportation, tools, and equipment, should be on duty in larger systems and be readily available. Response of an emergency crew should be made to multiple alarms of fire to assist the fire department in making the most efficient use of the water system, and to maintain the best possible service in the event of a water main break or other emergency.

### **Construction and Hazards of Buildings**

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. Structures should be of non-combustible construction and contain no combustible materials.

City of Fort Saskatchewan received **188** points of credit out of a maximum possible **200** for this grading item.

## 10.17. Management

A water supply system should be well administered and have adequate plans for development to keep pace with the growth of a community or municipality. Supervisory personnel should be qualified to perform their duties efficiently and should have competent assistants. Credit may be reduced in this grading item if the capability of the water system to provide fire protection is hindered by management.

City of Fort Saskatchewan received **97** points of credit out of a maximum possible **100** for this grading item.



## 11. FIRE INSURANCE GRADING - PFPC

Fire insurance grades are calculated as a single point in time measurement of fire risk and fire protection. The measurement is intended to be representative of the normal level of fire risk and fire protection resources in a community or a municipality at some given point in time and is considered from the perspective of property protection as opposed to life safety. In reality, fire protection capacity changes continuously as does fire risk.

The fire insurance grades have been calculated for the City of Fort Saskatchewan in 2013 based on information acquired throughout the field survey and described in this report.

### 11.1. PFPC - Fire Insurance Grading Areas

To determine the final fire insurance grades, four separate relative classifications (with differing weights) have been determined:

- Fire Department (40%)
- Water Supplies (30%)
- Fire Prevention and Safety Control (20%)
- Emergency Communications (10%)

Each of these areas is further broken down and scored in a number of separate items with differing weights based on the importance of the item with respect to control of losses.

### 11.2. Fire Department Assessment within the Fire Insurance Grading

The Fire Department Assessment contributes 40 percent to the total Public Fire Protection Classification grade of the City of Fort Saskatchewan. This is the most heavily weighted portion of the grading and as such is considered to be the most significant indicator of a community or municipality's overall preparedness for dealing with fire emergencies.

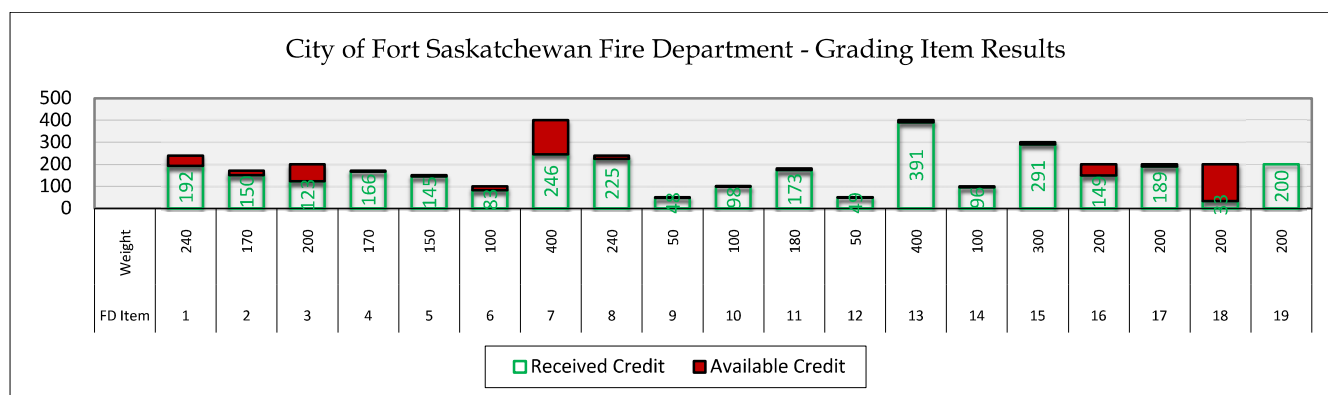
The weighting system is a two level system and the first level designates a specific number of available credit points for each item graded.



Table 8 Fire Department Grading Items Overall Summary

| Grading Item             | Category                                         | Credit Received | Maximum Credit | % of FD         | % of All |
|--------------------------|--------------------------------------------------|-----------------|----------------|-----------------|----------|
| FD-1                     | Engine Service                                   | 192             | 240            | 6.58%           | 2.63%    |
| FD-2                     | Ladder Truck Service                             | 150             | 170            | 4.66%           | 1.86%    |
| FD-3                     | Distribution of Companies and Type of Apparatus  | 123             | 200            | 5.48%           | 2.19%    |
| FD-4                     | Pumper Capacity                                  | 166             | 170            | 4.66%           | 1.86%    |
| FD-5                     | Design, Maintenance and Condition of Apparatus   | 145             | 150            | 4.11%           | 1.64%    |
| FD-6                     | Number of Line Officers – Fire Suppression       | 83              | 100            | 2.74%           | 1.10%    |
| FD-7                     | Total Fire Force Available                       | 246             | 400            | 10.96%          | 4.38%    |
| FD-8                     | Pumper and Ladder Company Unit Manning           | 225             | 240            | 6.58%           | 2.63%    |
| FD-9                     | Master and Special Stream Devices                | 48              | 50             | 1.37%           | 0.55%    |
| FD-10                    | Equipment for Pumpers and Ladder Trucks, General | 98              | 100            | 2.74%           | 1.10%    |
| FD-11                    | Hose                                             | 173             | 180            | 4.93%           | 1.97%    |
| FD-12                    | Condition of Hose                                | 49              | 50             | 1.37%           | 0.55%    |
| FD-13                    | Training and Qualifications                      | 391             | 400            | 10.96%          | 4.38%    |
| FD-14                    | Response to Alarms                               | 96              | 100            | 2.74%           | 1.10%    |
| FD-15                    | Fire Ground Operations                           | 291             | 300            | 8.22%           | 3.29%    |
| FD-16                    | Special Protection Required                      | 149             | 200            | 5.48%           | 2.19%    |
| FD-17                    | Miscellaneous Factors and Conditions             | 189             | 200            | 5.48%           | 2.19%    |
| FD-18                    | Pre-Fire Planning                                | 33              | 200            | 5.48%           | 2.19%    |
| FD-19                    | Administration                                   | 200             | 200            | 5.48%           | 2.19%    |
| Total Available          |                                                  | 3,046           | 3650           | 100%            | 40.00%   |
| Minimum to be Recognized |                                                  | 1,850           | 1850           | 100%            |          |
| Graded out of            |                                                  | 1,196           | 1800           | 66.43%          |          |
| Weight in Grading        | 40                                               |                 |                | Credit Received | 26.57    |
| Relative Classification  |                                                  |                 |                |                 |          |
| 4                        |                                                  |                 |                |                 |          |

Figure 4 Fire Department Grading Items Overall Summary





The relative classification of the Fire Department portion is a 4.

### 11.3. Water Supplies within the Fire Insurance Grading

The Water Supply Assessment contributes 30 percent to the total Public Fire Protection Classification grade of the City of Fort Saskatchewan. As noted in the Fire Department section above, the Water Supply is graded similarly with two separate tiers of weight.

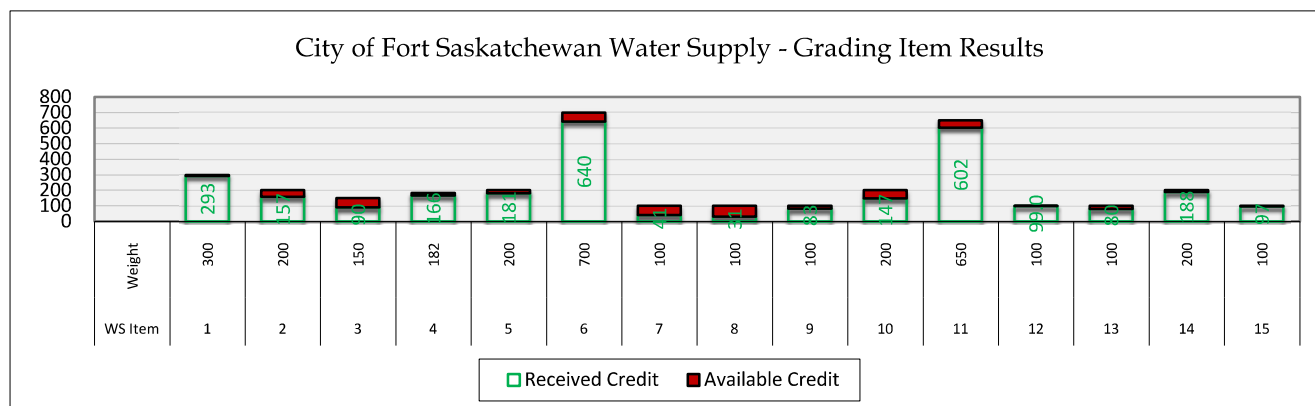
Table 9 Water Supply Grading Items Summary

| Grading Item             | Category                                                                             | Credit Received | Maximum Credit | % of WS         | % of All |
|--------------------------|--------------------------------------------------------------------------------------|-----------------|----------------|-----------------|----------|
| WS-1                     | Normal Adequacy of Supply Works                                                      | 293             | 300            | 8.87%           | 2.66%    |
| WS-2                     | Reliability of Sources of Supply                                                     | 157             | 200            | 5.91%           | 1.77%    |
| WS-3                     | Reliability of Pumping Capacity (Pumps and Drivers)                                  | 90              | 150            | 4.44%           | 1.33%    |
| WS-4                     | Reliability of Power Supply                                                          | 166             | 182            | 5.38%           | 1.61%    |
| WS-5                     | Reliability, Condition, Arrangement, Operation, and Maintenance of System Components | 181             | 200            | 5.91%           | 1.77%    |
| WS-6                     | Fireflow Delivery by Mains                                                           | 640             | 700            | 20.70%          | 6.21%    |
| WS-7                     | Reliability of Principal Mains                                                       | 41              | 100            | 2.96%           | 0.89%    |
| WS-8                     | Installation of Pipes                                                                | 31              | 100            | 2.96%           | 0.89%    |
| WS-9                     | Arrangement of Distribution System                                                   | 83              | 100            | 2.96%           | 0.89%    |
| WS-10                    | Additional Factors and Conditions Relating To Supply and Distribution                | 147             | 200            | 5.91%           | 1.77%    |
| WS-11                    | Distribution of Hydrants                                                             | 602             | 650            | 19.22%          | 5.77%    |
| WS-12                    | Hydrants – Size, Type, and Installation                                              | 99              | 100            | 2.96%           | 0.89%    |
| WS-13                    | Hydrants – Condition and Inspection                                                  | 80              | 100            | 2.96%           | 0.89%    |
| WS-14                    | Other Conditions affecting Adequacy and Reliability                                  | 188             | 200            | 5.91%           | 1.77%    |
| WS-15                    | Management                                                                           | 97              | 100            | 2.96%           | 0.89%    |
| Total Available          |                                                                                      | 2894            | 3382           | 100%            | 30%      |
| Minimum to be Recognized |                                                                                      | 1682            | 1682           | 100%            |          |
| Graded out of            |                                                                                      | 1212            | 1700           | 71.27%          |          |
| Weight in Grading        | 30                                                                                   |                 |                | Credit Received | 21.38    |
| Relative Classification  |                                                                                      |                 |                |                 |          |

3



Figure 5 Water Supply Grading Items Summary



The relative classification for the water supply items is a 3.

## 11.4. Fire Safety Control within the Fire Insurance Grading

The Fire Safety Control assessment contributes 20 percent to the total Public Fire Protection Classification grade of the City of Fort Saskatchewan.

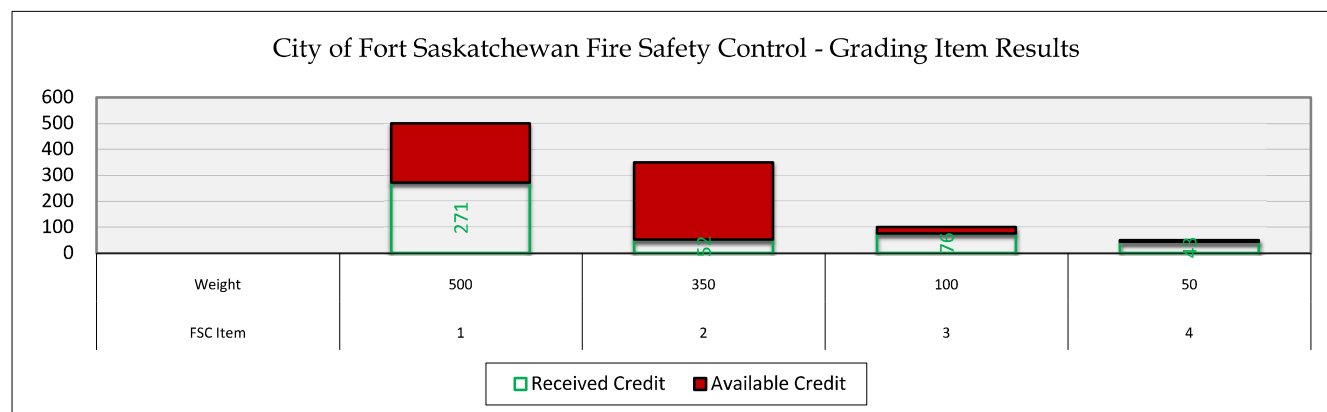
Fire Safety Control is graded more simplistically with 1,000 credit points being available and no minimum number needed to be recognized. However, two tiers of weights are applied as in other areas of the grading.

Table 10 Fire Safety Control Grading Items Summary

| Grading Item            | Category                                   | Credit Received | Maximum Credit | % of FSC        | % of All |
|-------------------------|--------------------------------------------|-----------------|----------------|-----------------|----------|
| FSC-1                   | General Program                            | 271             | 500            | 50.00%          | 10.00%   |
| FSC-2                   | Codes and Enforcement                      | 52              | 350            | 35.00%          | 7.00%    |
| FSC-3                   | Building Construction Laws and Enforcement | 76              | 100            | 10.00%          | 2.00%    |
| FSC-4                   | Electrical Code and Inspections            | 43              | 50             | 5.00%           | 1.00%    |
| Total Available         |                                            | 442             | 1000           | 100%            | 20%      |
| Graded out of           |                                            | 442             | 1000           | 44.20%          |          |
| Weight in Grading       | 20                                         |                 |                | Credit Received | 8.84     |
| Relative Classification |                                            |                 |                |                 |          |
| 6                       |                                            |                 |                |                 |          |

Figure 6 Fire Safety Control Grading Items Summary





The relative classification of Fire Safety Control is a 6.

## 11.5. Fire Service Communications within the Fire Insurance Grading

Fire service communications contributes 10 percent of the overall grade in the calculation of Public Fire Protection Classification.

As noted above in the sections of the Fire Department and Water Supply, Fire Service Communications is graded similarly with two tiers of weight.

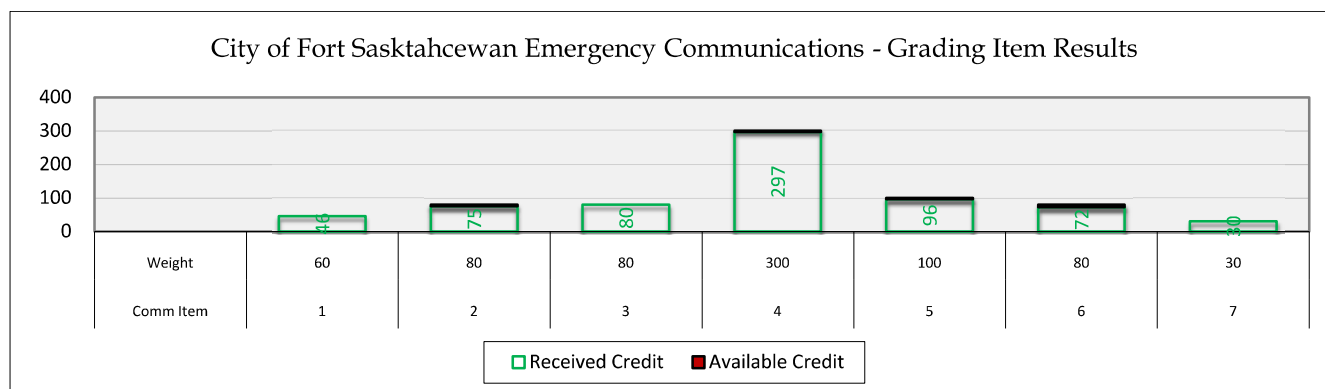
Note that a total of 730 credit points are available through the 7 items evaluated in Fire Service Communications, however this area of the grading is graded out of 500. This means that the first 230 points are required (at a minimum) to be recognized and the remaining 500 are then credit points. The total number of credit points are then scored as a percent ex.  $450/500 = 90$  percent.

This forms the basis of the relative classification of the Fire Service Communications.

Table 11 Fire Service Communications Grading Items Summary

| Grading Item             | Category                                                 | Credit Received | Maximum Credit | % of Comm       | % of All |
|--------------------------|----------------------------------------------------------|-----------------|----------------|-----------------|----------|
| Comm-1                   | Communication Center                                     | 46              | 60             | 8.22%           | 0.82%    |
| Comm-2                   | Means for Transmitting Alarm by Public                   | 75              | 80             | 10.96%          | 1.10%    |
| Comm-3                   | Fire Department Telephone Service (Incoming from Public) | 80              | 80             | 10.96%          | 1.10%    |
| Comm-4                   | Means of Alarm Dispatch                                  | 297             | 300            | 41.10%          | 4.11%    |
| Comm-5                   | Dispatching Service                                      | 96              | 100            | 13.70%          | 1.37%    |
| Comm-6                   | Operations Radio                                         | 72              | 80             | 10.96%          | 1.10%    |
| Comm-7                   | Miscellaneous Factors                                    | 30              | 30             | 4.11%           | 0.41%    |
| Total Available          |                                                          | 696             | 730            | 100%            | 10%      |
| Minimum to be Recognized |                                                          | 230             | 230            | 100%            |          |
| Graded out of            |                                                          | 466             | 500            | 93.20%          |          |
| Weight in Grading        | 10                                                       |                 |                | Credit Received | 9.32     |
| Relative Classification  |                                                          |                 |                |                 |          |
| 2                        |                                                          |                 |                |                 |          |

Figure 7 Fire Service Communications Grading Items Summary



The relative classification for the fire service communications items is a 2.

## 11.6. Summary of PFPC Fire Insurance Grading

The City of Fort Saskatchewan's overall credit score for the Public Fire Protection Classification in 2013 is 62.23. Table 12 indicates the credit range of each PFPC grade.

Table 12 PFPC Credit Range

| Overall PFPC | Credit Range Per PFPC Grade |
|--------------|-----------------------------|
| 1            | 90.00 – 100.00              |
| 2            | 80.00 – 89.99               |
| 3            | 70.00 – 79.99               |
| 4            | 60.00 – 69.99               |
| 5            | 50.00 – 59.99               |
| 6            | 40.00 – 49.99               |
| 7            | 30.00 – 39.99               |
| 8            | 20.00 – 29.99               |
| 9            | 10.00 – 19.99               |
| 10           | 0.00 – 9.99                 |

The following grades have been calculated for the City of Fort Saskatchewan in 2013.

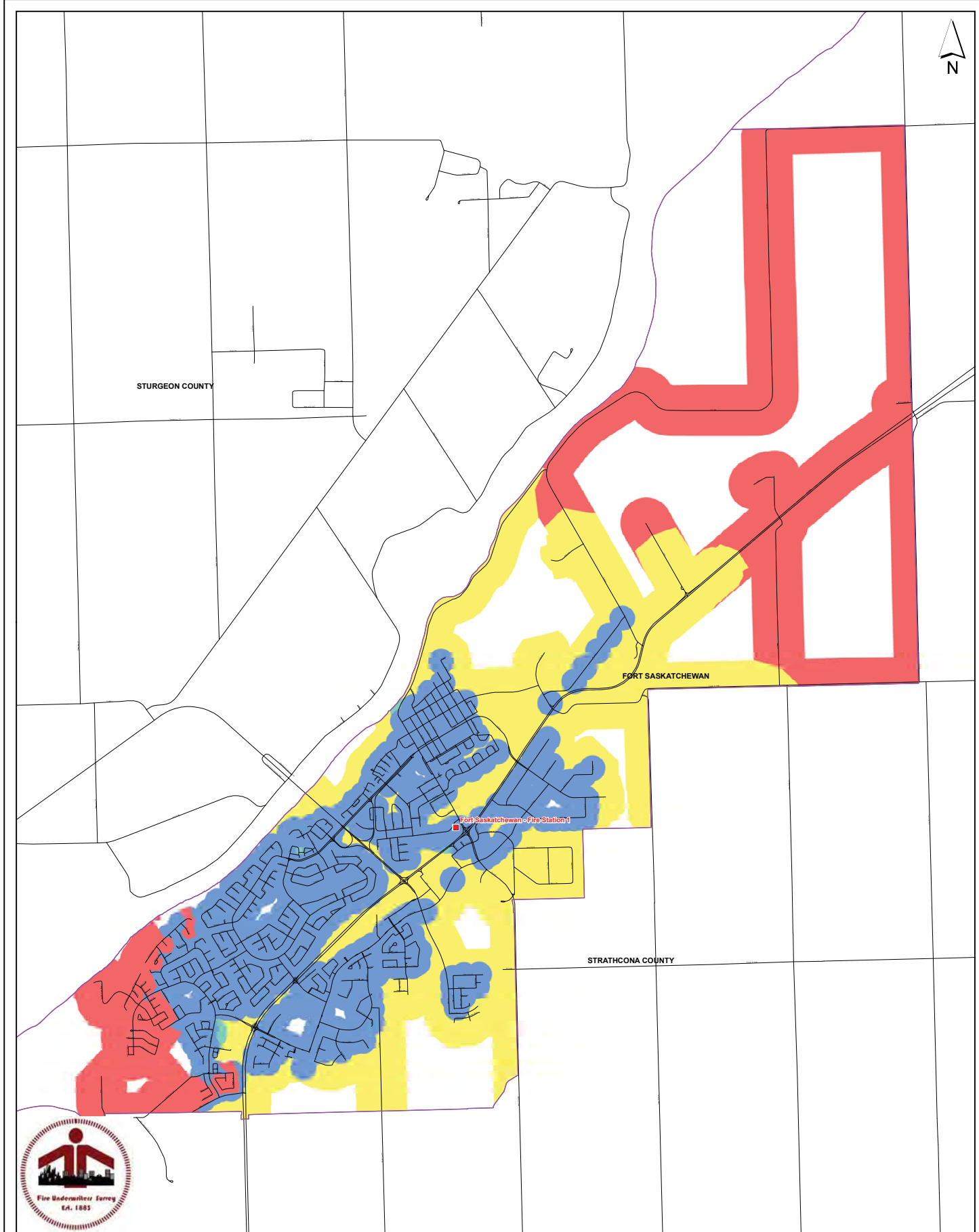
| SUB DISTRICT(S)                                                 | PPFC 2005 | PFPC 2013 | COMMENTS                                                                                                                                                                                         |
|-----------------------------------------------------------------|-----------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fort Saskatchewan Fire Station – Fort Saskatchewan Water System | 4         | 4         | Hydrant Protected – Commercial Lines insured properties within specified distances of a hydrant on the Fort Saskatchewan water system and within 5 road km of the Fort Saskatchewan Fire Station |

| SUB DISTRICT(S)                                                 | DPG 2005 | DPG 2013 | COMMENTS                                                                                                                                                                    |
|-----------------------------------------------------------------|----------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fort Saskatchewan Fire Station – Fort Saskatchewan Water System | 3A       | 3A       | Hydrant Protected – Personal Lines insured properties within 300m of a hydrant on the Fort Saskatchewan water system and within 8 road km of Fort Saskatchewan Fire Station |

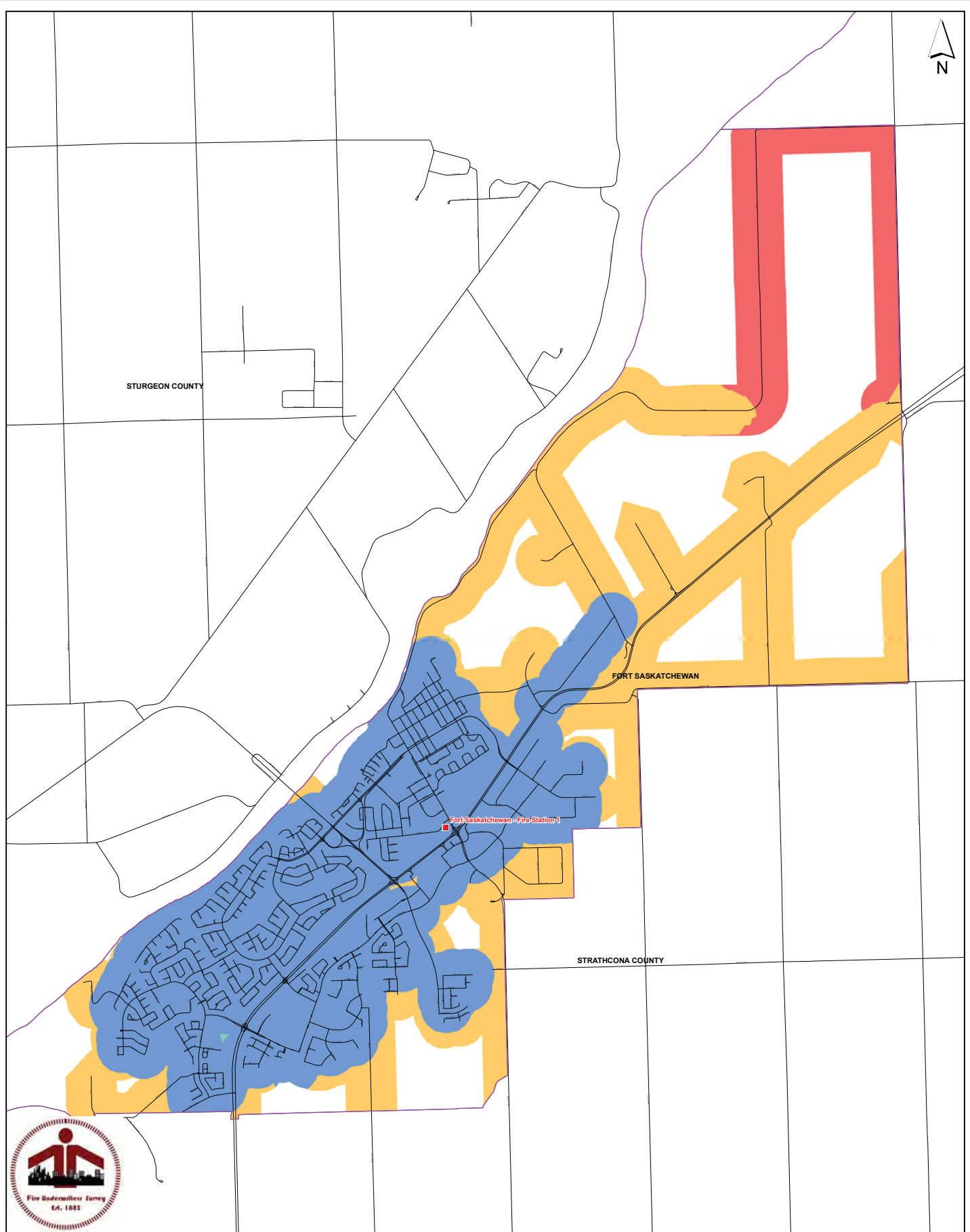


|                                         |   |   |                                                                                                                                                                                                  |
|-----------------------------------------|---|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                         |   |   |                                                                                                                                                                                                  |
| Fort Saskatchewan Fire Station          | 4 | 4 | Fire Hall Protected – Personal Lines insured properties not within specified distances of a hydrant on the Fort Saskatchewan water system but within 8 road km of Fort Saskatchewan Fire Station |
| Areas beyond 8km road response distance | 5 | 5 | Unprotected – Personal Lines insured properties not within 8 road km of Fort Saskatchewan Fire Station                                                                                           |

The current PFPC and DPG Grade maps are shown in Figure 8 and Figure 9.



|                                                                                                                                                                                                           |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                                                                                                                                                                                                                                 |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <p>City of Fort Saskatchewan</p> <p>Scale = 1:14,000 0 250 500 1,000 Meters</p>                                                                                                                           |  | <p><b>Figure 8 PFPC Grade Map 2013</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  | <p> <b>Fire Underwriters Survey</b><br/>A Division of Insurance and Mortgages</p>                                                          |  |
| <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Fire Hall</li> <li>Road</li> <li>Fire Protection Boundary</li> <li>4</li> <li>4 (Private Hydrant Protected)</li> <li>9</li> <li>10</li> </ul> |  | <p>These maps and figures are not intended to illustrate the exact response distance or fire insurance grade coverage areas but can be used to aid in determining the fire insurance grade that should be applied to the property in question.</p> <p>Fire Underwriters Survey does not warrant or make any representations with respect to the quality, completeness, currency or accuracy of anything contained in this map, the fitness of this map for any purpose or results obtained using information contained in this map and is not responsible for any action taken in reliance on information contained in this map. In all cases, field data should be used to confirm the data and accuracy of these maps; if differences are noted please contact Fire Underwriters Survey at 1-800-665-5661.</p> |  | <p>Date Drawn: 2013-12-16</p> <p>Drawn By: LZ</p> <p><input type="checkbox"/> Preliminary <input checked="" type="checkbox"/> Final</p> <p><input checked="" type="checkbox"/> Commercial <input type="checkbox"/> Personal</p> |  |



City of Fort Saskatchewan

Scale = 1:14,000 0 250 500 1,000 Meters

Figure 9 DPG Grade Map 2013



**Legend**

- Fire Hall
- Road
- Fire Protection Boundary
- 3A
- 3A (Private Hydrant Protected)
- 4
- 5

These maps and figures are not intended to illustrate the exact response distance or fire insurance grade coverage areas but can be used to aid in determining the fire insurance grade that should be applied to the property in question. Fire Underwriters Survey does not warrant or make any representations with respect to the quality, completeness, currency or accuracy of anything contained in this map, the fitness of this map for any purpose or results obtained using information contained in this map and is not responsible for any action taken in reliance on information contained in this map. In all cases, field data should be used to confirm the data and accuracy of these maps; if differences are noted please contact Fire Underwriters Survey at 1-800-665-5661.

Date Drawn: 2013-12-16

Drawn By: LZ

☐ Preliminary ☒ Final

☐ Commercial ☒ Personal



## APPENDIX A Dwelling Protection Summary of Basic Requirements

Dwelling Protection Grade Summary of Basic Requirements per Fire Station<sup>1</sup>

| DWELLING PROTECTION GRADE | WATER WORKS SYSTEM                                                                                                                                                                                                                                    | FIRE DEPARTMENT                                                                                                                                    |                                                                                                         | CORRELATION WITH PFPC <sup>1</sup><br>Public Fire Protection<br>Classification |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
|                           |                                                                                                                                                                                                                                                       | EQUIPMENT                                                                                                                                          | FIREFIGHTERS <sup>III</sup>                                                                             |                                                                                |
| 1                         | Water supply system designed in accordance with Fire Underwriters Survey standard "Water Supply for Public Fire Protection" with a relative classification of 5 or better                                                                             | Response from within 8 km by road of a triple combination pumper                                                                                   | Minimum Response:<br>- On-duty: 3 career fire fighters, plus<br>- Off-duty: fire chief or other officer | Water Supply and Fire Department must grade PFPC Relative Class 5 or better    |
| 2                         | Water supply system designed in accordance with Fire Underwriters Survey standard "Water Supply for Public Fire Protection" with a relative classification of 6 or better                                                                             | Response from within 8 km by road of a triple combination pumper                                                                                   | Minimum Response:<br>- On-duty: 1 career fire fighters, plus<br>- On-call: 15 auxiliary fire fighters   | Water Supply and Fire Department must grade PFPC Relative Class 6 or better    |
| 3A                        | Water supply system designed in accordance with, and meeting the minimum requirements of, Fire Underwriters Survey standard "Water Supply for Public Fire Protection"                                                                                 | Response from within 8 km by road of a triple combination pumper                                                                                   | 15 auxiliary fire fighters                                                                              | No Public Fire Protection Classification required                              |
| 3B                        | Not required – however fire department must have adequate equipment, training and access to approved water supplies to deliver standard shuttle service in accordance with NFPA 1142, Standard on Water Supplies for Suburban and Rural Fire Fighting | 2 units required. Triple combination pumper plus a mobile water supply with a combined water carrying capacity of not less than 6,820 L (1,500 IG) | 15 auxiliary fire fighters                                                                              | No Public Fire Protection Classification required                              |
| 4 <sup>3</sup>            | Not required – however fire department must have adequate equipment, training and access to approved water supplies to deliver shuttle service in accordance with NFPA 1142, Standard on Water Supplies for Suburban and Rural Fire Fighting          | 2 units required. Triple combination pumper plus a mobile water supply with a combined water carrying capacity of not less than 6,820 L (1,500 IG) | 15 auxiliary fire fighters                                                                              | No Public Fire Protection Classification required                              |
| 5                         | Unprotected communities or communities not qualifying for Grades 1, 2, 3A, 3B, or 4 above                                                                                                                                                             | Unprotected communities or communities not qualifying for Grades 1, 2, 3A, 3B, or 4 above                                                          | Unprotected communities or communities not qualifying for Grades 1, 2, 3A, 3B, or 4 above               | No Public Fire Protection Classification required                              |



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<sup>i</sup> Refer to additional notes and requirements for interpretation

<sup>ii</sup> The P.F.P.C. is a sophisticated municipal fire protection grading system utilized for Commercial Lines insurance. PFPC fire insurance grades are scaled from 1 to 10. One (1) represents a high level of fire protection and 10 indicates little or no recognized 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 and/or districts.

<sup>iii</sup> Requirements for Dwelling Protection Grade 4 are the same as for Dwelling Protection Grade 3B, however in some cases, an allowance may be considered for Dwelling Protection Grade 4 where all of the criteria for Dwelling Protection Grade 3B have been met with one exception. If more than one criteria has not been met (ex. less than 15 auxiliary fire fighters and a single pumper apparatus) Dwelling Protection Grade 5 is applied.

Where Dwelling Protection Grade 4 is applied, a signed letter of intent from the community is to be sent to Fire Underwriters Survey indicating that improvements will be made, within an agreed timeframe, to meet the criteria of Dwelling Protection Grade 3B.

It is important to note that the absolute minimum number of auxiliary fire fighters considered within the fire insurance grading is 10 and that maximum age of apparatus that can be considered is 30.





## APPENDIX B Fire Underwriters Survey – 1999 Water Supply for Public Fire Protection

# **WATER SUPPLY FOR PUBLIC FIRE PROTECTION**

**1999**



**FIRE UNDERWRITERS SURVEY**

A SERVICE TO INSURERS AND MUNICIPALITIES

For further information on this document or any matters relating to the Fire Underwriters Survey please contact the appropriate offices of CGI Risk Management Services (formerly the Insurers' Advisory Organization) as follows:

|                 |                                                                                                                                                      |                                                                           |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Western Canada  | CGI Risk Management Services<br>Fire Underwriters Survey<br>3999 Henning Drive<br>Burnaby BC V5C 6P9                                                 | Local: 604-6841581<br>Toll Free: 1-800-665-5661<br>Fax: 604-688-6986      |
| Central Canada  | CGI Risk Management Services<br>Fire Underwriters Survey<br>Suite 800, 7015 Macleod Tr. SW<br>Calgary Alberta T2H 2K6                                | Local: 403-296-1300<br>Toll Free: 1-800-465-4264<br>Fax: 403-296-1316     |
| Quebec          | CGI Risk Management Services<br>Fire Underwriters Survey<br>1611 Crémazie Blvd. East<br>Montreal, Quebec<br>H2M 2P2                                  | Local: 514-735-3561<br>Toll Free: 1-800-263-5361<br>Fax: 514-844-0777     |
| Ontario         | CGI Risk Management Services<br>Fire Underwriters Survey<br>Lock Box 200<br>150 Commerce Valley Drive, West<br>Markham, Ontario<br>L3T 7Z3           | Local: 905-882-6300<br>Toll Free: 1-800-387-4356<br>Fax: 905-695-6543     |
| Atlantic Canada | CGI Insurance Business Services<br>Fire Underwriters Survey<br>238 Brownlow Avenue, Suite 300<br>Park Place Center<br>Dartmouth, Nova Scotia B3B 1Y2 | Telephone: 902-423-9287<br>Toll-Free: 1-800-639-4528<br>Fax: 902-423-7376 |

FIRE UNDERWRITERS SURVEY is financed by the Canadian Insurance industry and utilizes technical staff of CGI Risk Management Services (formerly the Insurers' Advisory Organization Inc.) Its purpose is to survey fire protection conditions in Canadian communities and municipalities, providing data and advisory services to fire insurance underwriters and public officials concerned.

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# 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 of 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 special 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 say 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 incident 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 150kPa 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 plans 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 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 is supplied by pumps, should be sufficient, in conjunction with storage when the two most important 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 water 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 un-reliability 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 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 dead-end 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 (e.g. 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             |                                                | REQUIRED DURATION OF FIRE FLOW            |                     |
|-------------------------------------------|------------------------------------------------|-------------------------------------------|---------------------|
| Fire Flow Required<br>(litres per minute) | Average Area<br>per Hydrant ( m <sup>2</sup> ) | Fire Flow Required<br>(litres per minute) | Duration<br>(hours) |
| 2,000                                     | 16,000                                         | 2,000 or less                             | 1.0                 |
| 4,000                                     | 15,000                                         | 3,000                                     | 1.25                |
| 6,000                                     | 14,000                                         | 4, 000                                    | 1.5                 |
| 8,000                                     | 13,000                                         | 5,000                                     | 1.75                |
| 10,000                                    | 12,000                                         | 6,000                                     | 2.0                 |
|                                           |                                                | 8000                                      | 2.0                 |
| 12,000                                    | 11,000                                         | 10,000                                    | 2.0                 |
| 14,000                                    | 10,000                                         | 12,000                                    | 2.5                 |
| 16,000                                    | 9,500                                          | 14,000                                    | 3.0                 |
| 18,000                                    | 9,000                                          | 16,000                                    | 3.5                 |
| 20,000                                    | 8,500                                          | 18,000                                    | 4.0                 |
|                                           |                                                | 20000                                     | 4.5                 |
| 22,000                                    | 8,000                                          | 22,000                                    | 5.0                 |
| 24,000                                    | 7,500                                          | 24,000                                    | 5.5                 |
| 26,000                                    | 7,000                                          | 26,000                                    | 6.0                 |
| 28,000                                    | 6,500                                          | 28,000                                    | 6.5                 |
| 30,000                                    | 6,000                                          | 30,000                                    | 7.0                 |
|                                           |                                                | 32000                                     | 7.5                 |
| 32,000                                    | 5,500                                          | 34,000                                    | 8.0                 |
| 34,000                                    | 5,250                                          | 36,000                                    | 8.5                 |
| 36,000                                    | 5,000                                          | 38,000                                    | 9.0                 |
| 38,000                                    | 4,750                                          | 40,000 and over                           | 9.5                 |
| 40,000                                    | 4,500                                          |                                           |                     |
|                                           |                                                |                                           |                     |
| 42,000                                    | 4,250                                          |                                           |                     |
| 44,000                                    | 4,000                                          |                                           |                     |
| 46,000                                    | 3,750                                          |                                           |                     |
| 48,000                                    | 3,500                                          |                                           |                     |

***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 COPYRIGHT I.S.O.

**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:

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

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 No.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 separation:

| Separation  | Charge | Separation   | Charge |
|-------------|--------|--------------|--------|
| 0 to 3m     | 25%    | 20.1 to 30 m | 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 percentage 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.

## Notes to Calculation

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

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

### Examples of High Hazard Occupancies:

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



## APPENDIX C Insurance Grading Recognition of Used or Rebuilt Fire Apparatus

# TECHNICAL BULLETIN

## FIRE UNDERWRITERS SURVEY™

*A Service to Insurers and Municipalities*

### INSURANCE GRADING RECOGNITION OF USED OR REBUILT FIRE APPARATUS

The performance ability and overall acceptability of older apparatus has been debated between municipal administrations, the public fire service and many others for years. Fire Underwriters Survey (FUS) has reviewed experiences across Canada and in other countries and has developed a standard for acceptance of apparatus as the apparatus becomes less reliable with age and use.

The public fire service is unique compared to other emergency services in that fire apparatus vehicles are not continuously in use. However, when in use, the apparatus is subject to considerable mechanical stress due to the nature of its function. This stress does not normally manifest itself on the exterior of the equipment. It is effectively masked in most departments by a higher standard of aesthetic care and maintenance. Lack of replacement parts further complicates long term use of apparatus. Truck and pump manufacturers maintain a parts inventory for each model year for a finite time. After that period, obtaining necessary parts may be difficult. This parts shortage is particularly acute with fire apparatus due to the narrow market for these devices.

Fire Underwriters Survey lengthy experience in evaluating fire apparatus indicates that apparatus should be designed to an acceptable standard. The standard that is accepted throughout Canada by Fire Underwriters Survey is the Underwriters' Laboratories of Canada (ULC) Standard S515 (most updated version) titled, "Automobile Fire Fighting Apparatus," which was adopted as a National Standard of Canada in September 2004. Alternatively, NFPA 1901, the Standard for Automotive Fire Apparatus (most updated version) is also accepted by Fire Underwriters Survey with respect to apparatus design. Fire apparatus should be built by recognized manufacturers and tested by a suitably accredited third party.

Fire apparatus should respond to first alarms for the first fifteen years of service. During this period it has reasonably been shown that apparatus effectively responds and performs as designed without failure at least 95% of the time. For the next five years, it should be held in reserve status for use at major fires or used as a temporary replacement for out-of-service first line apparatus. Apparatus should be retired from service at twenty years of age. Present practice indicates the recommended service periods and protocols are usually followed by the first purchaser. However, at the end of that period, the apparatus is either traded in on new apparatus or sold to another fire department. At this juncture, the unit may have one or more faults which preclude effective use for emergency service. These deficiencies include:

- a. Inadequate braking system
- b. Slow pick-up and acceleration



- c. Structurally weakened chassis due to constant load bearing and/or overloading
- d. Pump wear

FUS has modified its application of the age requirement for used or rebuilt apparatus. Due to municipal budget constraints within small communities we have continued to recognize apparatus over twenty years of age, provided the truck successfully meets the recommended annual tests and has been deemed to be in excellent mechanical condition. The specified service tests are outlined below under the heading “Recommended Service Tests for Used or Modified Fire Apparatus”. Testing and apparatus maintenance should only be completed by a technician who is certified to an appropriate level in accordance with NFPA 1071, *Standard for Emergency Vehicle Technician Professional Qualifications*.

Insurance grading recognition may be extended for a limited period of time if we receive documentation verifying that the apparatus has successfully passed the specified tests. If the apparatus does not pass the required tests or experiences long periods of “downtime” we may request the municipal authority to replace the equipment with new or newer apparatus. If replacement does not occur, fire insurance grading recognition may be revoked for the specific apparatus which may adversely affect the fire insurance grades of the community. This can also affect the rates of insurance for property owners throughout the community.

**Table 1 Service Schedule for Fire Apparatus For Fire Insurance Grading Purposes**

| Apparatus Age              | Major Cities <sup>3</sup> | Medium Sized Cities <sup>4</sup>                   | Small Communities <sup>5</sup> and Rural Centres                     |
|----------------------------|---------------------------|----------------------------------------------------|----------------------------------------------------------------------|
| 0 – 15 Years               | First Line Duty           | First Line Duty                                    | First Line Duty                                                      |
| 16 – 20 Years              | Reserve                   | 2 <sup>nd</sup> Line Duty                          | First Line Duty                                                      |
| 20 – 25 Years <sup>1</sup> | No Credit in Grading      | No Credit in Grading<br>or<br>Reserve <sup>2</sup> | No Credit in Grading<br>or<br>2 <sup>nd</sup> Line Duty <sup>2</sup> |
| 26 – 29 Years <sup>1</sup> | No Credit in Grading      | No Credit in Grading<br>or<br>Reserve <sup>2</sup> | No Credit in Grading<br>or<br>Reserve <sup>2</sup>                   |
| 30 Years +                 | No Credit in Grading      | No Credit in Grading                               | No Credit in Grading                                                 |

<sup>1</sup> All listed fire apparatus 20 years of age and older are required to be service tested by recognized testing agency on an annual basis to be eligible for grading recognition. (NFPA 1071)

<sup>2</sup> Exceptions to age status may be considered in a small to medium sized communities and rural centres conditionally, when apparatus condition is acceptable and apparatus successfully passes required testing.

<sup>3</sup> Major Cities are defined as an incorporated or unincorporated community that has:

- a populated area (or multiple areas) with a density of at least 400 people per square kilometre; AND
- a total population of 100,000 or greater.

<sup>4</sup> Medium Communities are defined as an incorporated or unincorporated community that has:

- a populated area (or multiple areas) with a density of at least 200 people per square kilometre; AND/OR
- a total population of 1,000 or greater.

<sup>5</sup> Small Communities are defined as an incorporated or unincorporated community that has:

- no populated areas with densities that exceed 200 people per square kilometre; AND
- does not have a total population in excess of 1,000.



**Table 2 Frequency of Listed Fire Apparatus Acceptance and Service Tests**

|                                                                 | <i>Frequency of Test</i>                                        |                     |                     |                                 |                              |                                                          |
|-----------------------------------------------------------------|-----------------------------------------------------------------|---------------------|---------------------|---------------------------------|------------------------------|----------------------------------------------------------|
|                                                                 | @ Time of Purchase<br>New or Used                               | Annual Basis        | @ 15 Years          | @ 20 Years<br><i>See Note 4</i> | 20 to 25 Years<br>(annually) | After Extensive Repairs<br><i>See Note 5</i>             |
| <b><u>Recommended</u></b><br><b>For Fire Insurance Purposes</b> | Acceptance Test if new;<br>Service Test if used &<br>< 20 Years | Service Test        | Acceptance Test     | Acceptance Test                 | Acceptance Test              | Acceptance or Service Test depending on extent of repair |
| <b><u>Required</u></b><br><b>For Fire Insurance Purposes</b>    | Acceptance Test if new;<br>Service Test if used &<br>< 20 Years | No Test Required    | No Test Required    | Acceptance Test                 | Acceptance Test              | Acceptance or Service Test depending on extent of repair |
| <b>Factor in FUS Grading</b>                                    | Yes                                                             | Yes                 | Yes                 | Yes                             | Yes                          | Yes                                                      |
| <b>Required By Listing Agency</b>                               | Acceptance Test                                                 | No                  | No                  | No                              | N/A                          | Acceptance Test                                          |
| <b>Required By NFPA<br/><i>See Note 6</i></b>                   | Acceptance Test                                                 | Annual Service Test | Annual Service Test | Annual Service Test             | Annual Service Test          | Service Test                                             |

*Note 1: See: 'Service Tests for Used or Rebuilt Fire Apparatus' for description of applicable tests*

*Note 2: Acceptance Tests consist of 60 minute capacity and 30 minute pressure tests*

*Note 3: Service Tests consist of 20 minute capacity test and 10 minute pressure test in addition to other listed tests*

***Note 4: Apparatus exceeding 20 years of age may not be considered to be eligible for insurance grading purposes regardless of testing. Application must be made in writing to Fire Underwriters Survey for an extension of the grade-able life of the apparatus.***

*Note 5: Testing after extensive repairs should occur regardless of apparatus age within reason.*

*Note 6: Acceptance Tests: See NFPA 1901, Standard for Automotive Fire Apparatus*

*Service Tests: See NFPA 1911, Standard for Service Tests of Fire Pump Systems on Fire Apparatus, Article 5.1*



## SERVICE TESTS FOR USED OR MODIFIED FIRE APPARATUS

The intent of this document is to ensure that all used or modified fire apparatus, equipped with a pump or used for tanker service, essentially meet the requirements of Underwriters' Laboratories of Canada (ULC) "Standard for Automobile Fire Fighting Apparatus" S515-04 or subsequent (current) editions of the Standard. Full adherence with the following specified tests is recommended when purchasing used apparatus.

### **Weight Tests**

#### **Load Balance Test:**

When fully laden (including a 460kg (1000 lbs) personnel weight, full fuel and water tanks, specified load of hose and miscellaneous equipment), the vehicle shall have a load balance of 22% to 50% of total vehicle mass on the front axle and 50% to 78% of this mass on the rear axle.

Distribution of mass of 33% and 67% respectively on the front and rear axles is preferable for a vehicle having dual rear tires or tandem rear axles.

For a vehicle having tandem rear axles and dual tires on each axle, a loading of between 18% and 25% on the front axle with the balance of mass on the rear axles is permissible.

### **Road Tests**

#### **Acceleration Tests:**

- 2.1.1) From a standing start, the apparatus shall attain a true speed of 55 km/h (35 mph) within 25 seconds for Pumpers carrying up to 3,150 litres (700 gallons) of water.

For apparatus carrying in excess of 3,150 litres (700 gallons) or apparatus equipped with aerial ladders or elevating platforms, a true speed of 55 km/h (35 mph) in 30 seconds should be attained.

- 2.1.2) The vehicle should attain a top speed of at least 80 km/h (50mph).

#### **Braking Test:**

The service brakes shall be capable of bringing the fully laden apparatus to a complete stop from an initial speed of 30 km/h (20 mph) in a distance not exceeding 9 metres (30 feet) by actual measurement. The test should be conducted on a dry, hard surfaced road that is free of loose material, oil and grease.



## **Pump Performance Tests**

### **Hydrostatic Test**

Recent evidence of hydrostatic testing of the pump for 10 minutes at a minimum pressure of 3,400 kPa (500 psi). APPLICABLE TO NEW OR REBUILT PUMPS ONLY (see 3.3).

### **Priming and Suction Capability Tests**

#### **Vacuum Test:**

The pump priming device, with a capped suction at least 6 metres (20 feet) long, shall develop -75 kPa (22 inches of mercury) at altitudes up to 300 metres (1000 feet) and hold the vacuum with a drop of not in excess of 34 kPa (10 inches of mercury) in 10 minutes.

For every 300 metres (1000 feet) of elevation, the required vacuum shall be reduced 3.4 kPa (1 inch mercury).

The primer shall not be used after the 10-minute test period has been started. The test shall be made with discharge outlets uncapped.

#### **Suction Capability Test:**

The pump (in parallel or series) when dry, shall be capable of taking suction and discharging water with a lift of not more than 3 metres (10 feet) through 6 metres (20 feet) of suction hose of appropriate size, in not more than 30 seconds and not over 45 seconds for 6000 L/min (1320 lgpm) or larger capacity pumps. Where front or rear suction is provided on midship pumps, an additional 10 seconds priming time will be allowed. The test shall be conducted with all discharge caps removed.

### **Pump Performance**

#### **Capacity Test:**

Consists of drafting water (preferably with a 10 feet lift) and pumping the rated capacity at 1000 kPa (150 psi) net pump pressure for a continuous period of at least 1 hour.

#### **Pressure Test:**

Under the same conditions as in 3.3.1 above pumping 50% of the rated capacity at 1700 kPa (250 psi) net pump pressure for at least ½ hour



For additional information on the above noted tests and test procedures, the following documents provide useful data:

- Underwriters Laboratories of Canada (ULC) publication titled S515 Standard for Automobile Fire Fighting Apparatus, latest edition.
- Fire Underwriters Survey (FUS) publication titled Fire Stream Tables and Testing Data latest edition.
- International Fire Service Training Association (IFSTA) publication titled Fire Department Pumping Apparatus, latest edition.
- National Fire Protection Association (NFPA) 1901 Standard for Automotive Fire Apparatus, latest edition.
- National Fire Protection Association (NFPA) 1911 Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, latest edition.
- National Fire Protection Association (NFPA) 1912 Standard for Fire Apparatus Refurbishing, latest edition.

For further information regarding the acceptability of emergency apparatus for fire insurance grading purposes, please contact:

| Western Canada                                                                                                      | Quebec                                                                                                                         | Ontario                                                                                                                                | Atlantic Canada                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Risk Management Services<br>Fire Underwriters Survey<br>3999 Henning Drive<br>Burnaby, BC V5C 6P9<br>1-800-665-5661 | Risk Management Services<br>Fire Underwriters Survey<br>1611 Crémazie Blvd. East<br>Montreal, Quebec H2M 2P2<br>1-800-263-5361 | Risk Management Services<br>Fire Underwriters Survey<br>150 Commerce Valley Drive, West<br>Markham, Ontario L3T 7Z3<br>1-800- 268-8080 | Risk Management Services<br>Fire Underwriters Survey<br>238 Brownlow Avenue, Suite 300<br>Dartmouth, Nova Scotia B3B 1Y2<br>1-800-639-4528 |







## APPENDIX D Requirements for Aerial Apparatus

# TECHNICAL BULLETIN

## FIRE UNDERWRITERS SURVEY™

*A Service to Insurers and Municipalities*

### LADDERS AND AERIALS: WHEN ARE THEY REQUIRED OR NEEDED?

Numerous standards are used to determine the need for aerial apparatus and ladder equipment within communities. This type of apparatus is typically needed to provide a reasonable level of response within a community when buildings of an increased risk profile (fire) are permitted to be constructed within the community.

Please find the following information regarding the requirements for aerial apparatus/ladder companies from the Fire Underwriters Survey Classification Standard for Public Fire Protection.

#### ***Fire Underwriters Survey***

Ladder/Service company operations are normally intended to provide primary property protection operations of

- 1.) Forcible entry;
- 2.) Utility shut-off;
- 3.) Ladder placement;
- 4.) Ventilation;
- 5.) Salvage and Overhaul;
- 6.) Lighting.

Response areas with 5 buildings that are 3 stories or 10.7 metres (35 feet) or more in height, or districts that have a Basic Fire Flow greater than 15,000 LPM (3,300 IGPM), or any combination of these criteria, should have a ladder company. The height of all buildings in the community, including those protected by automatic sprinklers, is considered when determining the number of needed ladder companies.

When no individual response area/district alone needs a ladder company, at least one ladder company is needed if the sum of buildings in the fire protection area meets the above criteria."

The needed length of an aerial ladder, an elevating platform and an elevating stream device shall be determined by the height of the tallest building in the ladder/service district (fire protection area) used to determine the need for a ladder company. One storey normally equals at least 3 metres (10 feet). Building setback is not to be considered in the height determination. An allowance is built into the ladder design for normal access. The maximum height needed for grading purposes shall be 30.5 metres (100 feet).



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Exception: When the height of the tallest building is 15.2 metres (50 feet) or less no credit shall be given for an aerial ladder, elevating platform or elevating stream device that has a length less than 15.2 metres (50 feet). This provision is necessary to ensure that the water stream from an elevating stream device has additional "reach" for large area, low height buildings, and the aerial ladder or elevating platform may be extended to compensate for possible topographical conditions that may exist. See Fire Underwriters Survey - Table of Effective Response (attached).

Furthermore, please find the following information regarding communities' need for aerial apparatus/ladder companies within the National Fire Protection Association.

#### **NFPA**

*Response Capabilities: The fire department should be prepared to provide the necessary response of apparatus, equipment and staffing to control the anticipated routine fire load for its community.*

**NFPA Fire Protection Handbook, 20th Edition** cites the following apparatus response for each designated condition:

**HIGH-HAZARD OCCUPANCIES** (schools, hospitals, nursing homes, explosive plants, refineries, high-rise buildings, and other high-risk or large fire potential occupancies):

*At least four pumpers, **two ladder trucks** (or combination apparatus with equivalent capabilities), two chief officers, and other specialized apparatus as may be needed to cope with the combustible involved; not fewer than 24 firefighters and two chief officers.*

**MEDIUM-HAZARD OCCUPANCIES** (apartments, offices, mercantile and industrial occupancies not normally requiring extensive rescue or firefighting forces):

*At least three pumpers, **one ladder truck** (or combination apparatus with equivalent capabilities), one chief officer, and other specialized apparatus as may be needed or available; not fewer than 16 firefighters and one chief officer.*

**LOW-HAZARD OCCUPANCIES** (one-, two-, or three-family dwellings and scattered small businesses and industrial occupancies):

*At least two pumpers, **one ladder truck** (or combination apparatus with equivalent capabilities), one chief officer, and other specialized apparatus as may be needed or available; not fewer than 12 firefighters and one chief officer.*



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In addition to the previous references, the following excerpt from the 2006 BC Building Code is also important to consider when selecting the appropriate level of fire department response capacity and building design requirements with regard to built-in protection levels (passive and active fire protection systems).

**Excerpt: National Building Code 2006**

**A-3 Application of Part 3.**

In applying the requirements of this Part, it is intended that they be applied with discretion to buildings of unusual configuration that do not clearly conform to the specific requirements, or to buildings in which processes are carried out which make compliance with particular requirements in this Part impracticable. The definition of “building” as it applies to this Code is general and encompasses most structures, including those which would not normally be considered as buildings in the layman's sense. This occurs more often in industrial uses, particularly those involving manufacturing facilities and equipment that require specialized design that may make it impracticable to follow the specific requirements of this Part. Steel mills, aluminum plants, refining, power generation and liquid storage facilities are examples. A water tank or an oil refinery, for example, has no floor area, so it is obvious that requirements for exits from floor areas would not apply. Requirements for structural fire protection in large steel mills and pulp and paper mills, particularly in certain portions, may not be practicable to achieve in terms of the construction normally used and the operations for which the space is to be used. In other portions of the same building, however, it may be quite reasonable to require that the provisions of this Part be applied (e.g., the office portions). Similarly, areas of industrial occupancy which may be occupied only periodically by service staff, such as equipment penthouses, normally would not need to have the same type of exit facility as floor areas occupied on a continuing basis. It is expected that judgment will be exercised in evaluating the application of a requirement in those cases when extenuating circumstances require special consideration, provided the occupants' safety is not endangered.

The provisions in this Part for fire protection features installed in buildings are intended to provide a minimum acceptable level of public safety. It is intended that all fire protection features of a building, whether required or not, will be designed in conformance with good fire protection engineering practice and will meet the appropriate installation requirements in relevant standards. Good design is necessary to ensure that the level of public safety established by the Code requirements will not be reduced by a voluntary installation.

**Firefighting Assumptions**

The requirements of this Part are based on the assumption that firefighting capabilities are available in the event of a fire emergency. These firefighting capabilities may take the form of a



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paid or volunteer public fire department or in some cases a private fire brigade. If these firefighting capabilities are not available, additional fire safety measures may be required.

Firefighting capability can vary from municipality to municipality. Generally, larger municipalities have greater firefighting capability than smaller ones. Similarly, older, well established municipalities may have better firefighting facilities than newly formed or rapidly growing ones. The level of municipal fire protection considered to be adequate will normally depend on both the size of the municipality (i.e., the number of buildings to be protected) and the size of buildings within that municipality. Since larger buildings tend to be located in larger municipalities, they are generally, but not always, favoured with a higher level of municipal protection.

Although it is reasonable to consider that some level of municipal firefighting capability was assumed in developing the fire safety provisions in Part 3, this was not done on a consistent or defined basis. The requirements in the Code, while developed in the light of commonly prevailing municipal fire protection levels, do not attempt to relate the size of building to the level of municipal protection. **The responsibility for controlling the maximum size of building to be permitted in a municipality in relation to local firefighting capability rests with the municipality. If a proposed building is too large, either in terms of floor area or building height, to receive reasonable protection from the municipal fire department, fire protection requirements in addition to those prescribed in this Code, may be necessary to compensate for this deficiency.** Automatic sprinkler protection may be one option to be considered.

Alternatively, the municipality may, in light of its firefighting capability, elect to introduce zoning restrictions to ensure that the maximum building size is related to available municipal fire protection facilities. This is, by necessity, a somewhat arbitrary decision and should be made in consultation with the local firefighting service, who should have an appreciation of their capability to fight fires.

The requirements of Subsection 3.2.3. are intended to prevent fire spread from thermal radiation assuming there is adequate firefighting available. It has been found that periods of from 10 to 30 minutes usually elapse between the outbreak of fire in a building that is not protected with an automatic sprinkler system and the attainment of high radiation levels. During this period, the specified spatial separations should prove adequate to inhibit ignition of an exposed building face or the interior of an adjacent building by radiation. Subsequently, however, reduction of the fire intensity by firefighting and the protective wetting of the exposed building face will often be necessary as supplementary measures to inhibit fire spread.

In the case of a building that is sprinklered throughout, the automatic sprinkler system should control the fire to an extent that radiation to neighbouring buildings should be minimal. Although there will be some radiation effect on a sprinklered building from a fire in a neighbouring building, the internal sprinkler system should control any fires that might be ignited in the building and thereby minimize the possibility of the fire spreading into the exposed building. NFPA 80A, "Protection of Buildings from Exterior Fire Exposures," provides additional information on the possibility of fire spread at building exteriors.



The water supply requirements for fire protection installations depend on the requirements of any automatic sprinkler installations and also on the number of fire streams that may be needed at any fire, having regard to the length of time the streams will have to be used. Both these factors are largely influenced by the conditions at the building to be equipped, and the quantity and pressure of water needed for the protection of both the interior and exterior of the building must be ascertained before the water supply is decided upon. Acceptable water supplies may be a public waterworks system that has adequate pressure and discharge capacity, automatic fire pumps, pressure tanks, manually controlled fire pumps in combination with pressure tanks, gravity tanks, and manually controlled fire pumps operated by remote control devices at each hose station.

For further information regarding the acceptability of emergency apparatus for fire insurance grading purposes, please contact:

| Western Canada                                                                          | Quebec                                                                                             | Ontario                                                                                                    | Atlantic Canada                                                                                                |
|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
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## APPENDIX E FUS Technical Bulletin - Frequency of Inspections

# TECHNICAL BULLETIN

## FIRE UNDERWRITERS SURVEY™

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### FIRE UNDERWRITERS SURVEY RECOMMENDED FREQUENCY OF FIRE PREVENTION INSPECTIONS

The frequency of fire prevention inspections for all occupancies should be specifically appropriate for the level of fire risk within the occupancy. The frequency of inspections will vary from one occupancy to another depending on:

1. Type of occupancy.
2. Occupant load.
3. Function.
4. Grade of hazard.

As the fire risk increases, the frequency of inspections should also be increased.

The following table is a minimum frequency guideline for major occupancy classifications from the National Building Code of Canada.

| Group - Division (National Building Code) Occupancy | Minimum Inspection Frequency |
|-----------------------------------------------------|------------------------------|
| A-1                                                 | 6 months                     |
| A-2                                                 | 6 months                     |
| A-3                                                 | 6 months                     |
| A-4                                                 | 6 months                     |
| B-1                                                 | 6 months                     |
| B-2                                                 | 6 months                     |
| C                                                   | 6 months                     |
| D                                                   | 12 months                    |
| E                                                   | 12 months                    |
| F-1                                                 | 3 months                     |
| F-2                                                 | 6 months                     |
| F-3                                                 | 6 months                     |





Sample Customized Frequency Schedule

| <b>Sample Customized Frequency Schedule</b>    |                                                                                                                                                                                                                                                                                                        | <b>Sample Customized Frequency Schedule</b>    |                                                                                                                                                                            |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Group - Division National Building Code</b> | <b>Occupancy</b>                                                                                                                                                                                                                                                                                       | <b>Group - Division National Building Code</b> | <b>Occupancy</b>                                                                                                                                                           |
| <b>A-1</b>                                     | Movie Theaters<br>Theaters                                                                                                                                                                                                                                                                             | <b>C</b>                                       | Apartments<br>Boarding Houses<br>Hotels (Unsprinklered)<br>Hotels (Sprinklered)<br>Lodging Houses<br>Motels<br>Residential Schools                                         |
| <b>A-2</b>                                     | Bowling Alleys<br>Churches<br>Non-Residential Clubs<br>Community Halls<br>Dance Halls<br>Exhibition Halls<br>Gymnasiums<br>Libraries<br>Licensed Beverage Premises (Unsprinklered)<br>Licensed Beverage Premises (Sprinklered)<br>Museums<br>Restaurants<br>Schools<br>Daycares<br>Undertaker Premises | <b>D</b>                                       | Banks<br>Barbers/Hairdressers<br>Beauty Parlours<br>Dental Offices<br>Self-Services Laundries<br>Medical Offices<br>Offices<br>Radio Stations<br>Appliance Service/Rentals |
| <b>A-3</b>                                     | Arenas<br>Rinks<br>Indoor Pools                                                                                                                                                                                                                                                                        | <b>E</b>                                       | Department Stores<br>Shops<br>Stores<br>Supermarkets                                                                                                                       |
| <b>A-4</b>                                     | Stadiums                                                                                                                                                                                                                                                                                               | <b>F-1</b>                                     | Feed Mills<br>Spray Paint Booths                                                                                                                                           |
| <b>B-1</b>                                     | Jails<br>Police Stations                                                                                                                                                                                                                                                                               | <b>F-2</b>                                     | Warehouses, Service Stations                                                                                                                                               |
| <b>B-2</b>                                     | Children's Custodial Homes<br>Hospitals<br>Nursing Homes                                                                                                                                                                                                                                               | <b>F-3</b>                                     | Storage Garages, Medical Labs                                                                                                                                              |

For further information regarding frequency of fire prevention inspections for fire insurance grading purposes, please contact a Fire Underwriters Survey office.

| Western Canada                                                                                                      | Quebec                                                                                                                          | Ontario                                                                                                                                | Atlantic Canada                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
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## APPENDIX F Flow Test Results

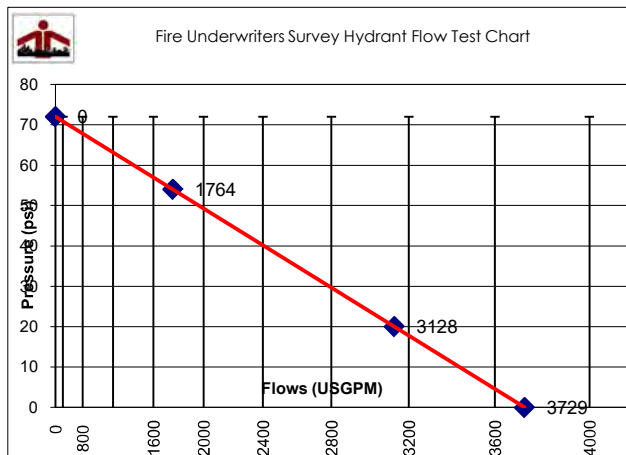
# WATER FLOW TEST REPORT

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Available Fire Flow Calculator for Fire Insurance Grading purposes. Independent verification needed for purposes outside of this study

|                                                                                                                                                       |                                                                                                        |                          |                                     |               |                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------|---------------|----------------------|
| Name of Risk:                                                                                                                                         | Flow testing                                                                                           |                          |                                     | Test No.      | Flow test 1          |
| Municipality:                                                                                                                                         | Fort Saskatchewan                                                                                      |                          |                                     | Test By:      | Public Works, FUS    |
| Purpose of Test:                                                                                                                                      | Fire Insurance Grading                                                                                 |                          |                                     | Date:         | 19-Sep-13            |
| Type of Construction                                                                                                                                  | N/A                                                                                                    |                          |                                     |               |                      |
| Ground Floor Area                                                                                                                                     | N/A                                                                                                    |                          | # of storeys                        | N/A           |                      |
| Occupancy                                                                                                                                             | N/A                                                                                                    |                          | Sprinklered?                        | N/A           |                      |
| Exposures                                                                                                                                             | Front:                                                                                                 | N/A                      | Rear:                               | N/A           | Left: N/A Right: N/A |
| Size of Main: <u>150mm</u> Dead End: <u>Y</u> Two Ways: <u>N</u> Loop: <u>N</u><br>Source Reliable: <u>Y</u> If not explain: _____<br>Comments: _____ |                                                                                                        |                          |                                     |               |                      |
| <b>TEST DATA:</b>                                                                                                                                     |                                                                                                        |                          |                                     |               |                      |
| Location of hydrants; Residual: <u>Val Terrace</u>                                                                                                    |                                                                                                        |                          |                                     |               |                      |
| Flow: <u>End of Val Terrace</u>                                                                                                                       |                                                                                                        |                          |                                     |               |                      |
| FLOW HYDRANT(S)                                                                                                                                       | SIZE OPENING:                                                                                          | Orifice #1<br><u>2.5</u> | Orifice #2<br><u>Used pitotless</u> | Orifice #3    |                      |
|                                                                                                                                                       | COEFFICIENT:                                                                                           | <u>0.88</u>              |                                     |               |                      |
|                                                                                                                                                       | PITOT READING:                                                                                         | <u>32</u>                |                                     |               |                      |
|                                                                                                                                                       | GPM:                                                                                                   | <u>928</u>               | <u>836</u>                          | <u>0</u>      |                      |
| TOTAL FLOW DURING TEST:                                                                                                                               | <u>1764</u> USgpm<br>1469 Igpm<br>6,678 LPM                                                            |                          |                                     |               |                      |
| STATIC READING:                                                                                                                                       | <u>72</u> PSI                                                                                          | RESIDUAL:                |                                     | <u>54</u> PSI |                      |
| RATED CAPACITY:                                                                                                                                       | <u>3128</u> USGPM @ 20 psi      AT 0 PSI <u>3729</u> GPM<br>2605 Igpm @ 20 psi<br>11,842 LPM @ 138 kPa |                          |                                     |               |                      |
| REMARKS:                                                                                                                                              | Error Margin +/-      10%                                                                              |                          |                                     |               |                      |



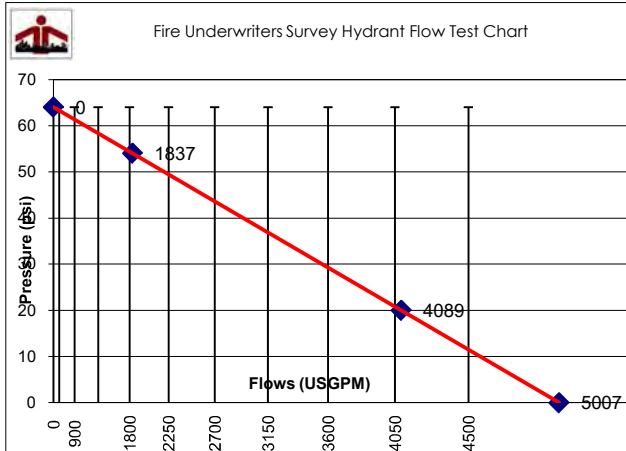
# WATER FLOW TEST REPORT

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Available Fire Flow Calculator for Fire Insurance Grading purposes. Independent verification needed for purposes outside of this study

|                                                                                                                                                       |                                                                                                        |                  |               |          |                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|------------------|---------------|----------|----------------------|
| Name of Risk:                                                                                                                                         | Flow testing                                                                                           |                  |               | Test No. | Flow test 2          |
| Municipality:                                                                                                                                         | Fort Saskatchewan                                                                                      |                  |               | Test By: | Public Works, FUS    |
| Purpose of Test:                                                                                                                                      | Fire Insurance Grading                                                                                 |                  |               | Date:    | 19-Sep-13            |
| Type of Construction                                                                                                                                  | N/A                                                                                                    |                  |               |          |                      |
| Ground Floor Area                                                                                                                                     | N/A                                                                                                    |                  | # of storeys  | N/A      |                      |
| Occupancy                                                                                                                                             | N/A                                                                                                    |                  | Sprinklered?  | N/A      |                      |
| Exposures                                                                                                                                             | Front:                                                                                                 | N/A              | Rear:         | N/A      | Left: N/A Right: N/A |
| Size of Main: <u>300mm</u> Dead End: <u>N</u> Two Ways: <u>Y</u> Loop: <u>Y</u><br>Source Reliable: <u>Y</u> If not explain: _____<br>Comments: _____ |                                                                                                        |                  |               |          |                      |
| <b>TEST DATA:</b>                                                                                                                                     |                                                                                                        |                  |               |          |                      |
| Location of hydrants; Residual: <u>82 Street and 98 Avenue</u>                                                                                        |                                                                                                        |                  |               |          |                      |
| Flow: <u>Outside James Mowat School</u>                                                                                                               |                                                                                                        |                  |               |          |                      |
| FLOW HYDRANT(S)                                                                                                                                       | Orifice #1                                                                                             | Orifice #2       | Orifice #3    |          |                      |
| SIZE OPENING:                                                                                                                                         | <u>2.5</u>                                                                                             | <u>pitotless</u> |               |          |                      |
| COEFFICIENT:                                                                                                                                          | <u>0.88</u>                                                                                            |                  |               |          |                      |
| PITOT READING:                                                                                                                                        | <u>36</u>                                                                                              |                  |               |          |                      |
| GPM:                                                                                                                                                  | <u>984</u>                                                                                             | <u>853</u>       | <u>0</u>      |          |                      |
| TOTAL FLOW DURING TEST:                                                                                                                               | <u>1837</u> USgpm<br>1530 Igpm<br>6,955 LPM                                                            |                  |               |          |                      |
| STATIC READING:                                                                                                                                       | <u>64</u> PSI                                                                                          | RESIDUAL:        | <u>54</u> PSI |          |                      |
| RATED CAPACITY:                                                                                                                                       | <u>4089</u> USGPM @ 20 psi      AT 0 PSI <u>5007</u> GPM<br>3405 Igpm @ 20 psi<br>15,480 LPM @ 138 kPa |                  |               |          |                      |
| REMARKS:                                                                                                                                              | Error Margin +/-      44% Main too large for 25% drop                                                  |                  |               |          |                      |



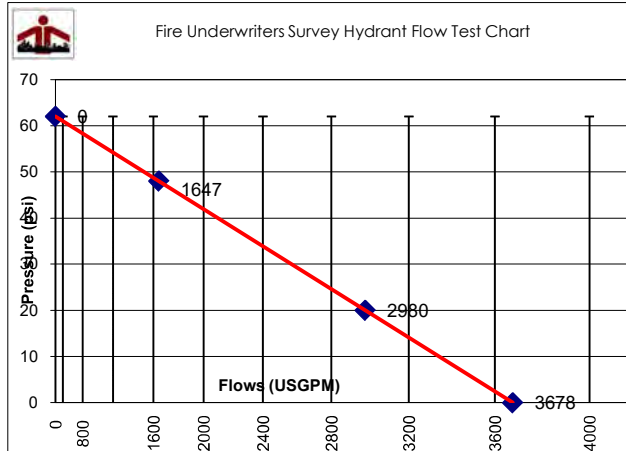
# WATER FLOW TEST REPORT

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Available Fire Flow Calculator for Fire Insurance Grading purposes. Independent verification needed for purposes outside of this study

|                                                                                                                                                                                                       |                        |                      |                              |            |                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------------------|------------------------------|------------|----------------------|
| Name of Risk:                                                                                                                                                                                         | Flow testing           |                      |                              | Test No.   | Flow test 3          |
| Municipality:                                                                                                                                                                                         | Fort Saskatchewan      |                      |                              | Test By:   | Public Works, FUS    |
| Purpose of Test:                                                                                                                                                                                      | Fire Insurance Grading |                      |                              | Date:      | 19-Sep-13            |
| Type of Construction                                                                                                                                                                                  | N/A                    |                      |                              |            |                      |
| Ground Floor Area                                                                                                                                                                                     | N/A                    |                      | # of storeys                 | N/A        |                      |
| Occupancy                                                                                                                                                                                             | N/A                    |                      | Sprinklered?                 | N/A        |                      |
| Exposures                                                                                                                                                                                             | Front:                 | N/A                  | Rear:                        | N/A        | Left: N/A Right: N/A |
| Size of Main: <u>Not on drawing</u> Dead End: <u>Not on drawing</u> Two Ways: <u>Not on drawing</u> Loop: <u>Not on drawing</u><br>Source Reliable: <u>Y</u> If not explain: _____<br>Comments: _____ |                        |                      |                              |            |                      |
| <b>TEST DATA:</b>                                                                                                                                                                                     |                        |                      |                              |            |                      |
| Location of hydrants; Residual: <u>Josephburg Road near 88 Avenue</u>                                                                                                                                 |                        |                      |                              |            |                      |
| Flow: <u>Josephburg Road near 88 Avenue</u>                                                                                                                                                           |                        |                      |                              |            |                      |
| FLOW HYDRANT(S)                                                                                                                                                                                       | SIZE OPENING:          | Orifice #1<br>2.5    | Orifice #2<br>Used pitotless | Orifice #3 |                      |
|                                                                                                                                                                                                       | COEFFICIENT:           | 0.88                 |                              |            |                      |
|                                                                                                                                                                                                       | PITOT READING:         | 30                   |                              |            |                      |
|                                                                                                                                                                                                       | GPM:                   | 899                  | 748                          | 0          |                      |
| TOTAL FLOW DURING TEST:                                                                                                                                                                               |                        | 1647 USgpm           |                              |            |                      |
|                                                                                                                                                                                                       |                        | 1371 Igpm            |                              |            |                      |
|                                                                                                                                                                                                       |                        | 6,233 LPM            |                              |            |                      |
| STATIC READING:                                                                                                                                                                                       |                        | 62 PSI               | RESIDUAL:                    | 48 PSI     |                      |
| RATED CAPACITY:                                                                                                                                                                                       |                        | 2980 USGPM @ 20 psi  | AT 0 PSI                     | 3678 GPM   |                      |
|                                                                                                                                                                                                       |                        | 2481 Igpm @ 20 psi   |                              |            |                      |
|                                                                                                                                                                                                       |                        | 11,281 LPM @ 138 kPa |                              |            |                      |
| REMARKS:                                                                                                                                                                                              | Error Margin +/- 19%   |                      |                              |            |                      |



# WATER FLOW TEST REPORT

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Available Fire Flow Calculator for Fire Insurance Grading purposes. Independent verification needed for purposes outside of this study

|                      |                        |              |              |                   |
|----------------------|------------------------|--------------|--------------|-------------------|
| Name of Risk:        | Flow testing           |              | Test No.     | Flow test 4       |
| Municipality:        | Fort Saskatchewan      |              | Test By:     | Public Works, FUS |
| Purpose of Test:     | Fire Insurance Grading |              | Date:        | 19-Sep-13         |
| Type of Construction | N/A                    |              |              |                   |
| Ground Floor Area    | N/A                    | # of storeys | N/A          |                   |
| Occupancy            | N/A                    |              | Sprinklered? | N/A               |
| Exposures            | Front: N/A             | Rear: N/A    | Left: N/A    | Right: N/A        |

Size of Main: 150mm Dead End: N Two Ways: Y Loop: Y  
 Source Reliable: Y If not explain: \_\_\_\_\_  
 Comments: \_\_\_\_\_

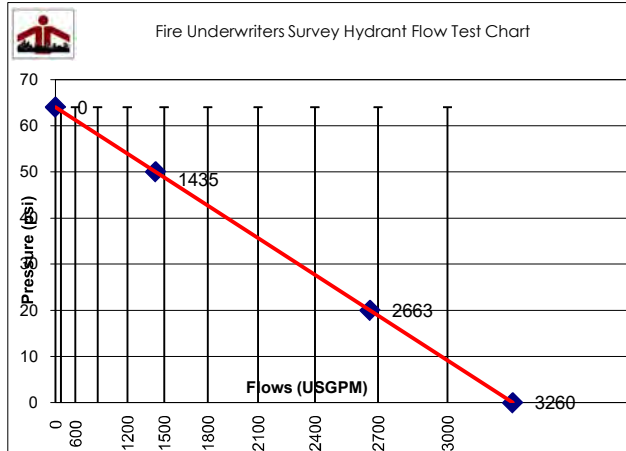
## TEST DATA:

Location of hydrants; Residual: On 103 Street south of 101 Avenue

Flow: 103 Street at 102 Avenue

| FLOW HYDRANT(S)         | Orifice #1                 | Orifice #2            | Orifice #3               |
|-------------------------|----------------------------|-----------------------|--------------------------|
| SIZE OPENING:           | <u>2.5</u>                 | <u>Used pitotless</u> |                          |
| COEFFICIENT:            | <u>0.88</u>                |                       |                          |
| PITOT READING:          | <u>23</u>                  |                       |                          |
| GPM:                    | <u>787</u>                 | <u>648</u>            | <u>0</u>                 |
| TOTAL FLOW DURING TEST: | <u>1435</u> USgpm          |                       |                          |
|                         | 1195 lpgm                  |                       |                          |
|                         | 5,431 LPM                  |                       |                          |
| STATIC READING:         | <u>64</u> PSI              | RESIDUAL:             | <u>50</u> PSI            |
| RATED CAPACITY:         | <u>2663</u> USGPM @ 20 psi |                       | AT 0 PSI <u>3260</u> GPM |
|                         | 2217 lpgm @ 20 psi         |                       |                          |
|                         | 10,080 LPM @ 138 kPa       |                       |                          |

REMARKS: Error Margin +/- 21%



# WATER FLOW TEST REPORT

## Fire Underwriters Survey

A SERVICE TO INSURERS AND MUNICIPALITIES



Available Fire Flow Calculator for Fire Insurance Grading purposes. Independent verification needed for purposes outside of this study

|                      |                        |     |              |          |                      |
|----------------------|------------------------|-----|--------------|----------|----------------------|
| Name of Risk:        | Flow testing           |     |              | Test No. | Flow test 5          |
| Municipality:        | Fort Saskatchewan      |     |              | Test By: | Public Works, FUS    |
| Purpose of Test:     | Fire Insurance Grading |     |              | Date:    | 19-Sep-13            |
| Type of Construction | N/A                    |     |              |          |                      |
| Ground Floor Area    | N/A                    |     | # of storeys | N/A      |                      |
| Occupancy            | N/A                    |     | Sprinklered? | N/A      |                      |
| Exposures            | Front:                 | N/A | Rear:        | N/A      | Left: N/A Right: N/A |

Size of Main: 300mm Dead End: N Two Ways: Y Loop: Y  
 Source Reliable: Y If not explain: \_\_\_\_\_

Comments: \_\_\_\_\_

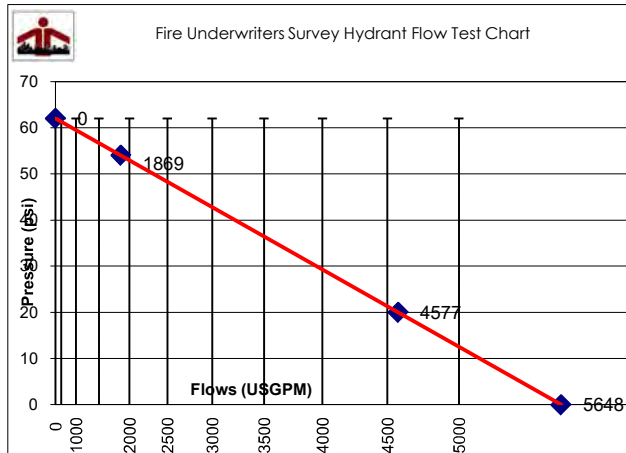
### TEST DATA:

Location of hydrants; Residual: On 97 avenue

Flow: On 97 Avenue near 89a Street

| FLOW HYDRANT(S)         | Orifice #1                 | Orifice #2            | Orifice #3               |
|-------------------------|----------------------------|-----------------------|--------------------------|
| SIZE OPENING:           | <u>2.5</u>                 | <u>Used pitotless</u> |                          |
| COEFFICIENT:            | <u>0.88</u>                |                       |                          |
| PITOT READING:          | <u>36</u>                  |                       |                          |
| GPM:                    | <u>984</u>                 | <u>885</u>            | <u>0</u>                 |
| TOTAL FLOW DURING TEST: | <u>1869</u> USgpm          |                       |                          |
|                         | 1557 Igpm                  |                       |                          |
|                         | 7,076 LPM                  |                       |                          |
| STATIC READING:         | <u>62</u> PSI              | RESIDUAL:             | <u>54</u> PSI            |
| RATED CAPACITY:         | <u>4577</u> USGPM @ 20 psi |                       | AT 0 PSI <u>5648</u> GPM |
|                         | 3811 Igpm @ 20 psi         |                       |                          |
|                         | 17,326 LPM @ 138 kPa       |                       |                          |

REMARKS: Error Margin +/- 54% Main too large for 25% drop





# WATER FLOW TEST REPORT

**Fire Underwriters Survey**  
A SERVICE TO INSURERS AND MUNICIPALITIES



Available Fire Flow Calculator for Fire Insurance Grading purposes. Independent verification needed for purposes outside of this study

|                                                                                                                                                                                                       |                        |                     |                              |            |                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------|------------------------------|------------|----------------------|
| Name of Risk:                                                                                                                                                                                         | Flow testing           |                     |                              | Test No.   | Flow test 6          |
| Municipality:                                                                                                                                                                                         | Fort Saskatchewan      |                     |                              | Test By:   | Public Works, FUS    |
| Purpose of Test:                                                                                                                                                                                      | Fire Insurance Grading |                     |                              | Date:      | 19-Sep-13            |
| Type of Construction                                                                                                                                                                                  | N/A                    |                     |                              |            |                      |
| Ground Floor Area                                                                                                                                                                                     | N/A                    |                     | # of storeys                 | N/A        |                      |
| Occupancy                                                                                                                                                                                             | N/A                    |                     | Sprinklered?                 | N/A        |                      |
| Exposures                                                                                                                                                                                             | Front:                 | N/A                 | Rear:                        | N/A        | Left: N/A Right: N/A |
| Size of Main: <u>Not on drawing</u> Dead End: <u>Not on drawing</u> Two Ways: <u>Not on drawing</u> Loop: <u>Not on drawing</u><br>Source Reliable: <u>Y</u> If not explain: _____<br>Comments: _____ |                        |                     |                              |            |                      |
| <b>TEST DATA:</b>                                                                                                                                                                                     |                        |                     |                              |            |                      |
| Location of hydrants; Residual: <u>Dow Centre</u>                                                                                                                                                     |                        |                     |                              |            |                      |
| Flow: <u>Dow Centre</u>                                                                                                                                                                               |                        |                     |                              |            |                      |
| FLOW HYDRANT(S)                                                                                                                                                                                       | SIZE OPENING:          | Orifice #1<br>2.5   | Orifice #2<br>Used pitotless | Orifice #3 |                      |
|                                                                                                                                                                                                       | COEFFICIENT:           | 0.88                |                              |            |                      |
|                                                                                                                                                                                                       | PITOT READING:         | 26                  |                              |            |                      |
|                                                                                                                                                                                                       | GPM:                   | 837                 | 709                          | 0          |                      |
| TOTAL FLOW DURING TEST:                                                                                                                                                                               |                        | 1546 USgpm          |                              |            |                      |
|                                                                                                                                                                                                       |                        | 1287 Igpm           |                              |            |                      |
|                                                                                                                                                                                                       |                        | 5,851 LPM           |                              |            |                      |
| STATIC READING:                                                                                                                                                                                       | 58 PSI                 |                     | RESIDUAL:                    | 42 PSI     |                      |
| RATED CAPACITY:                                                                                                                                                                                       |                        | 2466 USGPM @ 20 psi | AT 0 PSI                     | 3098 GPM   |                      |
|                                                                                                                                                                                                       |                        | 2053 Igpm @ 20 psi  |                              |            |                      |
|                                                                                                                                                                                                       |                        | 9,334 LPM @ 138 kPa |                              |            |                      |
| REMARKS:                                                                                                                                                                                              | Error Margin +/- 10%   |                     |                              |            |                      |

