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1.0 INTRODUCTION

The purpose of this study is to determine and rank potential locations for the proposed Uxbridge Fire Department and Township Emergency Operations Centre. Potential locations were ranked based on the following measures of effectiveness:

- Size of property;
- Ease of access onto arterial/collector road;
- Ease of implementation;
- Current land ownership and cost;
- Servicing;
- Transportation conditions;
- Coverage;
- Proximity to high risk uses; and
- Proximity to town centre.

Our assessment includes a computer simulation of each of the potential options, based on a GIS environment. The GIS environment has been calibrated to significant existing and future conditions. The National Fire Protection Association (NFPA) 1720 guideline for volunteer fire departments is used to establish the response time objectives.

2.0 PLANNING CONTEXT

2.1 Land Use Patterns

The Township of Uxbridge is one of the eight municipalities forming the Regional Municipality of Durham. It is bounded by the Region of York to the north and the west, the Township of Brock and the Township of Scugog to the east, and the Town of Pickering to the south. The Town of Uxbridge is home to the majority of the Township's population. The remainder of the Township consists of Goodwood, Leaskdale, Coppins Corners, Sandford, Siloam, Udora, and Zephyr. The Township is predominantly a rural community, with growing urban residential and commercial development. The Township also possesses a strong industrial economy.

The building stock of the Township includes single-family and multi-unit dwellings, commercial establishments, farms, schools, large and small industrial/manufacturing complexes, nursing homes, and a number of community centres. Single-family residential dwellings make up the majority of occupancies in the Township. The land use pattern of the Township is shown in **Figure 1**.

The major development areas within the Town include:

- The ICR Commercial area (5,110 sq. m) – located along Highway 47 and west of O'Neil Road;
- The Green Apple Commercial Vinces (3,710 sq. m) – located at the northwest of Highway 47 at Elgin Park Drive;
- The Action Commercial Area (2,818 aq. m) – located at the southwest of Highway 47 at Elgin Park Drive;
- The Suncreek Commercial Area (1,858 sq. m) – located at the northwest of highway 47 at Banff Road;
- The Williamson and Callo Commercial Area (5,886 sq. m) – located at the southwest of Highway 47 at Douglas Road;
- The Wal-Mart Expansion on Welwood Drive; and,
- Residential development of approximately 770 residential units that are currently draft approved.

2.1.1. Dwelling Characteristics and Residential Forecast Summary

According to the 2006 Census, the Township has a population of 19,169 over an area of 420.65 square kilometers. The population has increased 10.3 percent since 2001 and has a density of 45.6 people per square kilometer. The Township's Official Plan has anticipated that between the years 1999 and 2021, the population of the Township's urban area will increase

to 12,500 people, from 7,745 people in 1996. Beyond these levels residential growth is severely constrained by the provincial Places to Grow directive. In 2001 there were a total of 6,100 private dwellings. In 2006, there were a total of 6,900 private dwellings. Approximately 83.5 percent of the total 2006 private dwellings were comprised of single-detached houses followed by apartments (8.8 percent) and row houses (4.2 percent).

2.1.2. Employment in Uxbridge

According to the Simplified Needs Analysis conducted for the Township of Uxbridge Fire Department (SNA) in 2005, there were approximately 375 registered businesses within the Township of Uxbridge. There is an estimated total workforce of more than 10,895 in the Township of Uxbridge. The largest employer by industry sector is business services, which employs 2,205 staff. Other local employment types are shown in **Figure 2** below:

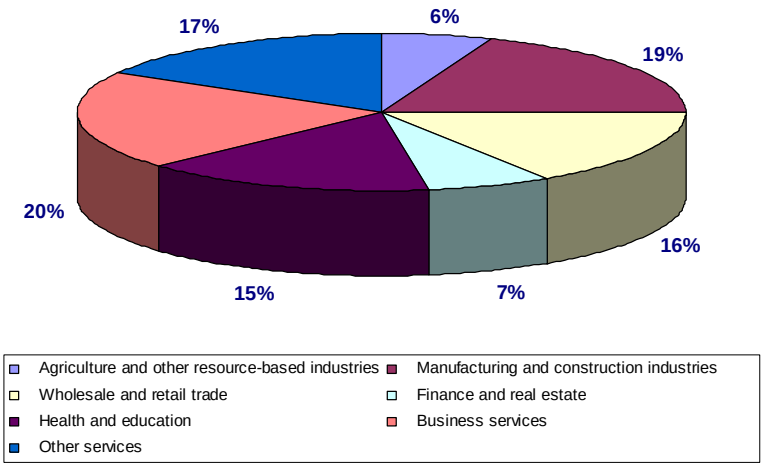

FIGURE 2: UXBRIDGE LOCAL EMPLOYMENT

Over the 2001- 2006 period, the following trends in employment are evident:

- Business service has replaced wholesale and retail trade, becoming the Township's largest employment sector. There has been an increase of 500 jobs in the business service sector;
- Increase of 320 jobs in the manufacturing and construction sectors;
- Increase of 365 jobs in the health and education sectors;
- Wholesale and retail trade has declined from 19 percent in 2001 to 16 percent in 2006 resulting in a net loss of 80 jobs;
- Net loss of 60 jobs in agriculture and other resource-based industries; and,
- Increase of 225 jobs in other sectors.

2.2 Future Road Network Considerations

A number of road improvements are planned or proposed in the Township of Uxbridge including:

- Signal improvement in 2008 at Regional Road #21 and Regional Road #23;
- Signal improvement in 2009 at Brock Street and Toronto Street;
- Roundabout at the intersection of 6th Concession Road and Regional Road #8; and,
- Traffic calming device at Old Campbell Drive/New Campbell Drive.

Improvements to the road network are in response to the future development expected to take place within the Township.

2.3 Response Guidelines

The two primary options for response time guidelines are the National Fire Protection Association 1710 and 1720 (NFPA) standards and the Ontario Fire Marshal (OFM) guidelines. These are summarized as follows:

- The Fire Ground Staffing Guideline, produced by the OFM, requires the arrival of 10 firefighting personnel (with appropriate apparatus) in 10 minutes total response time for 90 percent of incidents;
- Under the NFPA 1710 standard, first response is required within 4 minutes travel time, 90 percent of the time. Second response is required within 8 minutes travel time, 90 percent of the time. There should be a minimum of four fire-fighters on each apparatus. The 1710 Standard is an internationally recognized standard, applicable to full-time professional fire services; and
- The NFPA 1720 standard is applicable to volunteer firefighter departments, which provide emergency medical services and special operations. A Volunteer Fire Department is a fire department having volunteer emergency service personnel comprising 85 percent or greater of its department membership. According to the NFPA 1720:
    - Urban Zones with greater than 1000 people/sq. mi. call for 15 staff with a response time of 9 minutes, 90 percent of the time;
    - Suburban Zones with 500 to 1000 people/sq. mi. call for 10 staff with a response time of 10 minutes, 80 percent of the time;
    - Rural Zones with less than 500 people/sq. mi. call for 6 staff with a response time of 14 minutes, 80 percent of the time; and,

- Remote Zones with a travel distance greater than or equal to 8 mi. call for 4 staff 90 percent of the time. Upon assembling the necessary resources at the emergency scene, the fire department should have the capability to safely commence an initial attack within 2 minutes 90 percent of the time.

While the NFPA standards have no legal status in Canada, they are based on the collective experience of professional fire-fighters and technical research. These standards are considered to be the most comprehensive technically and are widely accepted in jurisdictions across the continent. Therefore, the NFPA guidelines have been relied upon as the primary benchmarks for this report. Given that this is a volunteer fire station servicing a mix of rural and urban areas, the NFPA 1720 is used.

3.0 ANALYSIS OF EXISTING RESPONSE TIMES AND GAP AREAS

3.1 Current Station

The existing Uxbridge Volunteer Fire Department is located at 17 Bascom Street in Uxbridge's downtown core. The fire apparatus exit the station via Bascom Street and reverses into the station upon returning. The current facility is serviced by municipal water and sewer.

The Fire Master Plan (FMP) identifies the following issues with the current fire station:

- The current fire apparatus are much larger than models built in the past and the apparatus bays are too small to house newer firefighting vehicles thus resulting in a number of health and safety issues;
- Fire suppression is no longer the primary activity of the Fire Department. Presently, fire prevention, public education, rescue, and medical aid represent a large portion of the services provided; and,
- Public access, gender issues, disaster preparedness, and training requirements place additional operation demands on the existing fire station.

The Fire Underwriters Survey expressed the following concerns in their Updated Risk Assessment of the Township:

- The present fire station is too small to house new apparatus and prevents the required expansion of the number of apparatus needed as the community grows;
- With the expansion of the Township’s urban area, the fire station is poorly located to provide prompt emergency response to all areas of the Township; and,
- The current location of the fire station is on a side street and access for the volunteer firefighters is by way of highly congested traffic routes during normal business hours.

It is evident from the Fire Underwriters Survey report and the Fire Master Plan that the construction of a new fire station is required in order to provide sufficient space for existing and future needs.

3.2 Modeling Emergency Response

Our assessment has included a computer simulation of emergency response, based on a GIS environment. This assessment has been calibrated to actual conditions.

The calibration of the travel time contours is a four-step process, with the final three steps part of an iterative framework as shown in **Figure 3**. The four steps are: geocoding of the historical fire calls onto the network; speed and travel time assignment to the network links; generation of travel time contours (9 minutes) for each station; and comparison of the number of geocoded calls included in the response contour to the pattern of the total call dataset. Each step is described below.

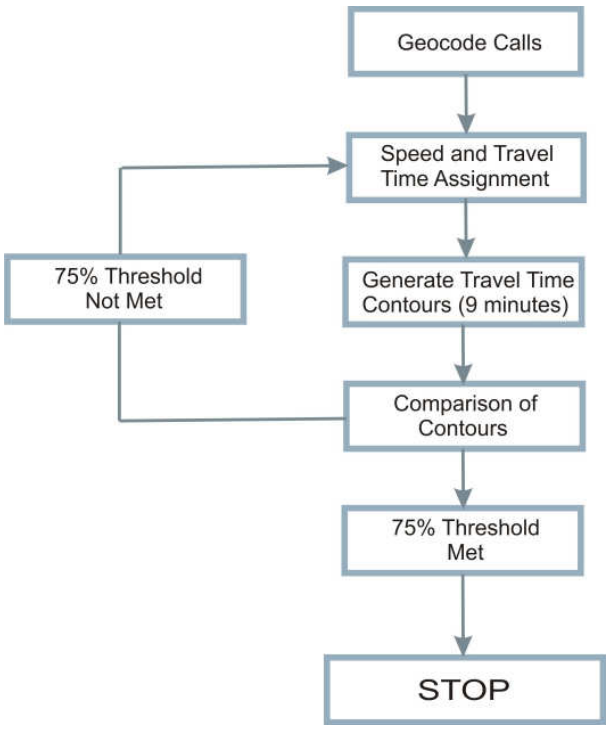

FIGURE 3: CALIBRATION FLOW CHART

- Geocode the historical fire calls dataset to spatially locate each call on to the model network. Each call has a unique set of geographic coordinates; assigning these to the mapping is referred to as “geocoding”;
- A 75 percent accuracy threshold was defined to account for inaccurate or blank addresses in the dataset; and,
- The above matched calls were stratified based on the associated fire station and a travel time of 9 minutes or less.

SPEED AND TRAVEL TIME ASSIGNMENT

- An initial speed and travel time was assigned to each link on the network. These speeds represent pumper speeds;
- The initial speeds were based on street classification e.g. 45 km/hr for local roads and a maximum of 80 km/hr for highways;
- Speed ranges for each type of functional road class were developed to avoid inaccurate speed assignments. e.g. local roads will not be assigned speeds higher than 50 km/hr, and hence the speed range for a local road is between 40 and 50 km/hr;
- The speeds and the travel times were selected to reflect time lost for turning movements, roadway geometry and intersection characteristics. A turning movement penalty of six seconds was assigned to both the left and right turns at each intersection; and,
- One-way street movements were taken into account while simulating fire response routes.

GENERATE TRAVEL TIME CONTOURS

- Response travel time contours for each fire station location were developed using the Network Analyst extension in ArcMap 9.2. These represent the distance that a fire engine can travel from its station within 9.0 minutes, and 14.0 minutes; and,
- The calculated travel time, based on the assigned speed for each link, was used as the factor to generate the response contours.

COMPARISON OF MODELED TIME CONTOURS TO ACTUAL DATA

- Each of the generated travel time contours was compared to the extent of the distribution of the 9-minute calls for the respective stations;
- If the contour contained 75 percent (threshold for stopping the calibration process) or more of the geocoded calls for the respective station then the process was stopped. Otherwise the iteration was repeated with revised speeds and travel times to improve the accuracy;
- A 75 percent threshold for stopping the calibration was adopted because some calls in the dataset have either zero or negative values for their travel times. Additionally, the threshold would also account for outliers in the dataset. Outliers are incident records that appear to be have incorrectly entered address ranges, that indicate unusually long distances from the fire station or other anomalies; and,
- The modelled travel time contours demonstrate how well fire rescue is performing in relation to NFPA 1720, relative to the existing developed area of the Township.

3.3 Coverage from the Existing Station

The coverage from the existing station has been analyzed in relation to the NFPA 1720 Guideline for travel times. **Figure 4** shows the urban area used for this study. **Figure 5** shows the high risk uses in the Township. The high risk uses include one hospital, nine schools, ten community centres, and eleven places of worships. The area covered by the existing station is shown for the 9-minute and 14-minute travel time contours is shown in **Figure 6**. The analysis of the travel from the existing station is summarized below:

9-MINUTE TRAVEL TIME CONTOUR (EXISTING STATIONS)

- The 9-minute travel time contour provides 100 percent coverage to the urban area of the Township of Uxbridge;
- The only hospital in the Town, the Uxbridge Cottage Hospital, is covered by the 9-minute contour;
- Seven out of nine (78 percent) schools in the Township are covered by the existing 9-minute contour;
- Six out of ten (60 percent) community centers in the Township are covered by the existing 9-minute contour;
- Six out of eleven (55 percent) places of worships in the Township are covered by the existing 9-minute contour; and,
- The existing station provides some coverage to the western areas of the Township of Scugog.

14-MINUTE RESPONSE CONTOUR (EXISTING STATIONS)

- Under the 14-minute travel time contour, 100 percent of the Township urban area is covered;
- A total of 28 percent of the Township urban and rural areas are covered;
- Two schools, three community centers, and four places of worships are not covered by the 14-minute contour;
- The existing station provides some coverage to the western areas of the Township of Scugog.

3.4 Analysis of Fire Calls Dataset

The travel time contours must be considered together with the demand levels, and the statistical records of how well the station has performed in relation to the NFPA guidelines.

3.4.1. Statistic Analysis of Call Volume Data Set

In 2007, the Uxbridge Fire Department received a total of 453 emergency calls (**Figure 7**). **Table 1** illustrates the type of incidents with the highest call volumes in 2007.

TABLE 1: 2007 CALL VOLUMES BY TYPE OF INCIDENT

Type of Incident	Total Calls
Brush/Grass Fire	14
Carbon Monoxide	42
Response to Alarms	44
Vehicle Collisions	125
Medical/Aid	137
Other	*91*

Of the 453 emergency calls received, approximately 57 percent (260 calls) were related to vehicle collisions, medical, or aid. **Figure 8** highlights the 2007 monthly emergency call volumes received by the Uxbridge Fire Department.

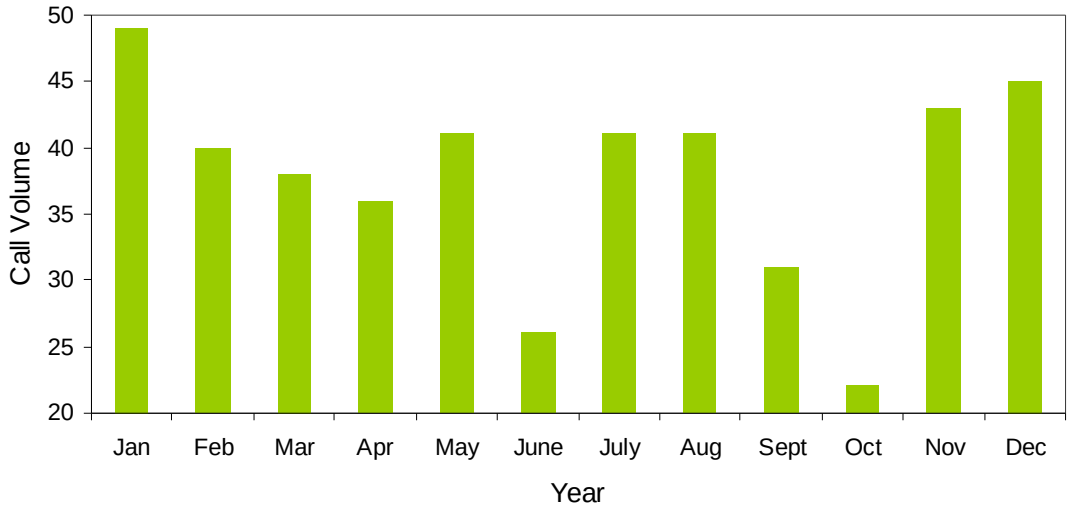

Figure 8: 2007 Uxbridge Fire Station Monthly Call Volumes

As shown in the figure above, 2007 call volumes peaked in January and were lowest in June and October.

3.4.2. Average Response and Cumulative Travel Time Analysis

Calls with travel times less than 30 minutes and greater than 10 seconds were used in the calculations. This method will get rid of "outliers" in the dataset, which can influence the calculations due to their extremely high or low values.

Table 2 and **Figure 9** show the cumulative response travel times for the Uxbridge Fire Station based on the 2007 call volume dataset.

TABLE 2: CUMULATIVE TRAVEL TIME ANALYSIS (2007 CALL VOLUMES)

Response Time (Minutes)	Call Volume	Percentage of Total Calls	Cumulative Percentage
< = 4	15	3.5	3.5
4 to 5	18	4.2	7.7
5 to 6	27	6.3	14.1
6 to 7	38	8.9	23.0
7 to 8	31	7.3	30.3
8 to 9	44	10.3	40.6
9 to 10	38	8.9	49.5
10 to 14	116	27.2	76.8
> 14	99	23.2	100.0
Total	**426**		

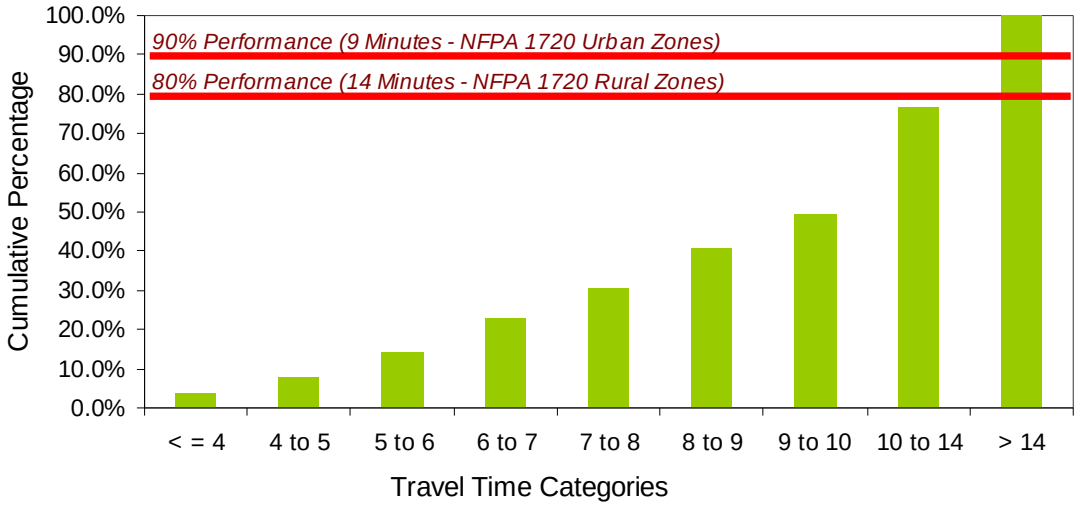

Figure 9: Cumulative Travel Time (2007)

The Uxbridge Fire Station responded to approximately 173 (41 percent) of the 426 calls in 9 minutes or less in 2007. This falls short of the NFPA 1720 criterion (discussed in Section 2.3) for Urban Zones (90 percent at 9 minutes). Of the total 2007 response times, 77 percent are less than 14 minutes which almost meets the NFPA 1720 criterion for Rural Zones (80 percent at 14 minutes).

4.0 STATION LOCATION ANALYSIS

The ideal location would be approximately 2 to 3 acres, with good access onto a major road network. To determine the optimum location of the new station, a three-tier assessment was carried out. In the first stage, the nine possible locations were examined for obvious deal-breakers, and the remaining potential sites were carried to the second stage. In the second stage, possible sites were ranked using quantifiable variables such as property size, ease of access and implementation, geographic coverage, and proximity to the key locations. In the third stage, only the top two ranked sites identified were evaluated in further detail using a more qualitative method based on GIS software.

4.1 Potential Station Locations

Nine sites were analyzed for the relocation of the Uxbridge Fire Station. The sites were determined through meetings with fire staff, fire fighters and local officials, based on their knowledge of available land and the status of the subdivision planning in the Township's urban area. The potential sites are shown in **Figure 10**. The salient features of each site are described below:

- ***Option 1***: This is a 13.7 Acre site located northeast of the intersection of 6th Concession Road North at Regional Road 8. The land is owned by the Township, zoned as community facility – 9, and designated as a park and open space area in the Official Plan. Fire Stations are permitted under this zoning provision;
- ***Option 2:*** This is a 4.1 Acre site located northwest of the intersection of Campbell Drive at Toronto Street South. The land is owned by the hospital, zoned as a community facility, and designated as an institutional area in the Official Plan. Fire Stations are permitted under this zoning provision;
- ***Option 3:*** This is a 2.6 Acre site located northwest of the intersection of Main Street South at Elgin Park Drive. The land is owned by the Township, zoned as rural, and designated as a residential area in the Official Plan. Fire Stations are permitted under this zoning provision;
- ***Option 4:*** This is a 5.9 Acre site located southeast of the intersection of Main Street South / 7th Concession Road at Elgin Park Drive. The land is zoned as recreational open space or an environmental protection zone and designated as an environmental constraint area / forest area / major open space area (Oak Ridges Moraine) in the Official Plan;
- ***Option 5:*** This is a 1.3 Acre site located southwest of the intersection of Brock Street East at Nelkydd Lane. The land is privately owned, zoned as community facility – 12, and designated as an institutional and residential area in the Official Plan. Only a public school is permitted on this zone. A zoning by-law amendment would be needed in order to allow for a fire station. Due to the size of the lot and the resulting

need to construct the station as a two floor facility, a minor variance application may be required if the station conflicts with the zoning regulations;

- ***Option 6:*** This lot is currently occupied, by Parks and Recreational facilities, located Southeast of the intersection of Main Street North at Dallas Street;
- ***Option 7:*** This site consists of six soccer fields (each approximately 1 acre) and is located northeast of the intersection of Main Street North at Colby Road. The land is publicly owned, zoned as community facility – 3, and designated as a general agricultural area in the Official Plan. Only a private school is permitted on this zone. A zoning by-law amendment would be needed in order to allow for a fire station;
- ***Option 8:*** This site is located northwest of the intersection of Brock Street East at Nelkydd Lane. Donland Lane is to be reconstructed to line up with Nelkydd Lane, so a lot will remain that borders the hydro transformer/residential on the west, residential to the north and the new street to the east; and,
- ***Option 9:*** This is a 5.3 Acre site located northwest of the intersection of Reach Street at Coral Creek Crescent. The land is owned by the Catholic School Board and zoned as a community facility.

4.2 Short-Listing Based on Deficiencies

Options 2, 4, 6, and 8 were removed from further consideration based on the following key-considerations determined through correspondence with the fire staff and our analysis meetings with the Township's Development Services Department:

- ***Option 2:*** This location lacks identity (hidden among the medical buildings) and the noise generated by the fire station would negatively impact the hospital;
- ***Option 4:*** This site is located on a flood plain;
- ***Option 6:*** This site has limited services, a small lot size and poor access; and
- ***Option 8:*** This site does not meet the size requirements for a serviced or non-serviced station. The land east of Donland Lane and north of Brock Street East was also investigated, but this land is privately owned and scheduled for commercial development with construction starting this fall.

Therefore Options 1, 3, 5, 7, and 9 were carried forward.

4.3 Quantifiable Analysis of Alternative Locations

The scoring system developed for this study is derived from the following variables.

- ***Size of property:*** Two acres is required if a property is serviced and three acres if a property is unserviced. These size requirements assume a one-storey station. Smaller lots can be considered if necessary, but would generate the extra expense of another

storey. These lot sizes are needed to accommodate safe and efficient movement of fire service vehicles in and out of the station;

- ***Ease of access onto the arterial /collector road:*** Distance to a major road, approximate distance and continuity (along the shortest path) to the town centre, and the ratio of preemptive signalized intersections to regular signalized intersections;
- ***Ease of implementation:*** Potential conflicts with existing land use;
- ***Cost/Ownership:*** Options are weighed by considering the higher cost associated with acquiring privately owned land compared to publicly owned land; as well as station (cost if applicable);
- ***Water supply:*** Servicing is assumed based on proximity to unserviced locations noted in the *Township of Uxbridge Rural Water Supply Listings* and through correspondence with the Region of Durham. Further investigation is required to determine (with certainty) if each location is serviced;
- ***Transportation conditions:*** Planned road network/intersection improvements, school buses routes, railway crossings, and pedestrian crossings;
- ***Coverage:*** The five potential options all provide very good urban coverage under the 9-minute (recommended by the NFPA 1720) contour. Urban area coverage was relatively indistinguishable using the 9-minute contour, therefore a 4-minute contour is used to distinguish the options better in the urban area. A 14-minute travel time contour, as suggested by the NFPA 1720, is used for rural areas;
- ***Proximity to high risk uses:*** Average travel time from each proposed location to all the high risk uses location using the link speed and turning penalty times defined in Section 3.2; and
- ***Proximity to the town centre:*** Travel time from each proposed location to the downtown core.

The variable values are shown in **Table 3.**

TABLE 3: VALUES FOR SCORING OF ALTERNATIVES

Variables	Option 1	Option 3	Option 5	Option 7	Option 9
Size of Property	13.7 Acres	2.6 Acres	1.3 Acres	5.9 Acres	5.3 Acres
Ease of Access	High	Low	High	Medium	Low
Ease of Implementation	High	Low	Low	High	High
Cost/Ownership	Township	Township	Private	Public	Private
Water Supply	Unserviced	Unserviced	Serviced	Serviced	Unserviced
Transportation Condition (Travel on Main Street and Brock Street with 9-min contour)	18,759 m	18,032 m	21,393 m	19,516 m	18,901 m
Coverage of the Urban Area (4-min contour)	32%	39%	54%	22%	41%
Coverage of the Rural Area (14-min contour)	38%	27%	25%	30%	23%
Proximity to the High Risk Uses (Average Travel Time)	707 seconds	712 seconds	748 seconds	699 seconds	712 seconds
Proximity to the town centre (Travel Time)	207 seconds	185 seconds	147 seconds	273 seconds	210 seconds

A numerical scoring system was developed for each variable. Options were assigned a high numerical value if they performed well in a specific category and low value if they performed poorly. The scores for each option are shown in **Table 4**.

TABLE 4: SCORING SYSTEM FOR EACH SITE

Variables	Option 1	Option 3	Option 5	Option 7	Option 9
Size of Property	3	2	1	3	3
Ease of Access	3	1	3	2	1
Ease of Implementation	3	1	1	3	3
Cost/Ownership	2	2	1	2	1
Water Supply	1	1	2	2	1
Transportation Condition	3	4	1	2	3
Coverage of the Urban Area (4- min contour)	2	3	4	1	3
Coverage of the Rural Area (14-min contour)	4	2	2	3	1
Proximity to the High Risk Uses	2	2	1	3	2
Proximity to the core	2	2	3	1	2
Total Score	**25**	**20**	**19**	**22**	**20**

The following options received the lowest scores:

- Option 5 is a very small site, which would require a more costly 2-storey station. This property is also privately owned, which would likely increase the cost further;
- Option 3 is located at Elgin Park which is home to various community events throughout the year. Traffic at this location is expected to be very busy during these events, which will potentially result in significant delay to emergency vehicles. The section of Main Street at Elgin Park is also very narrow and may require widening to accommodate emergency vehicles. There are also expected to be cost and safety concerns associated with the Main Street bridge under this option; and
- Option 9 is located close to two major schools, which will result in significant school traffic during peak hours. This will potentially cause significant delay to emergency vehicles. The closest major road is Reach Street, which has a steep grade located near Main Street. The steep grade will potentially create difficulties in the winter season.

The highest ranked potential location, Option 1, is ideal for the following reasons:

- Good location to service the new commercial core at Toronto Street and the surrounding area hamlets via 6th Concession Road;
- Fronts Brock Street, which is currently a key fire truck route used to service residential areas in the east, and Brock Street is wide enough to handle emergency vehicles; and
- The location is very visible, which will help promote awareness of the fire department.

It is noted that when the official urban boundary of Uxbridge was extended to 6th Concession to support a subdivision, the developer contributed a large portion of land back to the township as green space. Option 1 will potentially use a relatively small portion of this land (approximately 2-3 acres of the estimated 13.7 acres). Recognizing the importance of the Townships previous commitment for this land and given the land has not been developed as parkland, the following compromise may be reached:

- The Fire Department should work with the Township and the community to ensure the fire hall has a minimum footprint on the land;
- The fire hall should contain landscaping and features that enhance the overall appearance and safety of the area; and
- As part of the approval process and to appease previous commitments, a portion of the lands may be developed as parkland with the construction of the fire hall.

Figure 11 shows the travel time contours for Option 1.

If Option 1 is not feasible, Option 7 should be considered. Option 7 provides ample land and access onto Main Street, however it is in a relatively remote location and would result in the loss of recreational space. The Durham Regional Police Department has expressed interest in co-locating with the Fire Department. Options 1 and 7 are each large enough to accommodate the size requirements for both the Police and Fire Department. This provides an opportunity to share the costs associated with developing the land.

5.0 CONCLUSIONS AND RECOMMENDATIONS

A three-tier analysis was conducted and options were ranked based on qualitative and quantitative variables. The optimum location for the Township of Uxbridge Fire Station was determined based on the highest ranking option.

Option 1 (located northeast of the intersection of 6th Concession Road at Regional Road 8) is the most suitable location for the Township of Uxbridge Fire Station. This location will be effective in terms of coverage, providing a significant visual presence, ensuring safe operations for emergency vehicles, and providing effective and quick access to the high risk locations in the Township.

If Option 1 is not feasible, Option 7 (located northeast of the intersection of Main Street at Colby Road) will become the most suitable option. Although Option 7 performs relatively less well based on the qualitative variables, it shares a similar rank as Option 1 based on the quantitative variables.

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