Yellowknife 9-1-1

Feasibility Study and Implementation Analysis

Prepared for: City of Yellowknife

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Appendix A: Implementation Details and Alternatives

1. Summary

This report covers final results and recommendations from the Yellowknife 9-1-1 Feasibility Study conducted by Planetworks Consulting Corp. and incorporates feedback from the 9-1-1 Committee as of April 3, 2009.

The study consisted of (i) a detailed baseline review of existing emergency communications and dispatch operations in the City and Territory, (ii) information gathering and review meetings with all key City and Territorial stakeholders, (iii) a benchmark analysis of applicable standards, regulations and best practices for 9-1-1 and dispatch services, (iv) identification and assessment of technical and operational options and (v) estimates of initial and ongoing costs.

Unlike most North Americans, residents and travelers in the Northwest Territories cannot reach emergency services by dialing 9-1-1. Instead callers must dial separate seven digit numbers for police, fire or ambulance services and these numbers are different in each community. This is a source of confusion and delays in reaching emergency services, particularly since Yellowknife and the larger communities have a high proportion of transient residents from other parts of Canada who expect 9-1-1 service to be available. Most interviewed stakeholders agreed that implementation of 9-1-1 service is a high priority while recognizing that costs are significant and that territory-wide coverage may not be feasible in the near term. The City of Yellowknife also recognizes that enhancement of its existing fire / EMS dispatch operation is a high priority and could be effectively coordinated with implementation of a 9-1-1 call center in the City.

Current standards for 9-1-1 and emergency dispatch services are well defined by the National Fire Protection Association and other public safety organizations. Most systems today provide Enhanced 9-1-1 (E9-1-1) features which include automatic display of the caller's location to the 9-1-1 call taker. This greatly improves response time to the reported emergencies. The CRTC is currently finalizing Canadian regulations covering E9-1-1 calls from cell phones and VoIP devices. These calls and expected regulations must be taken into account when planning 9-1-1 call centers.

In developing a recommended plan Planetworks closely examined a number of other technical options including remote hosting of call answer and dispatch operations to existing PSAPs in Whitehorse, Yukon and Strathcona, Alberta as well as several alternative PSAP locations in Yellowknife.

Planetworks recommends that E9-1-1 service be initially provided in Yellowknife and six of the larger NWT communities, i.e., Inuvik, Hay River, Fort Simpson, Fort Smith, Norman Wells and Behchoko (Rae and Edzo). This would cover more than 77% of the territorial population. Providing service to the remaining 25 smallest communities is technically possible but would require major telecommunications network upgrades and take several years to complete. The telecommunications circuit rental costs alone for universal NWT coverage are estimated at over $2.8 Million per year. This could be less in future with implementation of IP-based transport in NorthwesTel's network. Also, these smallest communities generally have insufficient public safety resources to handle and take effective action on downstreamed 9-1-1 calls.

There are four basic deployment options that the City and GNWT should consider:

1. Do nothing.
2. Provide E9-1-1 service throughout the NWT.

3. Provide E9-1-1 service in Yellowknife (including Dettah and Ingraham Trail) now, but defer 9-1-1 service in other communities.
4. Implement E9-1-1 service in Yellowknife and six of the larger communities as soon as possible.

Option 4 is recommended. This option could be the second stage of a phased implementation plan starting with Yellowknife and eventually resulting in full NWT coverage.

The estimated initial capital and operating costs for the three options are summarized in Table A below. The E9-1-1 costs shown are incremental to Yellowknife fire dispatch improvement costs (Table B), i.e., they assume that a new Yellowknife Fire / EMS dispatch center and staffing is in place. E9-1-1 should not be implemented without fire dispatch improvements. Also, these costs exclude NorthwesTel and cellular company costs that would be covered by 9-1-1 fees on phone and cell bills. This cost information is confidential to the companies and is provided to the CRTC with the tariff filing.

Table A: Incremental Costs to Provide E9-1-1 Service		
Option	**Initial Costs**	**Annual Costs**
1. Do nothing	n/a	n/a
2. E9-1-1 throughout NWT	unknown	>$4,400,000
3. E9-1-1 in Yellowknife	$958,000	$570,000
4. E9-1-1 Yellowknife, Inuvik, Hay River, Fort Simpson, Fort Smith, Norman Wells and Behchoko (Rae and Edzo) - Recommended	$1,018,000	$1,290,000

Table B: Cost of Yellowknife Fire/EMS Dispatch Improvements		
Total (not included in E9-1-1 costs above)	$212,000	$1,100,000

A number of possible funding sources were investigated. Some telephone network costs (company confidential and not included in the above tables) can be covered by 9-1-1 fees on monthly phone and cell bills which would require approval by the CRTC. For Option 4 these fees are estimated by NorthwesTel at 60 cents or less for land line phones and 30 cents or more for cell phones. City and/or GNWT funding will be required for the remaining service components, however, provision of other call answering or monitoring services by PSAP dispatch personnel could provide some revenue offset. Also, the GNWT or City could enact legislation to collect additional revenue from telephone and cell phone bills although this source is limited by the relatively small number of customers. No applicable federal funding programs have been identified as of year-end 2008.

It is proposed that the GNWT and the served communities share the costs of implementing Option 4 that are not covered by phone and cell fees as follows: GNWT would pay the annual costs of the 9-1-1 access circuits to the six communities (estimated at $660,000 per year) and contribute to PSAP costs while the City and communities share the remaining costs on the basis of population served. For the recommended plan this would result in an initial allocation of about 59% / 41% for the City and other communities.

2. Background

The City of Yellowknife is considering implementation of 9-1-1 as well as enhancements to fire dispatch operations and facilities.

Planetworks Consulting has been contracted by the City to conduct a detailed investigation into the feasibility and costs of implementing 9-1-1 service. The territorial Government is contributing funds to include territory-wide 9-1-1 coverage in this investigation. The study consisted of (i) a detailed baseline review of existing emergency communications and dispatch operations in the City and Territory, (ii) information gathering and review meetings with all key City and Territorial stakeholders, (iii) a benchmark analysis of applicable standards, regulations and best practices for 9-1-1 and dispatch services, (iv) identification and assessment of technical and operational options and (v) estimates of initial and ongoing costs.

The following interim reports have been issued:

- TM01 - Baseline Assessment (reference [1]) – covers project background, stakeholder input and an analysis of current methods to emergency services in the City and territory
- TM02 - Benchmarking [2] – covers current 9-1-1/dispatch standards, regulations and best practices (i.e. external factors)
- TM03 - Technical Architecture Options [3] – covers the preliminary technical options considered and assessed
- TM04 - Governance and Cost Sharing Options [4] – covers the preliminary non-technical options considered and assessed

This Feasibility Study and Implementation Analysis report includes recommendations, detailed costs and a proposed implementation plan.

3. Rationale for 9-1-1

3.1 City and Territorial Situation Summary

Current processes and facilities for emergency call taking and dispatch are described in detail in the Baseline Assessment report (reference [1]. Most of the City and GNWT stakeholders that were interviewed stated that 9-1-1 access to emergency services is a high priority for Yellowknife and other NWT communities.

As a consequence of not having a single emergency number for fire, police, and ambulance, the public is forced to quickly identify the correct seven digit number to call for the type of emergency situation being faced.

Calls for police are received and managed by RCMP G Division and dispatched according to policy that applies for the entire territory. Calls for fire are not managed in a single, unified way and for a number of areas there may not be a defined fire department.

In Yellowknife the RCMP Operational Communications Center (OCC) is reached by dialing any Yellowknife prefix plus 1111 (e.g., 873-1111). The OCC also answers police calls from other communities during the night. For example if a caller in Hay River dials the

local RCMP emergency number 874–1111 the call is answered at the Hay River detachment however after hours the call is forwarded to the Yellowknife OCC.

Fire emergency calls (any Yellowknife prefix +2222) are answered by a maintenance staff member at Pump House No.1. When this call taker is making regular maintenance rounds of the pump house a designated fire fighter at the fire hall answers the call (the calls ring at both locations). The call taker not only dispatches fire services but also ambulance, municipal enforcement and public works staff and also does complaint recording.

Calls for Ambulance/EMS are handled more like fire calls in the sense that there is not a single, defined EMS service within the territory. In Yellowknife, EMS calls are received and managed by the Fire/Rescue Department, whose fire fighters are cross trained. In other areas medical calls may be referred to a public health nurse. The seven digit telephone numbers for ambulance service in the smaller communities do not follow a common pattern like police or fire. Some of the other fire departments may participate with pre-hospital care to some degree while others may not.

In summary the majority of NWT communities have RCMP and some form of volunteer fire department (or better), but only a few communities have a dedicated ambulance service.
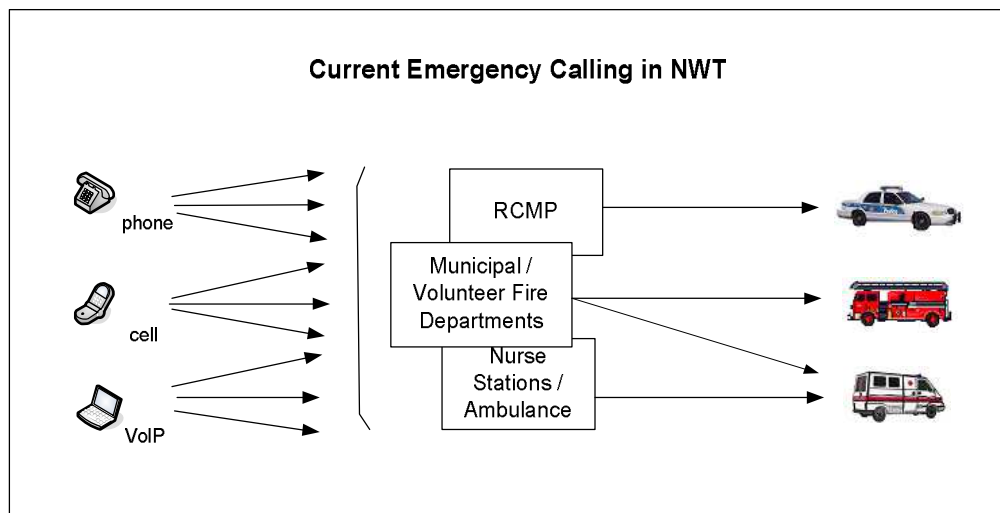

Figure 1: Current Multiple 7-Digit Numbers to Reach Emergency Services

3.2 The Business Case for 9-1-1

Implementation of a 9-1-1 system quite simply saves lives. A 9-1-1 system achieves this by eliminating any doubt or delay regarding the correct number to call in an emergency.

Depending on the type of emergency, a caller without the benefit of 9-1-1 may need to make a value judgment as to whether their emergency is a medical or rescue call, or possibly an assault. Based on that judgment, which may be incorrect, they then need to remember the correct phone number for the particular emergency service in their immediate area.

That is not the case where a 9-1-1 system is implemented because the emergency call attendant is trained to quickly triage the call and ensure that it is routed to the appropriate emergency service in the shortest possible time.

The 9-1-1 system also addresses the issue that may present itself where a caller with an emergency may be at or near the border between two service areas and have the additional dilemma of knowing which fire department (or other emergency service) to call. Phoning the wrong one will lead to a delay as the caller has to be transferred, or asked to redial a different number. As with the previous example, a 9-1-1 call attendant would be aware of the correct agency for any location and will route the caller appropriately.

The third reason for implementing 9-1-1 is that it is the overwhelming mode of reporting emergencies in North America. Any traveler to Yellowknife or any other part of the Northwest Territories will have no reason to believe that 9-1-1 is not in place. As Yellowknife increasingly becomes the hub for activity in the Territories there will be more and more travelers who will quite simply not know the correct way to report an emergency. It is highly unlikely that they are aware of the multiple numbers for Police, Fire or EMS and this will lead to a delay in reporting emergencies with adverse consequences.

Each of the emergency services considers call management as a mission-critical activity for many call types. Any delay in receiving a call for an emergency will result in a greater risk to life and property. In particular Fire and EMS have a very narrow window of time to arrive on scene and commence treatment and mitigation; delays can often have fatal consequences.
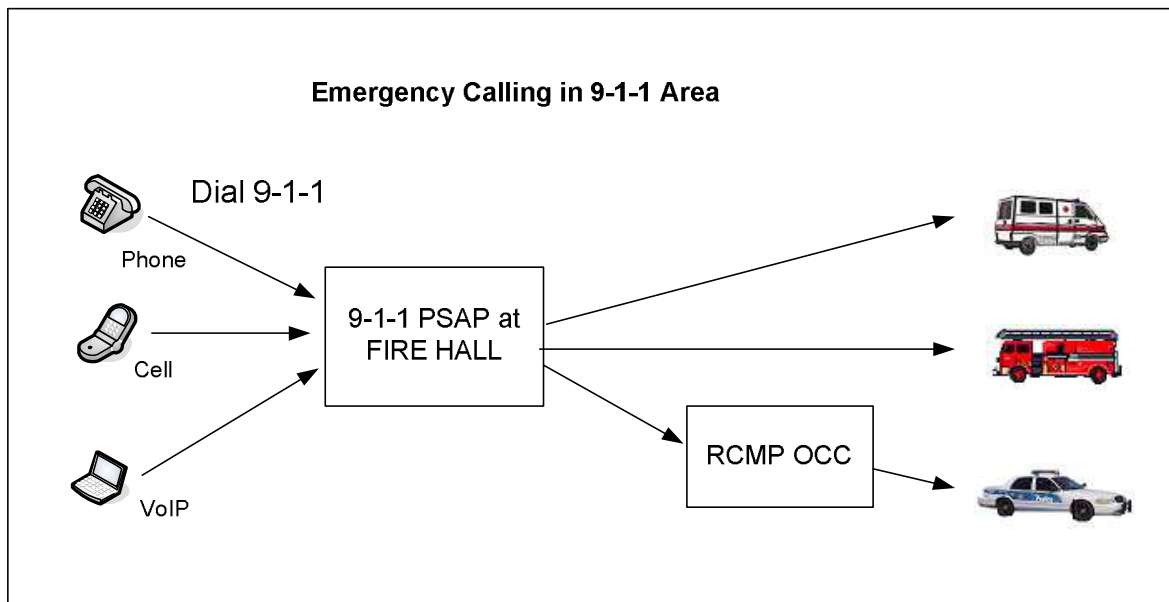

Emergency Calling in 9-1-1 Area

Dial 9-1-1

Phone

Cell

VoIP

9-1-1 PSAP at FIRE HALL

RCMP OCC

Figure 2: A Single 3-Digit Emergency Number for Police, Fire and EMS

4. 9-1-1 Deployment Options

4.1 Option 1: Do nothing

This option is not recommended for the reasons described in Section 3 above. Unlike most North Americans, residents and travelers in the Northwest Territories cannot reach emergency services by dialing 9-1-1. Instead callers must dial separate seven digit numbers for police, fire or ambulance services and these numbers are different in each community. Unless the caller remembers the correct number or has it in a speed-dial list he or she must look up the number at the moment of crisis. This is a source of confusion and delays in reaching emergency services, particularly since Yellowknife and the larger communities have a high proportion of transient residents from other parts of Canada who expect 9-1-1 service to be available. Given increasing publicity and public expectations regarding 9-1-1 in NWT an information program would be required to explain why 9-1-1 service is not required or is being deferred.

4.2 Option 2: All of NWT

This option would provide E9-1-1 service throughout the Northwest Territories using a 9-1-1 call center or PSAP (Public Safety Answering Point) at the Yellowknife fire hall. The PSAP and call handling processes are the same as described for Options 3 and 4 below. Technical and other design details as well as alternative approaches considered such as outsourcing call center operation are described in Appendix A.

Providing 9-1-1 or E9-1-1 service to all Northwest Territories communities is desirable and technically possible but would require major telecommunications network enhancements and take many several years to complete. The telecommunications circuit rental costs alone for universal coverage are estimated at over $2.8 Million per year. Moreover, the 25 smallest NWT communities have insufficient public safety resources to answer and take effective action on downstreamed 9-1-1 calls from the PSAP resulting in major impacts on RCMP resources as the "last resort" public safety personnel.

The capital cost for telephone network upgrades to provide universal 9-1-1 or E9-1-1 coverage has not been provided by NorthwesTel but is expected to be several million dollars. Total operating cost for this option including PSAP staffing is estimated at $4.4 Million per year. In addition, to cover their internal costs NorthwesTel and the cellular companies would likely charge a 9-1-1 fee on all telephone and cell phone bills of up to $1.00 and $0.50 per month respectively. (A cell phone fee equal to one half the land line fee has been the normal CRTC-approved practice in Canada.) In theory, a monthly fee of approximately $12 per month per subscriber could cover the telecommunications costs however it is extremely unlikely that this fee level would be approved by the CRTC or be acceptable to phone users.

Cost sharing for universal coverage could be similar to that described for Option 4 below with GNWT covering the circuit rental costs and allocation of the remaining costs to Yellowknife and the other communities based on population. Since the smallest communities do not have local tax bases their share would likely have to be covered the GNWT.

The ownership and governance structure for this option would be essentially the same as described for Option 4.

4.3   Option 3: Yellowknife only

This option would provide E9-1-1 service in Yellowknife and the nearby communities of Dettah and Ingraham Trail using a combined 9-1-1 / Fire / EMS dispatch PSAP in the fire hall. For other NWT communities without 9-1-1 service a recording would be installed that would inform anyone dialing 9-1-1 of the correct emergency numbers to call. If possible a mutual back-up arrangement between the PSAP and RCMP OCC should be negotiated. See Appendix A for design details and alternatives considered.

Enhanced 9-1-1 (E9-1-1) is recommended since Basic 9-1-1 does not provide the caller's location to the PSAP call taker and therefore does not meet currently accepted public safety standards. Over 90% of all 9-1-1 systems in North America are now Enhanced 9-1-1. A recent CRTC decision directing all cell service providers to provide E9-1-1 features by February, 2010 will not apply to areas that do not have E9-1-1 in operation for regular telephones.

Adding E9-1-1 PSAP functionality to the existing RCMP OCC call center rather than establishing a fire hall PSAP was ruled out by the RCMP. Remote hosting of E9-1-1 call handling service from an existing PSAP outside of the territory is not recommended for the reasons described in Appendix A.

The main advantages of a Yellowknife- only 9-1-1 deployment option are that it has the lowest cost and is the easiest to implement. The main disadvantage is that is covers only 45% of the NWT population.

The estimated initial and annual costs of providing E9-1-1 in Yellowknife are $958,000 and $570,000 per year respectively. This is incremental to (i.e., does not include) the cost of required improvements to Yellowknife Fire/EMS dispatch operations. In addition, to cover their internal costs NorthwesTel and the cellular companies would likely charge a 9-1-1 fee on all Yellowknife telephone bills of up to $0.90 per month and all cellular bills at least $0.45 per month (estimates provided by NorthwesTel).

It is assumed that the initial and annual costs of this option would be covered the City since no other NWT communities would be served however a financial contribution from the GNWT may be possible. The City would own and operate the PSAP, associated call router and other facilities.

A possible Governance model for this option is shown in Figure 3. As discussed in reference [4] the required governance and organizational structure is relatively simple if 9-1-1 and dispatch coverage is limited to the City and adjacent areas. It is assumed that the City would own and operate the 9-1-1 / dispatch PSAP. As a major stakeholder and PSAP client the RCMP must have direct involvement in decision making and it may be desirable to include the GNWT as well, particularly if coverage expansion to other communities is planned in the near future (see Section 4.4). The GNWT could also represent Dettah and the Ingraham Trail area.
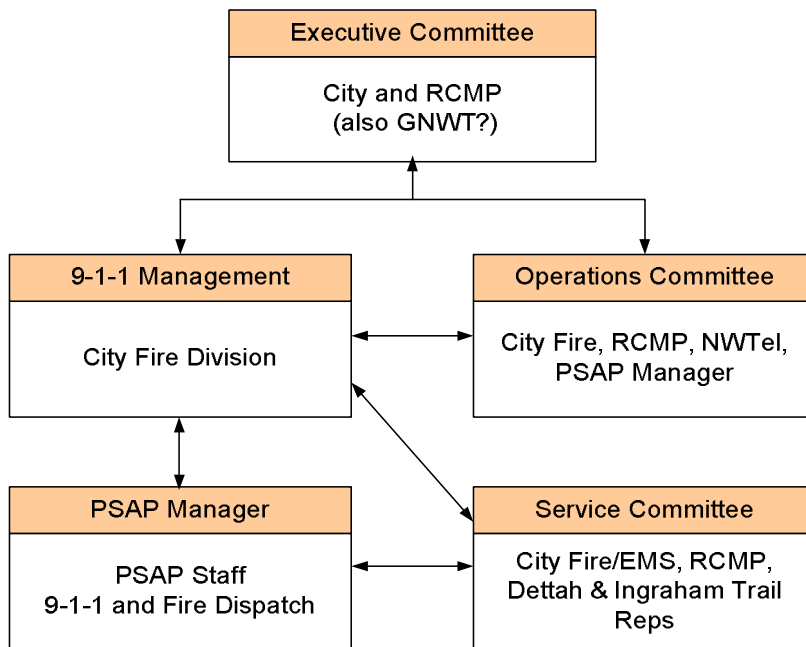
Figure 3: Governance and Organization for Option 3

4.4 Option 4: Yellowknife plus Six Communities

This option would provide E9-1-1 service in Yellowknife and six of the largest NWT communities using a 9-1-1 call center or PSAP (Public Safety Answering Point) at the Yellowknife fire hall. The PSAP and call handling processes are the same as described for Options 2 and 3 above. Technical and other design details as well as alternative approaches such as outsourcing call center operation are described in Appendix A.

Table 1 lists the advantages and disadvantages of this option.

Table 1: E9-1-1 in Yellowknife and Six Communities (Option 4)		
Coverage	**Advantages**	**Disadvantages**
Yellowknife plus Inuvik, Hay River, Fort Simpson, Fort Smith, Norman Wells and Behchoko (Rae and Edzo).	• Covers 77% of NWT population • Local fire/EMS agencies able to handle downstreamed or dispatch calls • Minimal telecommunications network upgrades • Serves all communities over 1000 population	• Does not include all NWT communities • High annual cost for telecommunications circuits to communities

Estimated costs for this expanded E9-1-1 coverage option are higher than the Yellowknife-only option as described below. Cost impacts on downstream agencies in the communities are not expected to be significant since facilities and staff for handing calls to existing fire and EMS emergency numbers are already in place. Costs incurred by NorthwesTel and the cellular companies would be covered by 9-1-1 fees on monthly phone and cell bills that would require approval by the CRTC. For this option these fees were estimated by NorthwesTel at 60 cents or less for land line phones and at least 30 cents per month for cell phones. The cost information supporting these fees is confidential to the companies and the CRTC. A recent CRTC decision affecting cell E9-1-1 service is expected to increase the cell phone fee which has historically been 50% of the land line fee.

Initial Costs

Costs for minor enhancements or expansion of CTI, CAD and other PSAP equipment to handle the six additional communities are not expected to be significant. The only major increase in initial costs is associated with refinement of addresses in the six communities. It is assumed that NorthwesTel will play a prime role in refining the address data from their billing system. The GNWT and involved municipal governments would need to assist in resolving incomplete address information (e.g., lot numbers). It is estimated that an additional ½ person-year or $60,000 in total would be required for this initial work.

Annual Operating Costs

The cost for telecommunications circuits required to provide 9-1-1 in the six communities is an estimated $660,000 per year based on NorthwesTel digital private line rates and NENA recommendations for circuit quantities. This is enabling infrastructure and could be covered by GNWT as described below.

Excluding costs covered by GNWT and the 9-1-1 service fees the additional annual cost to include the six communities is estimated at $60,000 per year. This covers ½ FTE for assisting NorthwesTel with ongoing address maintenance and could be shared between GNWT and the communities. The additional 9-1-1 / dispatch call volume is not expected to significantly impact PSAP staffing requirements or ongoing costs.

Table 2: Cost Estimate – Option 4		
Component	**Initial Costs**	**Annual Costs**
Estimated NorthwesTel costs[1] to be covered by 9-1-1 fees on telephone and cell bills	$300,000	$25,000
NorthwesTel circuit costs for six communities	-	$660,000
Incremental PSAP and RCMP OCC facilities, call routing equipment and staffing at the City Fire / EMS dispatch center	$698,000	$410,000
Address refinement and other (see Section A6 of Appendix A for details)	$320,000	$220,000
Total Incremental Costs (excluding Yellowknife Fire/EMS dispatch improvements and costs covered by 9-1-1 phone and cell fees)	$1,018,000	$1,290,000

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[1] Covers address refinement, systems modifications, equipment maintenance and administration.

It is proposed that the GNWT and the served communities share the costs of providing 9-1-1 service that are not covered by phone and cell fees as follows: GNWT would pay the annual costs of the 9-1-1 access circuits to the six communities (estimated at $660,000 per year) and contribute to PSAP costs while the City and communities share the remaining costs on the basis of population served. For the recommended plan this would result in an initial allocation of about 59% / 41% for the City and other communities respectively as shown in Table 3.

Table 3: Proposed Allocation of Costs for Option 4		
Funding Source	**Initial Costs**	**Annual Costs**
GNWT	$200,000	$760,000
City of Yellowknife	$479,251	$310,517
Other Six Communities	$338,749	$219,483
Total	$1,018,000	$1,290,000

If the PSAP is owned and operated by the City the governance and organizational structure for expanded 9-1-1 and dispatch coverage would be quite similar to the structure described for City–only service (see Section 4.3 above). However, representation from GNWT at all levels would need to be added and the included communities (e.g., Inuvik, Hay River) should also have representatives on the Service Committee and possibly the Board of Directors. The resulting recommended governance and organizational structure is shown in Figure 4.

As described in reference [4] another option would be to have the GNWT own the PSAP and have the City Fire department operate it on contract. In this case overall management would likely be GNWT responsibility with the PSAP manager reporting to a GNWT department.
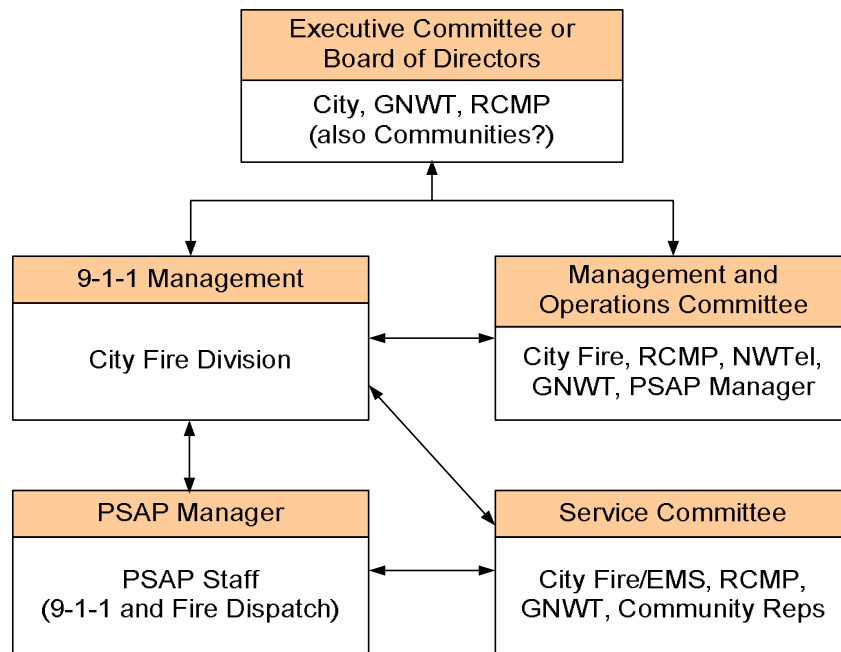
Figure 4: Governance and Organization for Option 4

5. Recommendation

It is recommended that E9-1-1 service be established in Yellowknife, Inuvik, Hay River, Fort Simpson, Fort Smith, Norman Wells and Behchoko (Rae and Edzo) using a combined E9-1-1 / Fire dispatch PSAP in the Yellowknife fire hall. For other NWT communities without 9-1-1 service a recording should be installed that would inform anyone dialing 9-1-1 of the correct emergency numbers to call. If possible, a mutual back-up arrangement should be developed with the RCMP OCC.

Capital and operating costs should be shared between the City, the other communities and GNWT as described in Section 4.4. This would result in GNWT paying $200,000 towards the capital cost and $760,000 per year towards circuit rentals and other operating costs. The City and other communities would cover roughly 59% and 41% of the remaining net costs respectively based on population. Net costs exclude those covered by 9-1-1 service fees as well as possible revenues generated by other call answer services. This allocation could be adjusted periodically to reflect population changes.

The main components of the recommended E9-1-1/ dispatch system for Yellowknife are as follows:

- A Public Safety Answering Point (PSAP) call center and dedicated call answer/dispatch staff in the Yellowknife fire hall
- Telephone network enhancements and circuit additions

- A selective router/controller located in NorthwesTel's Yellowknife central office (if NorthwesTel agrees) or at the PSAP building
- A fully backed up address database at the Northwestel central office or PSAP with daily updates from NorthwesTel's billing system
- Call answer / dispatch workstations and equipment

The following tables summarize estimated total costs to implement dispatch improvements and E9-1-1. The E9-1-1 costs shown in Table 4 are incremental to Yellowknife fire dispatch improvement costs (Table 5), i.e., they assume that a new Yellowknife Fire / EMS dispatch center is in place. E9-1-1 should not be implemented without fire dispatch improvements. Also, these costs exclude NorthwesTel and cellular company costs that would be covered by 9-1-1 fees on phone and cell bills. These costs are approximate and subject to change during detailed design and equipment procurement.

Table 4: Incremental Costs to Provide E9-1-1 Service		
Option	**Initial Costs**	**Annual Costs**
1. Do nothing	n/a	n/a
2. E9-1-1 throughout NWT	unknown	>$4,400,000
3. E9-1-1 in Yellowknife	$958,000	$570,000
4. E9-1-1 Yellowknife, Inuvik, Hay River, Fort Simpson, Fort Smith, Norman Wells and Behchoko (Rae and Edzo) - Recommended	$1,018,000	$1,290,000

Table 5: Cost of Yellowknife Fire/EMS Dispatch Improvements		
Total (not included in E9-1-1 costs)	$212,000	$1,100,000

A long term strategy for transition from the recommended plan (Option 4) to full territorial coverage (Option 2) should be developed. Additional communities should be added based on (i) the capabilities of local emergency agencies (e.g. volunteer fire) to act on downstreamed 9-1-1 calls and (ii) the scope and costs of NorthwesTel network upgrades required to establish dedicated 9-1-1 circuits between the community and the PSAP. A plan based generally on doing the largest communities first thereby maximizing population coverage may be the best approach. Transition to full NWT coverage could be implemented within five years if all parties give this top priority.

6. Proposed Implementation Plan

The City of Yellowknife should take the following initial steps toward implementation of E9-1-1:

1. Review recommendations and costs in this report and determine if any additional information is required.

2. Decide which option(s) should be pursued and whether GNWT and other community involvement are required at this time.

3. Confirm available City funding.

4. Confirm the transition of City Fire/EMS dispatch from the pump house to the fire hall under the jurisdiction of the Fire Chief and identify one individual to have responsibility for the transition and ongoing operation of this function.

Assuming E9-1-1 coverage will be provided in additional communities (Options 3 or 4) the City and GNWT should then take the following steps:

5. Obtain City and GNWT approvals for implementing Enhanced 9-1-1 based on preliminary design and cost estimates in this report.

6. Meet with affected communities.

7. Define responsibilities of a 9-1-1 project implementation manager

8. Appoint the 9-1-1 project implementation manager. 9-1-1 must be this person's primary responsibility.

9. Establish a 9-1-1 Executive Committee and a 9-1-1 Implementation Committee which will become the 9-1-1 Management and Operations Committee after service is turned up. Include community representatives on the Implementation Committee.

10. Develop and agree on cost sharing and governance structures.

11. Sign agreement with NorthwesTel covering 9-1-1 implementation and operation.

12. Designate or arrange to contract resources for project coordination, tariff filing support, technical design and procurement support.

13. Take required steps to implement fire dispatch improvements.

14. Assist and support NorthwesTel with the design and cost study for the E9-1-1 tariff filing.

15. Design mapping integration and interfaces.

16. Design and cost fire hall E9-1-1/dispatch call center including all workstation equipment.

17. Coordinate design of telecom voice and data network equipment and interfaces with NorthwesTel.

18. Assist Northwestel with address refinement for all included communities.

19. Confirm or modify funding / cost sharing arrangements.

20. Support NorthwesTel's tariff filing (approximately three months prior to planned turn-up of service).

21. Develop and implement public communications program.

22. Establish a 9-1-1 Service Committee with community representation.

23. Develop Standard Operating Procedures for PSAP.

24. Complete design, procurement, supply contracts and construction/installation of building modifications and call center equipment.

25. Recruit and train PSAP call taker / dispatchers.

26. Train RCMP call takers on ALI procedures.

27. Implement NorthwesTel network changes.

28. Arrange for joint testing of call center, network and ANI/ALI database testing with NorthwesTel.

29. Implement an improved recorded announcement for callers dialing 9-1-1 in non-served communities.

30. Turn up ALI/MSAG database and E9-1-1 service in Yellowknife.

31. Turn up E9-1-1 service in Inuvik, Hay River, Fort Simpson, Fort Smith, Norman Wells and Behchoko (Rae and Edzo). Roll-out can be phased and must be coordinated with the community agencies.

32. Investigate the possible provision of revenue producing services by dispatch personnel.

33. Consider coverage expansion to other communities.

34. Consider territory-wide, consolidated dispatch for police, fire and EMS using the Yellowknife PSAP.

7. Risks and Mitigation

Table 6 identifies some of the main project risks along with possible mitigation tactics.

Table 6: Summary of Risks and Mitigation	
Risk	**Mitigation**
Insufficient City funding available	• GNWT funding (with or without additional community coverage) • GNWT legislated Call Answer Levy
Opposition from un-served communities	• Public communications • Firm plan for expanded coverage
Lack of Telco resources or prioritization	• City or GNWT complaint to CRTC • GNWT directive
Costs of address refinement	• Contingency amount included
Major problems recruiting and/or retaining PSAP staff	• Wage scales, incentives
GNWT departments cannot agree on 9-1-1 implementation	• Defer community roll-out until agreement can be reached
The City and GNWT cannot agree on cost sharing or governance structure	
Impacts on community fire/EMS agencies cannot be resolved	

NorthwesTel has identified a number of additional risks relating to the cost estimates and the CTRC tariff filing process. These include:

• Connections to cell carriers – detailed design required
• Interventions in the 9-1-1 tariff filing process
• Rates for outside consultants
• US exchange rates
• Changing technology and standards (CRTC, NENA, etc.)
• Equipment vendor stability

Implementation of 9-1-1 service is totally dependent on NorthwesTel.

8. Glossary of Terms

Automatic Location Identification (ALI)	The automatic display at the PSAP of the caller's telephone number, the address/location of the telephone and supplementary emergency services information.
Automatic Number Identification (ANI)	Telephone number associated with the access line from which a call originates.
Basic 9-1-1	An emergency telephone system which automatically connects 9-1-1callers to a designated answering point. Call routing is determined by originating central office only. Basic 9-1-1 may or may not support ANI and/or ALI. The emergency and its location are communicated by voice (or TTY) between the caller and the call taker.
Computer Aided Dispatch (CAD)	A computer based system which aids PSAP attendants by automating selected dispatching and record keeping activities.
Consolidated PSAP	A facility where one or more Public Safety Agencies choose to operate as a single 9-1-1 entity.
Enhanced 9-1-1 (E9-1-1)	An emergency telephone system which includes network switching, database and CPE elements capable of providing Selective Routing, Selective Transfer, Fixed Transfer, ANI and ALI.
Enhanced Community Notification System (ECNS)	A system to inform the public of known hazards using a combination of database and GIS mapping technologies to deliver outbound notifications to communities using the E9-1-1 database.
Master Street Address Guide (MSAG)	A perpetual database defining the geographic area for 9-1-1 service by an alphabetical list of street names and number ranges for the addresses, Emergency Service Number and PSAP identification codes. This is used by the telephone company to build the ALI database.
Next Generation 9-1-1 (NG9-1-1)	Future evolution of 9-1-1 that is expected to allow transmission of text, photos and/or video along with voice for 9-1-1 calls from many types of communications devices. It will also support location-independent call access, transfer, and backup among multiple PSAPs.
Public Safety Answering Point (PSAP)	A facility equipped and staffed to receive 9-1-1 calls. A Primary PSAP receives the calls directly. If the call is relayed or transferred, the next receiving PSAP is designated a Secondary PSAP.

9. References

[1] 9-1-1 Feasibility Study – Baseline Assessment, Technical Memorandum # COY-0802-TM01, Planetworks Consulting Corp., 8 July 2008

[2] 9-1-1 Feasibility Study – Benchmarking, Technical Memorandum # COY-0802-TM02, Planetworks Consulting Corp., 8 July 2008

[3] Technical Architecture Options for 9-1-1 and Fire/EMS Dispatch Services, Technical Memorandum # COY-0802-TM03 - Client Draft, Planetworks Consulting Corp., 22 August 2008

[4] Governance and Cost Sharing Options for 9-1-1 and Fire/EMS Dispatch Services, Technical Memorandum # COY-0802-TM04 - Client Draft, Planetworks Consulting Corp., 22 August 2008

[5] Radio Replacement Study: Final Report, Planetworks Consulting Corp., 23 June 2008

[6] Report to the CRTC by the Emergency Services Working Group (ESWG) - Technical and Operational Requirements of Wireless Phase II E9-1-1 Implementation, Report Number: ESRE0046, October 31, 2008

Appendix A: Implementation Details and Alternatives

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Note: References in this Appendix A are listed in Section 9 of the main report.

A1: Current Emergency Call Taking Procedures and Facilities

See Reference [1] for a full description of current emergency call taking procedures and facilities in Yellowknife and NWT as well as input from stakeholder interviews held during May 2008.

As a consequence of not having a single emergency number for Fire, Police, and Ambulance someone requiring emergency assistance is required to quickly remember or find the correct number for the required emergency service based on the area or phone exchange they are calling from. Current emergency numbers are shown in Table A1.

Calls for Police are received and managed by G Division and dispatched according to policy that applies for the entire Territory. Calls for Fire and EMS are not managed in a single, unified way as for a number of areas there may not be a defined fire department.

Table A1: Emergency Numbers in NWT Communities				
Community	**Population**	**Police**	**Fire / EMS**	**EMS / Other**
Yellowknife	19429	Any Yellowknife prefix + 1111	Any Yellowknife prefix + 2222	766-550
Hay River	3825	874-1111	874-2222	874-6522
Inuvik	3521	777-1111	777-2222	777-2198
Fort Smith	2385	872-1111	872-2222	872-3111
Behchoko (Rae & Edzo)	1951	392-1111	392-2222, or 371-2222	392-6075
Fort Simpson	1233	695-1111	695-2222	695-2601
Tuktoyaktuk	990	977-1111	977-2222	
Fort Providence	840	699-1111	699-2222	
Fort Mcpherson	823	952-1111	952-2222	
Norman Wells	818	587-1111	587-2222	
Aklavik	600	978-1111	978-2222	
Fort Liard	591	770-1111	770-2222	
Fort Good Hope	576	598-1111	598-2222	
Deline	545	589-1111	589-2222	
Fort Resolution	534	394-1111	394-2222	
Tulita	502	588-1111	588-2222	
Whati	502	573-1111	573-2222	
Ulukhaktok	434	396-1111	396-2222	
Lutselke	414	370-1111	370-2222	
Paulatuk	318	580-1111	580-2222	
Gameti	302	669-1111	997-2222	
Hay River Reserve	299	396-1111		
Dettah	218	669-1111	873-2222	
Tsigehtchic	200	953-1111	953-2222	

Table A1: Emergency Numbers in NWT Communities (Cont'd)				
Community	Population	Police	Fire / EMS	EMS / Other
Wrigley	182		581-2222	
Colville Lake	140	709-1111		
Wekweeti	138	669-1111	713-2222	
Sachs Harbour	119	777-1111	690-2222	
Nahanni Bute	116	770-1111	602-2222	
Enterprise	91	1-867-874-1111	984-2222	
Trout Lake	82	770-1111	206-2800	
Jean Marie River	69	695-1111	809-2222	
Kakiska	36	669-1111	699-9949	

Calls for the RCMP

When an emergency call (Any Yellowknife prefix +1111) is placed from a wireline telephone or cellular phone, the NorthwesTel GT5 central office at 4919 – 50th Street routes the call to the RCMP's Redcom switching platform located at 5010 – 49 Avenue, the The RCMP Operations Communications Center (OCC). The call is presented to the Telecommunicator (emergency call taker or dispatcher) on Pantel's Windows InterTalk Console (WIC) that essentially replaces the desktop telephone set. A WIC can fully integrate the functions of the telephone with the CAD, GIS, Radio system and Voice Logging system. The OCC has 3 workstations that are fixed units with equipment firmly bolted into position. The OCC Manager indicated they are getting 4 new Evans workstations that are height adjustable reducing visual and muscular strain causing fatigue for the Communications Specialists and a cable management system for power wiring, monitor screen cables, etc.

Some of the features provided by a WIC are:

- Integrated TTY functionality to allow handling of calls from the hearing impaired community. The call transcript can then be recorded in the CAD as part of the incident record.
- Instant recall capability allows the call taker to instantly replay calls to obtain information that was missed.
- Speed dial capability that is unlimited.
- Integration of E9-1-1 for ANI/ALI information.

If a caller in Hay River dialed the RCMP emergency number 874–1111 they would be answered at the Hay River Detachment however after hours the call is forwarded to a Direct In Dial (DID) number that terminates on the Yellowknife RCMP Redcom system. The call would appear on the WIC screen as Hay River and the Telecommunicator would process the call.

The RCMP OCC is supplied by an emergency diesel generator located at 5010 - 49 Avenue. The emergency generator adequately serves the needs of the Center and is run monthly. The RCMP OCC does not use an in-line UPS but has installed multiple UPS units for specific equipment, such as the Mitel Telephone system.

Calls for Fire/EMS

Calls for Ambulance/EMS are handled more like fire calls in the sense that there is not a single, defined EMS service within the Territory. In Yellowknife, EMS calls are received and managed by the Fire/Rescue Department, whose fire fighters are cross trained. Other fire departments may participate with pre-hospital care to some degree while others may not. In other areas medical calls may be referred to a public health nurse.

When an emergency call (any Yellowknife prefix +2222) is placed from a wire line telephone or cellular phone, the NorthwesTel GT5 central office at 4919 – 50th Street routes the call to the Pump House No.1 located at the end of 48th Street towards Yellowknife Bay. The call is presented to the Pump House Stationary Engineer on a Toshiba telephone system and if required the Stationary Engineer would dispatch the Fire department and communicate with them on the Radio system. The Stationary Engineer makes regular maintenance rounds of the Pump House 4 times a day, during this time a designated Firefighter at Fire Hall No.1 answers the calls. The Fire Hall located at 100 Taylor Road has the same Toshiba telephone system and the 669-2222 call rings at both the Pump House No.1 and Fire Hall No.1 at the same time.

The Pump House Stationary Engineer not only dispatches fire but also ambulance, Municipal Enforcement, Public Works & Engineering and also does complaint recording.

At the present time fire dispatch is provided by the staff at the pump station as part of their other regular duties. The pump station operators have a control Center for their multiple tasks, shown in Figure A1. There is one fixed workstation. The dispatch equipment includes radio and paging control equipment as well as a telephone console to receive and manage requests for service. This equipment is replicated at the fire hall to allow for control to pass between the two offices as required for breaks or other reasons.

Figure A1: Fire Dispatch Equipment: Pump House

Pump House No.1 is supplied by an emergency diesel generator located at the end of 48th Street towards Yellowknife Bay. The emergency generator adequately serves the needs of the Pump House and is run monthly. The Pump House No.1 does not use an in-line UPS but has installed multiple UPS units for specific equipment, such as the Toshiba Telephone system.

Figure A2 is a composite photograph that shows the alarm room at the Yellowknife fire hall which has the same voice radio and paging capability that is found at the pump house along with the required telephony equipment. In the case of the fire hall, the dispatch equipment is contained within a communications room that is immediately adjacent to the apparatus floor and contains additional equipment to support operation of the fire department. The alarm room has two workstations that are fixed units.

Figure A2: Fire Dispatch Equipment: Fire Hall

The Fire Hall is supplied by an emergency diesel generator located at the side of the building at 100 Taylor Road. The emergency generator adequately serves the needs of the Center and is run monthly.
The Fire Hall does not use an in-line Uninterrupted Power Supply (UPS). A UPS is important for three reasons:

- UPS will filter the power to ensure that power spikes that are common on a standard power grid do not damage equipment.

- UPS ensures that there is a constant power supply while the generator cycles up to full speed.

- In the event that the generator fails to start, the UPS can ensure that the equipment continues running until the backup center is activated, or until the generator is serviced.

The Fire Hall does not use an in-line UPS but has installed multiple UPS units for specific equipment, such as the Toshiba Telephone system.

Instant Recall Recorders

Instant Recall Recorders allow the Communications Specialist to replay recent conversations in the event that the original conversation could not be understood and must be replayed. An example of this would be an emergency call where the caller was in a panic and spoke too quickly. The call can be replayed for more clarification.

Eventide's Instant Recall Recorders at the Pump House No.1 and the Fire Hall are in proper working order. Pantel's InterTalk WIC Instant Recall Recorders at the RCMP OCC is in proper working order.

Voice Logger

The Voice Logging equipment records all telephone and radio conversations to be archived. These conversations can be used in a Court of Law as evidence.

The logger in use at the Pump House No.1 and Fire Hall is an Eventide digital recorder. The logger in use at the RCMP OCC is a Pantel's InterTalk WIC digital recorder.

CAD and RMS Technology

RCMP use CIIDS, which is their national standard Computer Aided Dispatch (CAD) system. Fire is currently using a Record Management System provided by FDM software and this is capable of being expanded to be used as a CAD with the purchase of additional modules.

Networks

The City of Yellowknife has a fibre network linking their major facilities; some of this fibre is owned by the City, other fibre is provided by NorthwesTel.

Cell and VoIP Service Providers

There are currently three cellular companies operating in the Northwest Territories. Calling number information is available from Bell Mobility and Latitude Wireless but not from Ice Wireless or legacy NorthwesTel Mobility Inc. customers. Caller location information is not currently available from any of the wireless carriers, however a recent CRTC decision requires that all carriers have this capability by February 2010 in areas where E9-1-1 is available .

There are currently no fixed VoIP providers in the territory. Nomadic and foreign exchange VoIP services are available from Primus and others but without number portability.

Current Call Volumes

Current call volumes for all three classes of service for the entire Territory are not complete for a number of reasons including the lack of definition of EMS services and lack of a formal recording process for the number of requests that are received by telephone.

In terms of Police responses, G Division note that they handle over 35,000 calls for service per year for the Territory, while Yellowknife Fire/EMS responded to 3,700 calls for service in the last year of which 2,200 were EMS responses. It could be estimated that Fire and EMS calls for the remainder of the Territory might be approximately 1,500.

On this basis the annual number of emergency events for all three classes of service within the Territory might equate to 40,000.

Current Problems/Issues

There are a number of problems or issues related to the provision of emergency communications. These include technical considerations such as the lack of standard addressing, some insufficiency in switching capability by the incumbent telephony provider, as well as the challenges of integrating radio telephone and satellite phone technology which is relied on by some users. The main NorthwesTel central office switch in Yellowknife is a GTD-5 system which cannot provide some E9-1-1 features; therefore, outboard call routing equipment would be required for full E9-1-1. There are also significant technical obstacles to providing 9-1-1 in the smallest communities due to switch technology and satellite links. Although NorthwesTel has the most complete and current number/address database there would be a significant cost to build and maintain a complete E9-1-1 ALI (MSAG) data base.

Closely related to the technology issues are the fairly substantial costs expected to upgrade these systems once they are properly identified or to provide them where are currently missing. The issues are costs must be clarified, with some innovation potentially being identified to support the significant costs for a system over a very large area with a sparse population. Another issue related to funding for the system, is grounded in the fact that many communities are not taxation based, and must rely heavily on grant funding which may pose challenges to determining ongoing costs.

The issue of the location and authority for fire dispatching is also identified as a current problem that must also be resolved. The Fire Chief has made it clear that he is supportive of this function being returned to his direct control. If this occurs, it may make it possible for the dedicated fire dispatchers to also become the 9-1-1 call takers, especially given that the RCMP have noted they do not want to assume the PSAP function.

A2: Standards, Regulations and Best Practices for 9-1-1 and Dispatch

The history of 9-1-1 began in the U.S.A. In 1967, President Johnson's Commission on Law Enforcement and Administration of Criminal Justice recommended a "single number should be established" nationwide for reporting emergency situations. Subsequently, AT&T announced it had reserved the numbers 9-1-1 for emergency use nationwide and to provide the public with fast and easy access to a Public Safety Answering Point (PSAP). On February 16, 1968, Senator Rankin Fite completed the first 9-1-1 call made in the United States in Haleyville, Alabama.

Approximately 99% of the population of the United States and Canada is now served by either basic or enhanced 9-1-1.

Basic 9-1-1

Basic 9-1-1 is an emergency telephone service which connects a caller dialing 9-1-1 to a designated PSAP. Call routing is determined by the originating telephone central office only. Basic 9-1-1 may or may not support automatic number identification (ANI) or automatic location identification (ALI) and implies only that three digit dialing and a protected, dedicated network exists for the emergency voice call. Additional information that may be vital to determining the location of a caller who is unable to describe their address is not necessarily provided. Call flow to an emergency response agency via a 9-1-1 PSAP is illustrated in Figure A3.
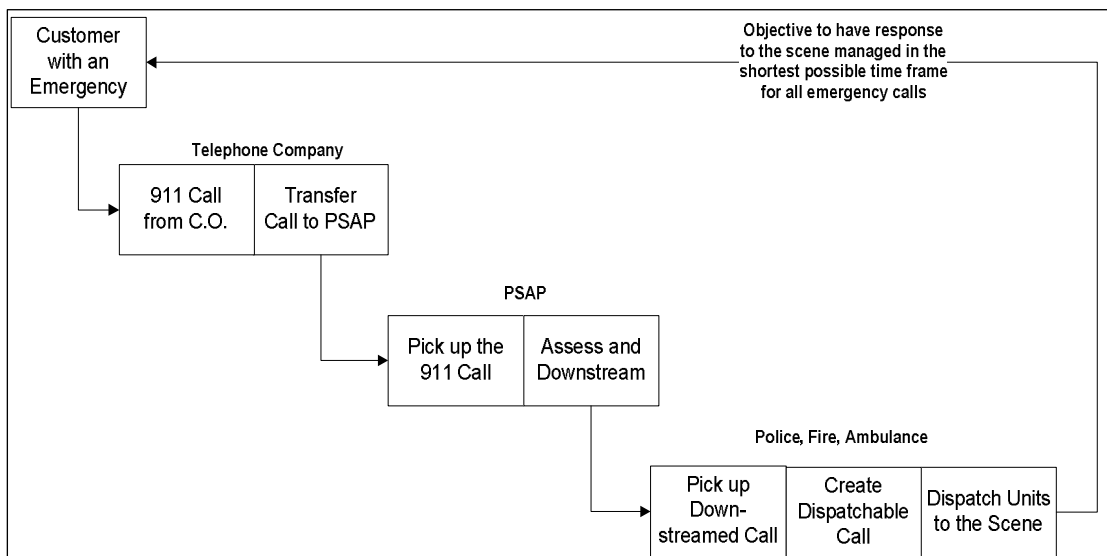

Figure A3: 9-1-1 Call Flow

Enhanced 9-1-1

In an Enhanced 9-1-1 (E9-1-1) system, the PSAP has interface equipment and an information database that allows the emergency call taker to see the caller's phone number and address on a screen. The screen can be either a standalone terminal or integrated with a Computer Aided Dispatch (CAD) system. This lets the call taker quickly dispatch emergency help, even if the caller is unable to communicate where they are located or what

the emergency is. E9-1-1 service implies that features such as selective routing, selective transfer, caller routing and location information are provided. E9-1-1 components are illustrated in Figure A4.

E9-1-1 calls are routed to the PSAP along with the originating number (ANI) and location information (ALI). Other enhancements include the ability for the call to be intelligently routed based on the caller's Emergency Service Zone (ESZ). This is used where calls are routed to different PSAPs depending on the caller's location.

Often the single biggest issue in rolling out E9-1-1 with ALI is addressing. In order to have access to ALI, a Master Street Address Guide (MSAG) must be created which contains accurate, usable address information. A high quality MSAG requires that each location that could have a telephone number assigned is identifiable by a unique address. The MSAG is usually built and updated using telephone company records however it is likely that in rural areas there are many locations without formally assigned addresses. The assignment of addresses can be a time consuming process requiring participation from public safety agencies, the incumbent telephone company, other carriers, the municipality and Canada Post. Where address ranges conflict or addresses appear more than once, some consolidation and possible re-addressing to deal with anomalies may be necessary. The addition of latitude / longitude data for rural residents is a database enhancement being considered by some jurisdictions. Responsibility for ongoing management of the MSAG database is often a major issue.
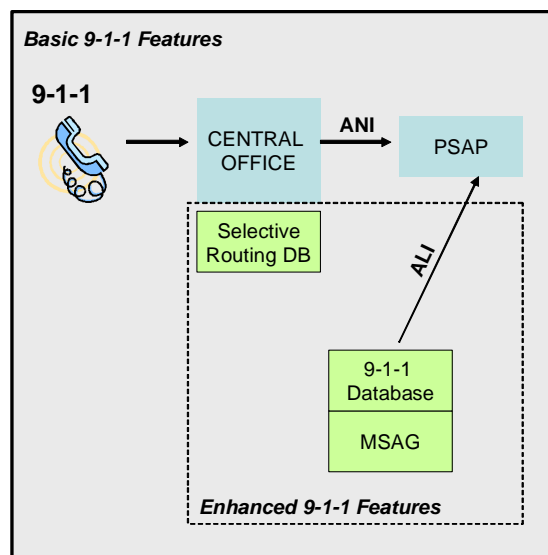

Figure A4: Basic and Enhanced 9-1-1

Some phones and networks have technical limitations which prevent automated display of caller location information. These include cell phones, VoIP-based phones and phones on some privately owned telephone systems (PBX's). These limitations are described in the following sections. Depending on the capabilities of the telephone network and the availability of good address information it may not be feasible to provide full E9-1-1 in all areas.

Wireless (Cellular) 9-1-1 Calls

When someone dials 9-1-1 from a cell phone the call may not be routed to the correct 9-1-1 PSAP center. In fact the call could be sent to another PSAP hundreds of miles away

depending on which cellular company and tower the caller accesses. Also, ANI and ALI are often not available on cellular 9-1-1 calls. This is potentially life threatening due to lost response time, particularly if callers are unable to speak, don't know where they are, or don't know their cellular phone number and the call is dropped.

In response to these problems, the Federal Communications Commission (FCC) in the U.S. and the Canadian Radio-television and Telecommunications Commission (CRTC) in Canada have defined requirements for cellular providers to ensure that cell phones are compatible with enhanced 9-1-1 emergency calling systems.   These requirements are described later in this section.

The number of 9-1-1 calls placed from cell phones is currently about the same as landline 9-1-1 calls. As of May 15, 2008 there are approximately 259 million U.S. wireless subscribers according to the Cellular Telephone Industry Association (CTIA).   The following table illustrates the growth of wireless in the U.S.

Data	Dec-07	Dec-05	Dec-00	Dec-95
Wireless Subscribers	255.4M	207.9M	109.5M	33.8M
Wireless Penetration % of total U.S. population	84%	69%	38%	13%
Wireless-Only Households % of U.S. Households	15.8%	8.4%	n/a	n/a
SMS Messages Per Year	363B	81B	n/a	n/a
Wireless 9-1-1 and Distress Calls Per Day	291K	260K	139K	55K
K=Thousand M=Million B=Billion				

In Canada there were 19.3 million wireless phone users at the end of September 2007 representing an overall population penetration of about 60%. According to the Canadian Wireless Telecommunications Association (CWTA) over 47 percent of all phone connections in Canada are now wireless. These devices are used to make about six million calls per year to 9-1-1 or other emergency numbers.

Voice over Internet Protocol (VoIP) Calls

VoIP is a technical protocol that allows telephone calls to be sent over a private data network or the public Internet. A VoIP service provider supplies a telephone number and a network translator device that permits their customer to talk via high-speed Internet connections such as cable modems, DSL or a local area network. The caller's voice signal is encoded into data packets by the network translator device. These packets are sent over the Internet toward their final destination by various routes as opposed to a fixed, circuit-switched connection for the duration of the call. The packets are then reassembled into a voice signal at the other end allowing communication with another VoiP subscriber or a regular telephone.

Because VoIP services use Internet Protocol (IP) networks rather than traditional telephone or cellular networks, access to E9-1-1 must be provided in a different way. VoIP Service

Providers (VSPs) must resolve a new set of challenges for determining the location of the caller, routing the call to the closest PSAP and automatically delivering the caller's location and call- back number to the PSAP.

The challenge of locating VoIP callers using 9-1-1 is a consequence of VoIP's flexibility. There are four categories of VoIP services:

- Fixed (static) VoIP: placing calls from a single location
- Nomadic VoIP: placing calls from different locations where Internet access is available
- Foreign Exchange VoIP: allows users in one exchange to receive telephone calls dialled as local calls in another exchange that they have selected (e.g. a customer located in Ottawa with a Halifax local telephone number).
- Mobile VoIP: continuous movement within a WiFi or other wireless network

Fixed subscribers use VoIP as a landline supplement or replacement, typically using residential ADSL or TV cable. Their VoIP phone is deployed in a fixed location and uses the standard North American Numbering Plan. Local exchange carriers can support fixed VoIP subscribers with local telephone numbers in the same way they support their wireline subscribers, i.e., by provisioning each VoIP number into the ALI database so the selective routers can recognize and correctly route the 9-1-1 calls. But in most cases, this wireline model only supports fixed subscribers with local phone numbers. Because of the frequent use of non-local phone numbers, VSPs face challenges similar to those once faced by cellular carriers in terms of routing calls and location data through selective routers that don't recognize numbers from outside their area.

Nomadic subscribers view VoIP as a highly portable telephony configuration that allows them to establish a telecommunication connection wherever they can obtain Internet access. Nomadic users take their VoIP service with them while on the go, connecting at the airport, in their hotels, and at any available hot spot.

Mobile subscribers not only take their VoIP phone with them wherever they go, but they remain continuously connected. Much like cellular technologies allow today, mobile VoIP subscribers may eventually be able to roam from their home-based telephony connection throughout a continuously interconnected Wireless Fidelity (WiFi) network. As coverage of WiFi hot spots and other wireless methods for WiFi access become ubiquitous, the number of mobile VoIP subscribers is expected to increase.

Because of the mobility of nomadic and mobile VoIP subscribers, VoIP 9-1-1 solutions are dependent upon all subscribers accurately identifying their location when they register for VoIP services, as well as every time they log in. However, since it often takes 24-48 hours for subscriber location data to be updated in the ALI database, new solutions are required for rapidly updating location data. At this point these new solutions are neither deployed nor fully developed.

 In Canada a 9-1-1 call from a Cable IP device (fixed computer or VoIP telephone) will be handled like a call made using the traditional telephone network with the ANI and ALI being displayed at the PSAP. In order to provision E9-1-1 service, the Cable VoIP provider (such as Rogers or Shaw) assigns a telephone number to the customer's modem, and the modem is associated with a physical street address. This information, when conveyed to the appropriate 9-1-1 database managers has the capability to accurately convey the physical location of a 9-1-1 call.

Regulatory requirements covering VoIP services are described later in this section.

Enhanced Community Notification System (ECNS)

ECNS is a communications methodology that can be put in place to inform the public of known hazards. It uses a combination of database and GIS mapping technologies to deliver outbound notifications to communities using the E9-1-1 database. The CRTC has recently approved the recommendations of the Emergency Services Working Group to facilitate the implementation of ECNS in Canada.

Next Generation 9-1-1

Within five years it is projected that 70% of calls will be from wireless devices and at least 40% of all wireline calls will be routed through VoIP providers. This means that less than 20% of all calls could be carried over the traditional telephony network around which current 9-1-1 technology is based.

Current 9-1-1 systems are not able to handle the text, data, images and video which are increasingly common in personal communications devices. This gap is becoming increasing critical with advances in transportation safety and mobility. The Next Generation 9-1-1 (NG 9-1-1) initiative will establish the foundation for public emergency communications services in a wireless mobile society.

NG 9-1-1 is expected to allow transmission of text, photos and/or video along with voice for 9-1-1 calls from many types of communications devices. It will also support location-independent call access, transfer, and backup among multiple PSAPs and between PSAPs and other authorized emergency organizations.

9-1-1 and Dispatching Standards

Technical and operational standards covering various aspects of 9-1-1 service have been developed by North American public safety organizations including NENA (National Emergency Number Association), APCO (Association of Public Safety Communications Officials) and NFPA (National Fire Protection Association).

The NFPA 1221 Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems dates back to 1898. At that time guidance for municipal fire alarm systems was separated from the general technical standard covering signaling systems. There was a major rewrite of the standard in 1999 to reflect the emergence of joint communications centers and the role communications plays in emergency scene operations within the Incident Command System. The current version of the standard was issued in 2007 and covers a wide variety of topics including:

- Communications center design
- Emergency response facilities
- Operations
- Computer-aided dispatching systems
- Public alerting systems
- Planning guidelines for 9-1-1 systems

The NFPA standards for 9-1-1 call processing as well as fire dispatching have been adopted by numerous PSAPs and dispatch providers in Canada. In some cases they have been written into the contract for service between the PSAP and down-stream agencies.

The following sections describe some of the key points in the NFPA 1221 standard that must be considered in the Yellowknife/NWT 9-1-1 project. Note that the term "telecommunicator" refers to an individual whose primary responsibility is to receive,

process, or disseminate information of a public safely nature via telecommunications devices. 9-1-1 call takers and fire department dispatchers are examples of telecommunicators.

Communication Center / PSAP Design

- Each jurisdiction must maintain an alternate communications center that is capable, when staffed, of performing the emergency functions normally performed at the primary communications center. The alternate center must be geographically separate from the primary center to ensure survivability.

- The communications center must be provided with an alternate means of communication with the emergency response facilities (e.g. fire hall). The alternate means of communication must be readily available to the telecommunicator in the event of failure of the primary communications system.

- The communications center and other buildings that house essential operating equipment must be protected against damage from vandalism, terrorism and civil disturbances.   Any windows must be bullet resistant.

- Other facility design requirements including power supplies, generators, air conditioning, lighting, communications circuits and cables, fire protection, toilets, etc. are specified in some detail within the standard.

Emergency Response Facilities (e.g. fire station)

- A primary and secondary means of dispatch notification must be provided. These must be compatible with the primary and alternate means of communication with the communications center. Other detailed design requirements are specified.

Operations

- Telecommunicators must meet the requirements of the NPFA "Standard for Professional Qualifications for Public Safety Telecommunicators" as appropriate for their position.

- Communications centers that provide emergency dispatching protocols must have at least two telecommunicators on duty at all times.

- Ninety-five percent of alarms received on emergency lines shall be answered within 15 seconds and 99 percent of alarms shall be answered within 40 seconds. An alarm is defined as a signal or message from a person or device indicating the existence of a fire, medical emergency or other situation that requires action by an emergency response agency. Ninety-five percent of emergency call processing and dispatching shall be completed within 60 seconds and 99 percent within 90 seconds.

- Where alarms are transferred from the PSAP to a secondary answering point (e.g. dispatch center) the transfer procedure shall not exceed 30 seconds for 95% of all alarms processed.

- Complete records of the dispatch of emergency response units to alarms must be maintained.

- Standard operating procedures must be fully defined and followed.

- Communications centers must have a logging voice recorder with one channel for each radio channel or talk group, each dispatch alarm circuit and each telecommunicator telephone.

- The standard describes how 9-1-1 must be listed and described in telephone directories.

It must be emphasized that the above points are based on selected excerpts from the NFPA 1221 Standard. This document should be consulted for complete information.

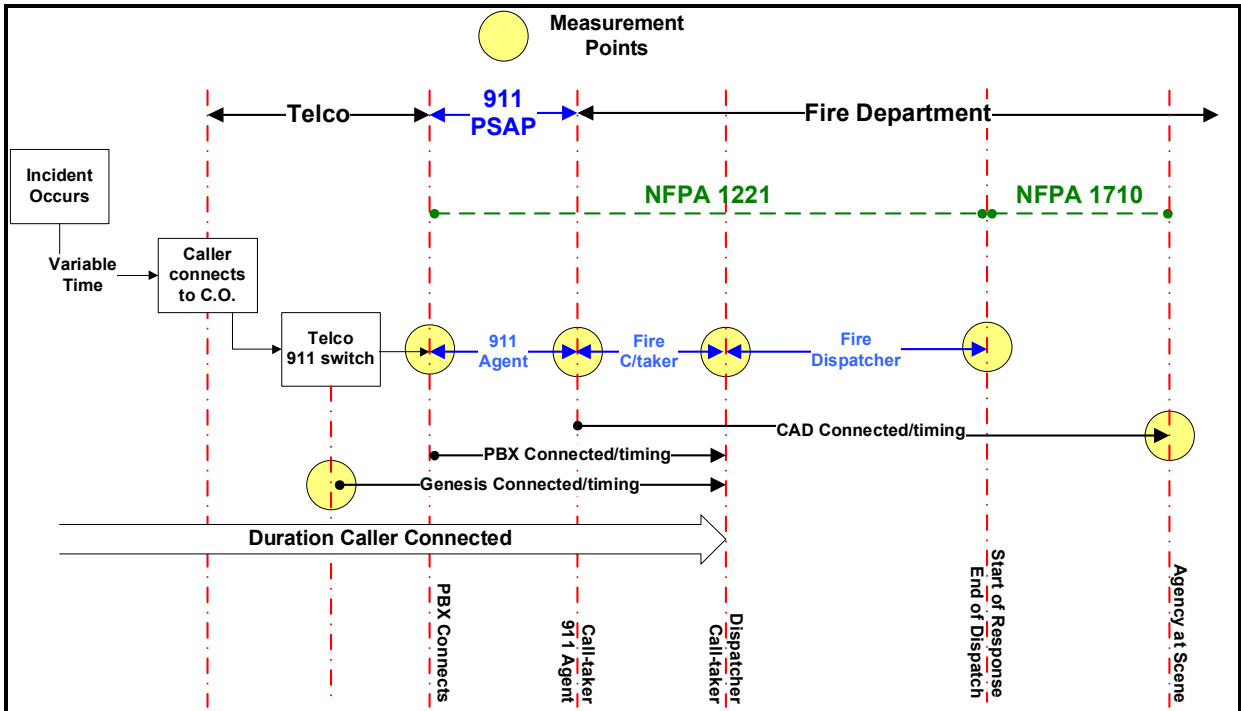Figure A5 illustrates emergency call flow and the scope of NFPA 1221.

Figure A5: Emergency Call Flow and Response

Standard of Service for 9-1-1 and Fire Call Taking and Dispatch

There are a number of reasons why 9-1-1 systems have been implemented throughout Canada and the United States. One of the stated reasons was to eliminate the multiple different emergency numbers that existed in various communities and the confusion about which was the correct number to call. It is well accepted that multiple different emergency numbers have contributed to delays in response and so currently we understand that a single emergency number actually serves two purposes, the first being simplicity or standardization, while the other is to speed up the call notification process.

9-1-1 is the first point of contact for a citizen with an emergency and although the underlying technology may be complex, the role of a 9-1-1 handler is straightforward; it is to determine the location of the caller, and the nature of the call and then to transfer the caller as quickly as possible to the correct agency—Police, Fire or EMS. Over time, standards of service for these processes have been developed and simply put they are to manage this process as quickly as possible with the highest degree of accuracy.

Similarly one of the principal requirements for a Fire or EMS Department is to provide timely response to emergency fire, medical and rescue events and this requirement starts with fire dispatching. This is in addition to the non-emergency responses, fire inspections, public education, pre-planning and other less visible activities. The former activities are the ones with the highest profile, and the ones with the largest degree of risk to residents, property owners and responding fire fighters.

In every sense of the expression, these are 'mission critical responses' and it is useful to understand the series of steps that must take place between the call for assistance by a resident of the NWT and the arrival on scene of a Fire or EMS crew. Each of the steps that will be described can be analyzed to understand the total time until arrival of emergency personnel.

The following figure summarizes the processes from the point at which an incident occurs and a call for help is placed. This illustrates how the communication steps (the 911 process is shown in light blue/green, the fire dispatch is shown in orange) are gating items for the completion of response and arrival activities of the Fire/EMS service (shown in red).
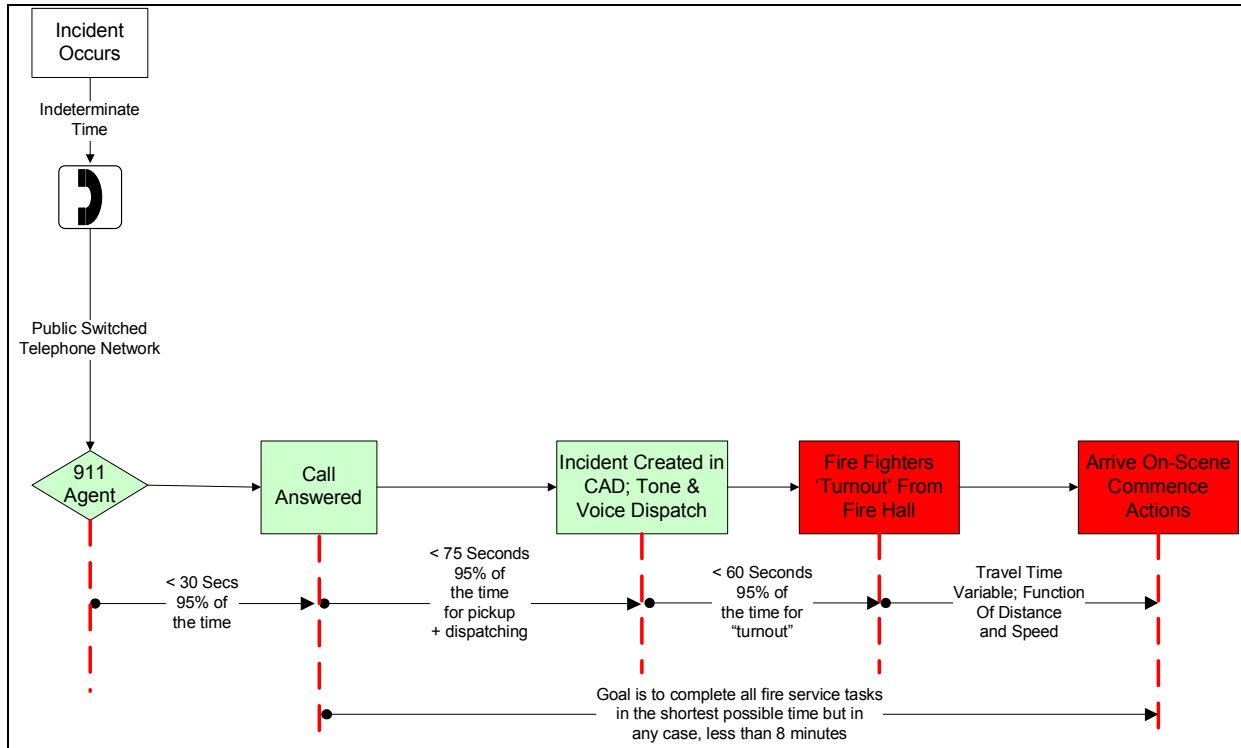

Figure A6: Event Sequence for 911 and Fire Call Handling, Response and Arrival, with Time Lines

Each of these steps from the time the caller reaches the 911 centre, until the arrival of the fire apparatus at the scene is part of a sequence for which time objectives have been identified. The standards of service for emergency communications in the fire service are described in the NFPA Standard 1221. NFPA 1221 provides an analysis model for key steps involved with emergency call taking and dispatch and prescribes time milestones in which these should occur. Figure A6 is taken from the standard, and identifies key processes with time milestones.

1. The time to place a call to 911 and to have it successfully 'down-streamed' to the fire department[2] (30 seconds).
2. The time to pick up, or answer the call reporting an emergency (15 seconds).
3. The time to interrogate the caller, determine the emergency, create a 'dispatchable' event in the CAD system and alert crews (60 seconds).
4. The time for responders to 'turnout' from the fire hall and begin their response to the scene (60 seconds).
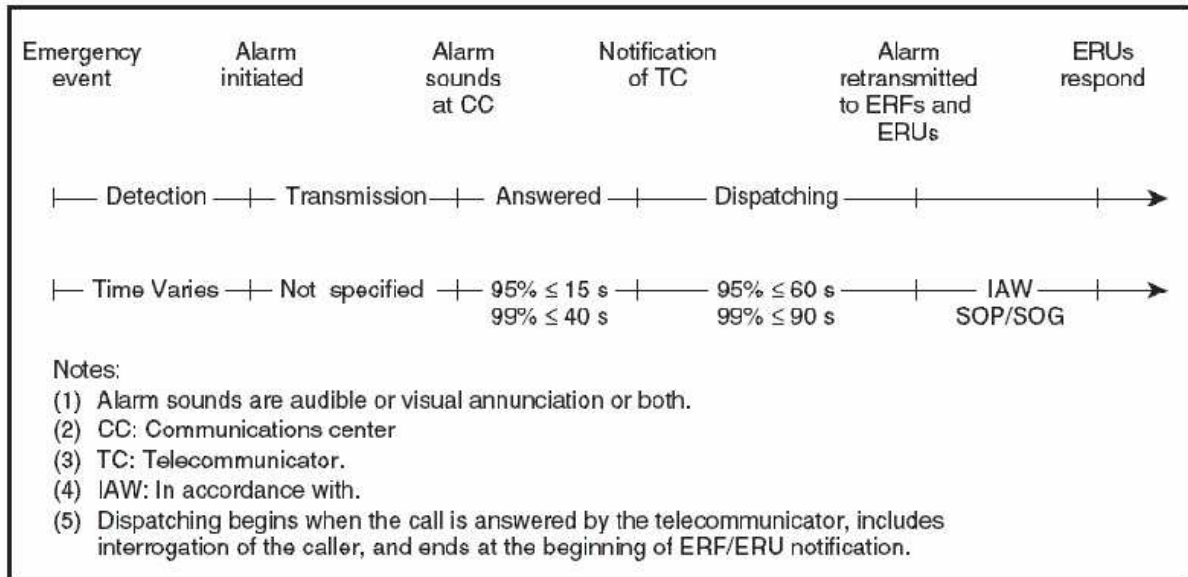

Figure A7: NFPA 1221: Emergency Call Management Analysis

In the diagram above, there are two timelines. The upper line describes the steps which occur from the moment at which the emergency event occurs, until the units respond to the incident. The lower line identifies the elapsed time at which these are expected to occur.

The overall process described above, with response time objectives can be described in the following manner.

- Emergency Event.
  - An emergency occurs (this can be either a fire or medical incident[3]).
  - Until emergency services are notified in the following steps, this emergency has not yet been noticed or reported.
- Detection.
  - The emergency event has been 'detected' leading to notification of emergency services.

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[2] The particular reference in this case is to section 7.4.4 which states "*Where alarms are transferred from the primary public safety answering point (PSAP) to a secondary answering point, the transfer procedure shall not exceed 30 seconds for 95 percent of all alarms processed*". From this it is clear that the 9-1-1 standard for down-streaming of calls applies to Police, Fire and EMS, i.e., it is not solely a fire service standard.

[3] This model also applies to police events however there are no specific defined call management metrics for these

- Alarm Initiated.
  - At this point a call to an emergency service is placed by dialing 911 or a 10 digit number and is transferred to the PSAP[4] by the Public Switched Telephone Network (PSTN).
- Transmission.
  - In this step the PSTN makes the routing decisions and 'presents' the emergency call to the 911 primary call agent(s) at the PSAP.
  - The time for this to occur is indeterminate, though it may be measured by the telephone company; to this point emergency services have yet to be notified of the emergency.
- Alarm Sounds at PSAP.
  - This is the point at which the emergency call first begins to ring at the 911 call centre.
- Alarm Transferred to CC.[5]
  - The 911 agent queries the caller to determine which emergency service they require and then transfers them to the call taker for that class of service.
- Alarm Sounds at CC.
  - This is the point at which the emergency call first begins to ring at the communications centre for Police, Fire or EMS.
  - This is normally the first point at which the communications centre has the ability to begin measuring the elapsed times for call management.
- Answered.
  - This is the time frame which measures the interval between when the emergency call first begins ringing, until the call taker has begun speaking with the caller reporting the emergency.
    - For the fire service the expectation is that all calls will be 'answered' within 15 second 95% of the time; and within 40 seconds 99% of the time.
    - This measurement equates to the time taken until the phone is 'picked up' by the fire call taker.
- Notification of TC.[6]
  - This is the point at which the call taker begins taking information from the caller reporting the emergency and this period of time ends when the dispatcher has completed the dispatching process.
    - The expectation is that all calls will be processed to the point at which the call has been dispatched, within 60 seconds 95% of the time and within 90 seconds 99% of the time.
    - This measurement equates to the total time taken until fire crews have been alerted and the information transferred to them.
- Alarms Retransmitted to ERF's[7] and Response Units.
  - This marks the completion of the dispatch process and the commencement of the 'turnout phase' for the fire service. This is the interval between when

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[4] Public Safety Answering Point, another term for a 911 call centre
[5] Communications Centre
[6] In this document TC stands for Telecommunicator; in this case this is the fire call taker/dispatcher at the Fire Department
[7] Emergency Response Facility

dispatching has been completed and when the Fire/EMS service leaves the fire hall.

- The expectation is that turnout from the fire hall will occur within 60 seconds.[8]
- Response Units Respond
  - This marks the completion of the turnout phase, and the commencement of the travel time which is completed when the unit(s) arrive at scene

In summary, the expectation is that all emergency calls for service will be answered, the caller will be interrogated, the 'call' will be created on paper or in a computer aided dispatch system, and the tones and information will be sent to the responding fire fighters within 60 seconds, 95% of the time.

The time for this measurement starts when the phone first starts to ring in the fire dispatch office, and lasts until the response information has been gathered and transferred to the emergency responders. Where an agency uses a CAD system these times are normally recorded as time stamps and thus can provide the basis for analysis[9].

The reason for the focus on the time required to create a call and dispatch it is well founded in the notion that emergency calls are serious when they occur and have the capacity to significantly deteriorate in a very short space of time. This in turn requires that the initial phases—911 call taking, call assessment and dispatch—occur in the shortest possible time to insure the earliest possible intervention by emergency services personnel.

As noted, a primary mandate of any emergency service is to provide for a timely response to emergencies. In the vast majority of these, crews respond and travel some distance to the incident. For the fire service these responses must occur within a relatively short time frame to minimize fire damage and save lives, effective call management is crucial. This is because emergency call management is the precursor or 'gating' item for Fire and EMS response to the scene.

The National Fire Protection Association (NFPA) has developed response time objectives for the North American fire service over many years and these provide applicable benchmarks. The NFPA standards are international peer-reviewed standards that address most if not all issues related to the operation of the fire service. NFPA 1710 is the standard that describes the organization and management of a career fire department[10], and defines response time objectives for the turnout of crews from the fire hall, as well as 4 minute and 8 minute expectations for arrival at any emergency incident.

The graph shown in the following figure is taken directly from the NFPA 1710 standard and demonstrates the expected fire propagation curve, which indicates the point at which a fire spreads beyond the room of origin. This is normally at or about 8 minutes from the point of ignition.

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[8] The timeframe for turnout is described in an associated NFPA Standard 1710 which describes the operation of a Career Fire Department
[9] The Yellowknife Fire Department has purchased a CAD system provided by FDM Software of North Vancouver which records all information related to emergency and non-emergency events
[10] This standard applies to the Yellowknife Department in terms of the first response vehicles
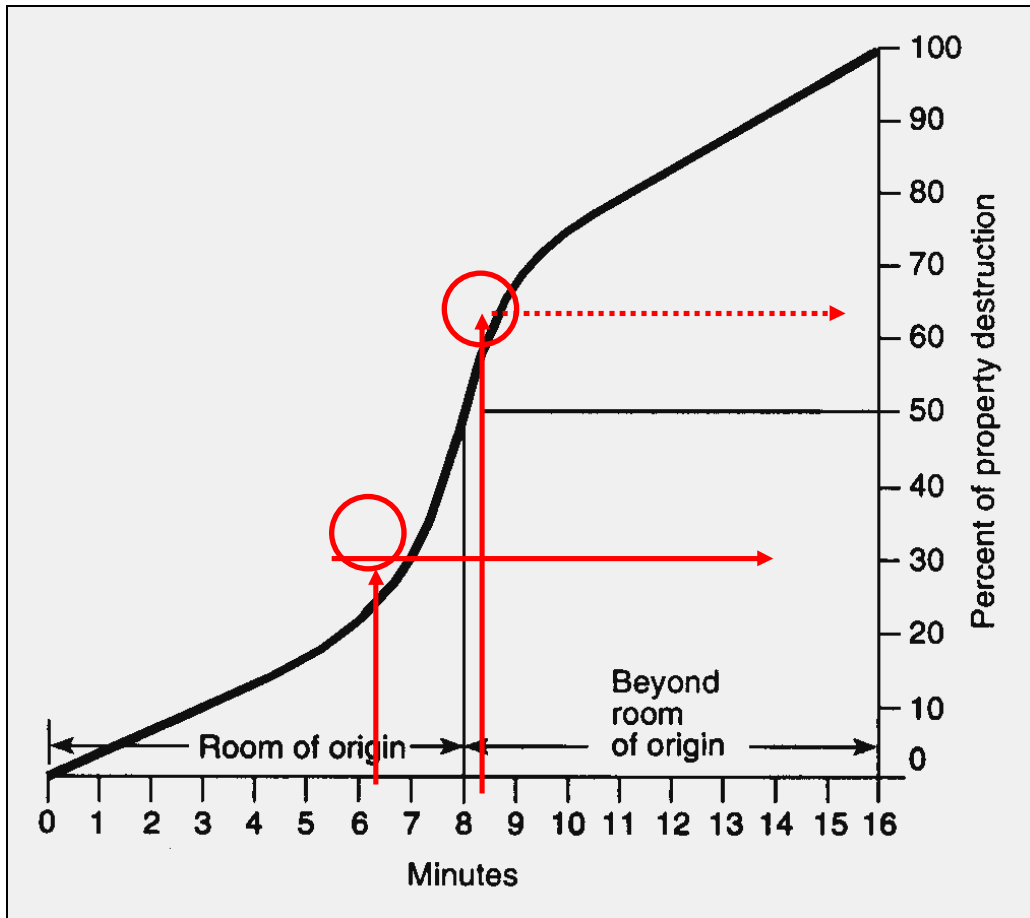
Figure A8: Fire Propagation Curve, Modeled from NFPA 1710

From this graph it can be seen that in the range of time from 7 to 9 minutes after ignition, a fire is expected to rapidly accelerate and the percentage of property destruction (shown on the Y axis) increases from approximately 30% to a little less than 70%. At some point in this short period of time, the assumption is that the fire will spread beyond the room of origin.

The significant point is that each of the steps in the fire department's response sequence, including 911 call processing, call assessment, dispatch, turnout and travel time should all occur prior to the time when a fire will extend beyond the room of origin, with a much higher risk to life and property. In this regard, the NFPA notes:

> *"At approximately 10 minutes into the fire sequence, the hypothetical room of origin flashes over. Extension outside the room begins at this point. Consequently, given that the progression of a structural fire to the point of flashover (i.e., the very rapid spreading of the fire due to superheating of room contents and other combustibles) generally occurs in less than 10 minutes, two of the most important elements in limiting fire spread are the quick arrival of sufficient numbers of personnel and equipment to attack and extinguish the fire as close to the point of its origin as possible[11]."*

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[11] NFPA 1710, A.5.2.1.2.1

The key element going forward then is the requirement to manage all parts of the response equation as quickly and efficiently as possible to minimize the risk to life and property.

Calls to 9-1-1 from Cell Phones

The Federal Communications Commission (FCC) in the U.S. has adopted requirements for cellular providers to ensure that cellular phones are compatible with enhanced 9-1-1 emergency calling systems.   These requirements are to be delivered in two implementation phases:

- Phase I was to be implemented by April 1, 1998 or within 6 months of being requested by the PSAP, whichever comes later. This first phase requires the delivery of a wireless 9-1-1 call with a valid callback number and identification of the cell site/sector from which the call originated, to help identify the general location of the caller.

- Phase II adds the requirement of locating the caller within 50 to 100 meters of his or her location in 67% of all calls. Additionally, Selective Routing (i.e., the call must be routed to closest PSAP) has to take place based upon those coordinates.

Location information will be sent to the PSAP as latitude and longitude coordinates which will be displayed on a map using a Geographic Information System (GIS).

Compliance with the FCC rulings requires that public safety entities and wireless carriers work together with each local E9-1-1 provider. To receive wireless 9-1-1 service, a PSAP must formally request the service from their wireless carriers and have a mechanism in place to allow carriers to recover their costs.

The original implementation target for Phase II in the U.S. was to be October 1, 2001 however this compliance date has been extended numerous times. Specific requirements differ for network-based and handset-based ALI solutions. For example by December 31, 2005 ninety-five percent of all subscriber handsets (cell phones) were to be ALI-capable with built-in GPS. The FCC has granted a series of waivers to these requirements that establish individual schedules and required reports for many of the individual service providers.

The Canadian Radio-Television & Telecommunications Commission (CRTC) has not mandated a similar solution for Canadian wireless providers but has requested the Canadian Wireless Telecommunications Association (CWTA) to form a committee to review these issues and report back to them. In October 1999 TELUS Alberta conducted a Phase I wireless trial that allowed wireless carriers to transmit the call-back number and cell site/sector location information to the 9-1-1 call taker. Today all the major wireless carriers have deployed this solution. In 2003 the CRTC issued a decision (2003-53) setting conditions of service for wireless competitive local exchange carriers and for emergency services offered by wireless service providers. In April 2004 Bell Canada conducted a Phase 2 Wireless E9-1-1 enhanced location trial in Toronto along the 401 Highway.

In a letter dated March 19, 2008, the Commission tasked the Emergency Services Working Group (ESWG) with the investigation of the provision of Phase II wireless service for Canada. The group was requested to identify any technical and operational issues that may impede the provision of wireless Phase II E9-1-1 and recommend the preferred solution(s), with supporting rationale.

On October 31, 2008 the ESWG issued a report to the CRTC entitled Technical and Operational Requirements of Wireless Phase II E9-1-1 Implementation [6].

Following are some of the key ESWG recommendations:

Voice Routing: The current wireless phase I E9-1-1 capability must be preserved and should form a basis, i.e. a default 9-1-1 call handling capability, for all wireless phase II E9-1-1 calls.

Automatic Enable of GPS on GPS-equipped Handsets: The Canadian Wireless Service Providers (WSPs) will adopt the US practice of automatically enabling GPS functionality in GPS-equipped handsets when 9-1-1 is dialed.

Confidence and Uncertainty: The Confidence (%) and Uncertainty (metres) values in addition to X,Y coordinates will be transmitted to the PSAP during a wireless phase II E9-1-1 call.

No Data Filtering: The WSPs and the 9-1-1 Service Providers should not filter any X,Y, Confidence, and Uncertainty data destined for the PSAP.

Deployment Strategy: Wireless phase II E9-1-1 can initially be deployed (named "Stage 1") containing X,Y Confidence, and Uncertainty values or an error message. The ESWG further agrees that Stage 2 deployment, subject to further investigation and resolution by the ESWG, can contain incremental wireless phase II E9-1-1 features such as the support of roamers, unsubscribed handsets, and Rebid capability.

Deployment (calendar) Timing of Stage 1 and Stage 2: The ESWG could not arrive at a consensus on the timing of Stage 1 and Stage 2 wireless phase II E9-1-1 deployment. However, the ESWG agrees that it can develop criteria and a rollout schedule which takes into account PSAP, 9-1-1 Service Provider, and WSP operational requirements and restrictions, similar to that developed for the Wireless Local Number Portability (WNP) rollout.

PSAP Readiness: The ESWG could not arrive at a consensus on the issue of PSAP readiness prerequisites for wireless phase II E9-1-1 services.

On February 2, 2009 the CRTC announced that cellular service providers will have until February 1, 2010 to install the necessary equipment to give 9-1-1 dispatchers the ability to locate cellular callers in an emergency. This will be of no benefit to Yellowknife and NWT unless an E9-1-1 call center is established.

Calls to 9-1-1 from Voice-over-IP Phones

In the U.S. NENA and the Voice on the Net (VON) Coalition (a group of companies in the VoIP marketplace) have been working together to come up with voluntary solutions to the vexing 9-1-1 issues that are present with VoIP. To date, they have identified three levels of solutions:

- **Immediate (I1):** Allows a VoIP provider to directly dial 9-1-1 calls to a 10-digit PSAP administration number. The VoIP 9-1-1 call is delivered to a 24x7 administrative line without the caller's location; the caller's phone number is only provided when caller ID is available on the receiving PSAP phone.
- **Immediate (I2):** VoIP providers route 9-1-1 calls through existing tandems and update the existing ALI databases. The VoIP 9-1-1 call is delivered to the correct PSAP via a selective router infrastructure solution. The caller's location and callback number are automatically delivered to the PSAP without any required hardware or software upgrades to the existing PSAP E9-1-1 infrastructure.
- **Long Term (I3):** IP to IP call flow to a fully VoIP enabled PSAP.

The overall goal of I1 and I2 is to not require any changes to the PSAPs.

During 2005 the CRTC issued several decisions affecting fixed, nomadic and foreign exchange VoIP services in Canada. The CRTC directed VoIP service providers who provide fixed VoIP service (such as Shaw and Rogers) to also provide the same level of 9-1-1 emergency service that is provided by the incumbent telephone company in the service area, i.e. either Enhanced 9-1-1 or Basic 9-1-1.

The Commission also requires that VoIP service providers delivering either nomadic or foreign exchange VoIP services (such as Vonage and Primus) implement an interim solution which provides a level of service comparable to Basic 9-1-1 service. This can include routing of the 9-1-1 call to a private central call center which in turn contacts or forwards the call to the correct emergency response center or PSAP. At this point the caller must identify his or her location in order for an emergency response service to be dispatched. The PSAP does not receive the ANI or ALI information associated with this type of call. This additional call handling step that occurs at the very start of the communications process adds a minimum of a 30 second delay to providing assistance to the caller.

All local VoIP service providers in Canada must provide specific notification to current and prospective customers regarding the availability, characteristics and limitations of their 9-1-1 and Enhanced 9-1-1 (E9-1-1) service. As an example, following is an excerpt from Primus service terms and conditions:

> **E9-1-1**
> PRIMUS SHALL NOT BE LIABLE TO CUSTOMER OR ITS END USERS FOR ANY CLAIM ARISING AS A RESULT OF CUSTOMER'S OR IT'S END USERS INABLLITY TO DIAL 9-1-1 USING THE SERVICES PROVIDED PURSUANT TO THIS AGREEMENT. CUSTOMER ACKNOWLEDGES THAT THE VOIP SERVICE PROVIDED PURSUANT TO THIS AGREEMENT DOES **NOT** SUPPORT E9-1-1 SERVICE UNDER ANY CIRCUMSTANCES, INCLUDING BUT NOT LIMITED TO:
> - broadband connection failure
> - loss of electrical power
> - delays that may occur in making a registered location available in or through the ALI database
> - relocation of the end user's IP -compatible CPE
> - use by end user of a non-native telephone number.
> CUSTOMER ALSO RECOGNIZES THAT IF THE TECHNOLOGY THAT CUSTOMER AND ITS END USERS UTILIZES INVOLVES A PHONE SYSTEM IN WHICH BOTH A VOIP LINE AND A TRADITIONAL TELEPHONE LINE SUPPORT THE TELEPHONE SERVICE, 9-1-1 CALLS WILL NOT GO THROUGH (AND TRADITIONAL 9-1-1 SERVICE WILL NOT BE AVAILABLE) IF THE TRADITIONAL TELEPHONE LINE IS INOPERABLE FOR ANY REASON.

Figure A9: Primus Terms of Service for 9-1-1

The Commission directed Canadian carriers, as a condition of providing telecommunications services to VoIP service providers, to include in their service contracts or other arrangements with these service providers the requirement that the latter comply with all of the Commission's rulings.

With respect to the funding of the provincial 9-1-1 networks, the Commission considers that the Incumbent Local Exchange Carrier's (ILEC) current provincial 9-1-1 tariffs should apply to local VoIP service providers in the same manner as they apply to other carriers and resellers.

The CRTC Interconnection Steering Committee (CISC) has been tasked with resolving the remaining technical and operational challenges related to providing 9-1-1 with nomadic and foreign exchange VoIP services. Specific timeframes have been established for when CISC is required to report to the Commission on possible solutions and recommendations.

In Decision 2007-125 the Commission initiated a proceeding to investigate the implementation costs of the VoIP E9-1-1 service in Canada and how such costs will be recovered. Also in Decision 2007-125 the CRTC released an Interconnection Steering Committee (CISC) "non-consensus" report on a functional architecture for the implementation of nomadic VoIP 9-1-1 service in Canada. CISC is currently attempting to develop technical and financial contribution requirements for adoption by nomadic VoIP service providers. This includes implementation of a Canadian "I2" solution. The process has been very slow but the CRTC is expected to release a decision and regulations in early 2010.

There are currently no fixed VoIP services in the Northwest Territories since the telephone company also provides the cable TV services. Elsewhere, cable companies have introduced these VoIP services to compete with the telephone providers.

Many of the nomadic VoIP services available in other parts of Canada are also offered in the NWT. These include Vonage and Primus. There are currently no mandatory requirements for these service providers to deliver Enhanced 9-1-1.

Telecommunications Device for the Deaf (TTY)

A TTY is a device with a keyboard and text screen, which is used in conjunction with a telephone, to communicate with persons who are hearing impaired or who have speech impediments. TTY is the historical abbreviation for teletype. To communicate via TTY, a caller types his or her conversation, which is read on a TTY display by the person who receives the call. Both parties must have TTY's to communicate. When typing on a TTY, each letter is transmitted in the form of tones to the TTY on the receiving end of the call. The receiving TTY transforms the tones back to letters on a small display screen. This is intended to replicate voice communications occur between the two parties.

The Americans with Disabilities Act (ADA) requires all 9-1-1 PSAP's to provide direct, equal access to their services for people with disabilities who use TTY equipment. In addition, in order to afford equal access to TTY users, every call-taking position is required by the ADA to have its own TTY or TTY-compatible equipment. PSAP's are also required to have systems that enable call takers to handle TTY calls as properly, promptly, and reliably as voice calls. TTY equipment must also, according to the ADA, be maintained and tested at least as often as voice telephone equipment, to ensure that the equipment is operating properly.

In Canada it is not a mandated requirement to provide direct and equal access to the PSAP's using TTY and there is usually only one (1) TTY unit in a PSAP that can answer 9-1-1 calls.

Other Standards, Guidelines and Regulatory Developments

A number of other relevant technical and operational standards and guidelines are available from the National Emergency Number Association (NENA) and the Association of Public Safety Communications Officials Association (APCO)

In Telecom Decision CRTC 2007-13 dated February 28, 2007 the Commission directed the CISC to establish a set of standard guidelines, security procedures, processes and practices for Enhanced Community Notification System (ECNS). This work is in progress.

At a meeting of Federal / Provincial / Territorial (FPT) Ministers Responsible for Justice in November 2002, Manitoba advised that a recent inquest report in the province noted an appalling level of abuse of the 9-1-1 emergency number in Manitoba. Subsequently, at the Ministers' request, in January 2003, the Deputy Ministers Responsible for Justice created an

ad hoc Federal-Provincial-Territorial Committee to be chaired by Manitoba and Justice Canada to examine this issue.

The mandate of the Committee is to examine the scope of possible legislative responses to abuse of the 9-1-1 system and, specifically to:

- Consult other jurisdictions as to whether there are any concerns regarding the adequacy of current *Criminal Code* offences;
- Work together on obtaining, where available, data on the incidence of 9-1-1 abuse, as well as prosecutions;
- Make recommendations to Ministers and Deputy Ministers on the issue of whether *Criminal Code* amendments or provincial legislative changes should be pursued; and
- Make recommendations on future opportunities for improving the capacity for data collection and community education.

Activities of this committee got underway in May 2008.

Typical PSAP Equipment

Equipment and facilities at a 9-1-1 PSAP that also covers dispatch functions includes all or most of the following:

- Call Center Building with HVAC, Security System, AC generator, etc.
- Workstations and furniture
- Terminals, screens, PCs
- Private Branch Exchange (PBX)
- ANI/ALI Controller
- Telephones
- Fax Machines
- Telecommunication Device for the Deaf (TDD) Equipment
- Computer Automated Dispatch (CAD) System with Interfaces to Police, Fire, EMS CAD systems
- CAD - CAD Links
- Computer Telephone Integration (CTI) systems and equipment

- Voice Logging System
- Instant Recall Recorder
- Logging Recorder
- Records Management System
- Data Warehouse System
- Local Area Network
- Modems
- Multiplexers
- Uninterruptable Power Supply (UPS)
- Radio system interface
- Misc (headsets, bells, chimes, etc.)

Ergonomics is a critical aspect of call center design. The last twenty years have seen significant advancement in the evolution of furniture for the Communications industry. Awareness of repetitive stress injuries such as carpal tunnel syndrome, back and neck problems, and stress related problems have led to radical changes in designs.

Traditional call center furniture was fixed units with equipment firmly bolted into position. The only motion possible for dispatchers was to position the chair differently.

Today most call centers are installing fully adjustable workstations that allow the user to vary the height and distance of the equipment in relation to their seat.

It is common to have furniture that can be adjusted to full standing position. This provides dispatchers with the option of sitting or standing to help alleviate back pain.

Old CRT monitors have been mostly replaced by flat screen panels, often on articulating arms that allow the dispatcher to move the monitor closer, further, higher or lower.

More detail on standards, regulations and best practices for 9-1-1 and dispatch services can be found in Reference [2].

A3: Technical Alternatives Considered for 9-1-1 in Yellowknife and NWT

Service Options: Basic 9-1-1 or Enhanced 9-1-1

Over 90% of all 9-1-1 systems in North America are now Enhanced 9-1-1. Basic 9-1-1 without location display does not meet currently accepted public safety standards and is not recommended, particularly for new installations.

Full Enhanced 9-1-1 features including location display should be provided and the latest CRTC regulations and guidelines for wireless and VoIP calling should be followed. Anything less would not meet today's emergency calling standards or public expectations.

It might be possible to provide a basic (sub-standard) 9-1-1 service in the smaller communities without a major investment in telecommunications improvements however 9-1-1 calls could be blocked due to network capacity restrictions. Also, this approach would likely exacerbate the downstream agency call taking / dispatch limitations. It cannot be recommended[12].

As discussed in reference [3] the option of establishing of multiple PSAPs to provide expanded 9-1-1 coverage would involve annual operating cost of over a million dollars per PSAP without offering any significant advantages over a single shared PSAP.

For those communities without 9-1-1 service a recording should be installed that would inform anyone dialing 9-1-1 of the correct emergency numbers to call.

Coverage Options

The 9-1-1 coverage options considered were (i) Yellowknife only, (ii) Yellowknife plus Inuvik, Hay River, Fort Simpson, Fort Smith, Norman Wells and Behchoko (Rae and Edzo), and (iii) all communities listed in Table A1 above. As explained in reference [3] the second option is recommended for the following reasons:

- Covers 77% of NWT population
- Minimal telecommunications upgrades
- Local fire/EMS agencies able to handle downstreamed or dispatch calls
- Serves all communities over 1000 population

Providing 9-1-1 service to the remaining 25 smallest communities is technically possible but would require major telecommunications network enhancements and take several years to complete. The circuit rental costs alone for universal coverage are estimated at over $2.8 Million per year. Although this and other telecommunications costs could theoretically be covered by a monthly 9-1-1 fee on phone bills this fee would likely exceed $12 per month per subscriber. Also, there are insufficient resources in the smaller communities to handle downstreamed 9-1-1 or fire dispatch calls, resulting in major impacts on RCMP resources as the "last resort" public safety personnel.

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[12] A "call forwarding" approach for 9-1-1 in small communities has also been suggested. We feel that this is not a viable option from a public safely viewpoint since the emergency agency dispatch center that would get all the forwarded 9-1-1 calls would have to deal with calls for the other agencies/services. That is the purpose of a 9-1-1 PSAP.

Table A2: 9-1-1 Coverage Options		
Option	**Pros**	**Cons**
Yellowknife plus nearby communities of Dettah and Ingraham Trail (served from NorthwesTel's Yellowknife central office)	• Easiest to implement	• Only covers 45% of NWT population
Yellowknife plus Inuvik, Hay River, Fort Simpson, Fort Smith, Norman Wells and Behchoko (Rae and Edzo).	• Covers 77% of NWT population • Serves all communities over 1000 population • Minimal telecommunications upgrades and costs • Local fire/EMS agencies able to handle downstreamed or dispatch calls	• Does not include all NWT communities – may be controversial
All of Northwest Territories	• Universal NWT coverage • Least public controversy	• Very costly telecommunications upgrades required • Lack of downstream fire/EMS agency capabilities in small communities • RCMP impacted as "last resort" public safety personnel in small communities

Local Hosting

One option will be to provide the 9-1-1 service from one or more sites within the NWT however this option will have all the associated start up costs, as the service is not currently provided. There are a number of advantages with going forward in this way including that the technology requirements will be provided based on the current telephony architecture within the Northwest Territories. The policy and procedure that govern how the system operates will need to be developed regardless of location and there are many templates that can form a basis for this implementation. There will also be a requirement to develop a Master Street Address Guide (MSAG) that is used to match the emergency caller with a known address which in turn helps to guide the call for service to the correct jurisdiction. This location information also assists when handling callers where there is a language barrier.

The first option will also require appropriate staff to receive and manage these emergency calls for all three services. The staff may be those already employed within one of three emergency services, or they may be provided by another service provider. Where that is not

the case, new staff will be required and this poses the obvious problems of recruitment and retention as well as training, management and mentoring.

In terms of governance, the first option also provides the opportunity to directly control the process with 'ownership' of the entity being a direct function of local government. Depending on how the model was structured, this would be governed by a combination of the City of Yellowknife and/or the GNWT. Governance options are summarized in Section A8 below and described in more detail in Reference [3].

Remote Hosting

The second option will be to have the 9-1-1 service hosted by an existing PSAP in another Territory or Province. The advantages to proceeding in this way include the cost avoidance related to establishing a new technical and operational entity. For example, an existing centre with its equipment and staff would provide the required service by adding to its current operation. The implication is that a marginal increase in staff which would be required may be less than a stand alone operation, and that management and mentoring of the staff would be included as a service provided for a fee.

While the second option has some advantages it also has its disadvantages. These include the cost of connectivity from the Northwest Territory to and from the host centre which might be in the Yukon, BC, Alberta or Saskatchewan. The connectivity model would need to include a redundant path in the case of failure of the primary link, and the cost of these connections often increase with distance. The second issue that arises with a 9-1-1 PSAP in BC, Alberta, Saskatchewan, etc. is the need to manage relationships between two telephone providers that may be competitors in a number of areas. In the first two examples, this relationship would be with TELUS and based on our initial discussions there does not appear to be any interest in proceeding. There may also be issues related to technology incompatibility that would need to be overcome by additional engineering, or the provision of interfacing technology.

The second option also poses the question regarding whether or not the call management protocols provided will meet the requirements of Yellowknife and the GNWT. These standards of service vary from region to region and the call management standard that may have been adopted by a particular system is sometimes simply a goal that is not reliably measured or met. Any decision to partner with another service provider would need to address this issue to ensure that appropriate call metrics were regularly provided and that some method to address inconsistencies or other performance deficits would be addressed and corrected.

PSAP Call Center Options considered for Yellowknife and NWT are summarized in Table A3 below.

Table A3: Summary of PSAP Call Center Options		
Option	**Pros**	**Cons**
PSAPs in several NWT centers	• More local community control	• Very high cost • Staffing Issues
Centralized PSAP in Yellowknife	• Centralized ownership and control	• High cost • Lack of telecom link diversity
Share out-of-territory PSAP (Remote Hosting)	• Likely lowest overall cost	• Dependence on another jurisdiction. • Long, vulnerable telecommunications connections • Requires close cooperation between two or more telephone companies

Remote Hosting Options

Remote hosting of E9-1-1 call handling service from two of the closest existing PSAPs (Whitehorse and Strathcona) was investigated in some detail (see Reference [3]). Although cost savings might be achievable these options are not recommended for the following reasons.

(a) Dependence on an outside jurisdiction for critical emergency services.

(b) High cost and vulnerability of telecommunications. The transmission route distance between Yellowknife and either Edmonton or Whitehorse is more than 1000 Km and the costs of the required connections (estimated at $350 to $450 Thousand per year) would partially offset any staff savings gained by sharing PSAP functionality. There is also a lack of physical route diversity to Whitehorse meaning that a single equipment or cable failure could disable PSAP functionality for several hours.

(c) No improvement to current fire dispatch operation. It would likely not be practical for the Whitehorse or Strathcona PSAPs to provide fire dispatch service for Yellowknife. Therefore the current deficiencies in fire dispatch would still have to be addressed.

(d) Lack of PSAP call handling capacity and Enhanced 9-1-1 features in Whitehorse. The RCMP operates the Whitehorse PSAP and has stated that there is essentially no capacity for additional calling and dispatch traffic due to restrictions to both physical space and staffing. As a general policy the RCMP has been reducing their involvement in PSAPs wherever possible. There is currently no committed plan to upgrade the Whitehorse PSAP to provide Enhanced 9-1-1.

(e) Strathcona management's lack of interest in hosting Yellowknife 9-1-1 based on discussions to date.

(f) The Strathcona option would require NorthwesTel to work closely with TELUS in Alberta to provide telecommunications voice and data connections as well as 9-1-1 call routing into the Strathcona PSAP. TELUS competes with NorthwesTel in many arenas and has not been supportive. TELUS is also concerned about taking on the potential liability associated with involvement in emergency services outside its operating territory.

Remote hosting options other than Whitehorse or Strathcona were also considered [3] however none would offer any advantages over Strathcona and would have similar disadvantages.

Table A4: Comparison of Remote Hosting Options		
Option	**Pros**	**Cons**
Whitehorse RCMP OCC / PSAP	• Existing DMS-100 switch could provide E9-1-1 routing • Likely NorthwesTel MSAG location nearby	• PSAP is currently operating at capacity • Uncertain RCMP policy re PSAPs • Indirect telecom facility links • Lack of telecom link diversity • Does not currently provide E911 features (but upgrading is planned)
Strathcona County PSAP	• Full E9-1-1 features • Direct facility links (fibre) • ISO Certified	• Would require close cooperation between competing carriers • TELUS has shown no interest upon initial contact • High telecom link costs • Lack of telecom link diversity • Lack of interest in hosting Yellowknife 9-1-1
E-COMM PSAP	• Full E9-1-1 features • Large complement of highly trained staff	• Similar to Strathcona
Prince Albert PSAP	• Full E9-1-1 features	• Similar to Strathcona

Yellowknife PSAP Options

Possible locations that were considered for a 9-1-1 PSAP in Yellowknife included the RCMP OCC, Fire Hall, new Reservoir / Pump House / Water Treatment complex, new GNWT IT center, the correctional center, a private contractor facility [3] as well as a proposed concept for a new multi-agency emergency center. Since the RCMP does not wish to add 9-1-1 to

its existing operation the Fire Hall is clearly the best choice among the currently available options.

Table A5: Yellowknife PSAP Location Options		
Option	**Pros**	**Cons**
RCMP	n/a	• Ruled out by RCMP policy
Fire Hall	• Co-located with Fire/EMS dispatch • Suitable space and good network interconnectivity	
New Reservoir / Pump House / Water Treatment Plant	• City property • More design options	• No co-located public safety agency • Completion in 2010 or later
Correctional center	• Existing 24/7 staffed location	• Security issues • Lack of telecom link diversity (?)
Private contractor, e.g. - Arctic Alarms – SNC-Lavalin – SecureCheck	• Possible cost savings • Existing 24/7 staffed location	• Dependence on financial success of a private enterprise • Security issues, especially for RCMP • Complex contractual agreement with service level guarantees

Selective Router and ANI/ALI Controller Location

Since the NorthwesTel GTD-5 local telephone switch at the Yellowknife central office will not support E9-1-1 features a separate call routing switch ("selective router") and ANI/ALI controller must be provided. These could be separate or integrated units and would include a Computer Telephony Integration (CTI) solution that puts all of the functions of the telephone on a computer which can be controlled by a keyboard, mouse or touch screen capability. Although this is "subscriber premises" type equipment (CPE) and could be installed at the PSAP there would be advantages to locating it in the NorthwesTel central office for the reasons described in TM03 [3]. This would enable NorthwesTel to operate and maintain the equipment in an appropriate environment. Other advantages are the existing backup power and UPS, building security, trained personnel with easy access to trouble reports, use of NorthwesTel's 7 x 24 alarm monitoring for the equipment and co-location with the GTD 5 local central office switch thus reducing exposure to external cable problems. On the other hand, there is limited available space in the central office for additional equipment and NorthwestTel has concerns about supporting a technology that would be unique in its network.

Possible options to replace the GTD-5 with a DMS-100 switch or route 9-1-1 calls through the Whitehorse DMS-100 switch were considered too costly and impractical.

The GTD-5 switch could be set up to route 9-1-1 calls to regular telephones (without ALI) in case of failure of the Selective Router / ANI/ALI controller.

Address (ALI/MSAG) Database

A major component of any Enhanced 9-1-1 system is the address database. This must be fully redundant and ideally in physically separate locations to ensure reliability. The redundant databases could be provided and operated by the City, GNWT, NorthwesTel or a remote service provider such as Telus or Bell. For the reasons described in TM03 [3] it is preferred that NorthwesTel have this responsibility and cover the associated costs in its 9-1-1 tariff. However, based on discussions it appears NorthwesTel will not agree to take on this role and it is therefore assumed that the ALI database computer will also be located at the PSAP.

Table A6: Address Database Options		
Option	**Pros**	**Cons**
City or GNWT provides and operates	• Direct control	• High Cost • Requires NorthwesTel agreement to release and update non-published numbers and address data • A back-up database would need to be provided
NorthwesTel provides and operates	• NorthwesTel already maintains the data • Most costs covered by 9-1-1 tariff increase • Costs and backup would likely be shared with Yukon	• Highly dependent on NorthwesTel resource availability
Bell or TELUS	• Currently operate such databases in other parts of Canada	• Requires working with another, out-of-territory carrier • TELUS has not been cooperative upon initial contact • Long, vulnerable telecommunications connections
US MSAG Center	• Currently serves large areas the US	• Complex security issues • Long, vulnerable telecommunications connections

Backup Facilities

Options considered [3] for a back-up location to ensure continued PSAP operation during a disaster included the existing RCMP backup OCC at the airport, the primary RCMP OCC, the new Reservoir / Pump House / Water Treatment complex and the Whitehorse PSAP. Establishing mutual back-up roles for the proposed Fire Hall PSAP and the primary RCMP OCC would offer many advantages and is recommended, subject to negotiations and RCMP approval. This should also provide back-up for the fire dispatch function however there is some concern regarding available space at the OCC. Both 9-1-1 and fire dispatch back-up

functions could likely be added to the OCC without requiring additional work stations however the existing consoles would require additional software. This is allowed for in the cost estimates (Section A5). If this mutual back-up option could be achieved it would provide for a 'warm' backup. The alternative would be to provide the minimum amount of equipment at another location that could be used on a temporary basis when required. This would be considered a 'cold' backup which would take longer to activate by comparison.

It is recommended that the ALI database computer be fully backed up at another City or NorthwesTel location. The NorthwesTel billing system where most of the primary address information is generated is fully backed up at another location in NorthwesTel's network. Failure of both ALI databases and/or ANI would disable Enhanced 9-1-1 features meaning that the service would drop back to Basic 9-1-1 with the caller having to describe the emergency location to the 9-1-1 operator.

A4: Design Factors

Call Routing

Figure A10 is an overview of 9-1-1 call routing for the recommended Yellowknife PSAP with ANI/ALI controller / Selective Router (SR) equipment located at the PSAP.

This equipment receives the 9-1-1 call with the calling number (ANI) from the GTD-5 switch, sends the caller's number and address information (ALI) to the answering positions, and transfers the caller (with ANI and ALI) to the RCMP OCC if the call is for police.   The GTD5 will use special trunks to forward landline calls with ANI to the SR.

The City will provide the ALI database which has the caller's home address supplied from NorthwesTel's billing system. The 9-1-1 call is presented to the 9-1-1 PSAP call taker located at the Fire Hall and on answer the ALI database computer sends the address and telephone number to the PSAP call taker's computer aided dispatch (CAD) screen, which is used to verify the address information provided by the caller. If the caller requires the RCMP rather than Fire or EMS services the call is transferred via the SR to special trunks that are connected to the RCMP Redcom/ Windows InterTalk Console (WIC) system.

Cellular companies would likely trunk directly from their Mobile Switching Centers (MSC) to the SR using digital SS7 trunks or Primary Rate Interface (PRI) trunks. These can provide Phase I delivery (see reference [2]) of a valid callback number, as well as identification of the cell-sector from which the call originated to help identify the general location of the caller. When Enhanced Wireless 9-1-1 (Phase 2) becomes available there will be a data connection between the cellular companies Mobile Position Centers (MPC) and the ALI database computer which will receive the caller's X/Y coordinates for mapping.
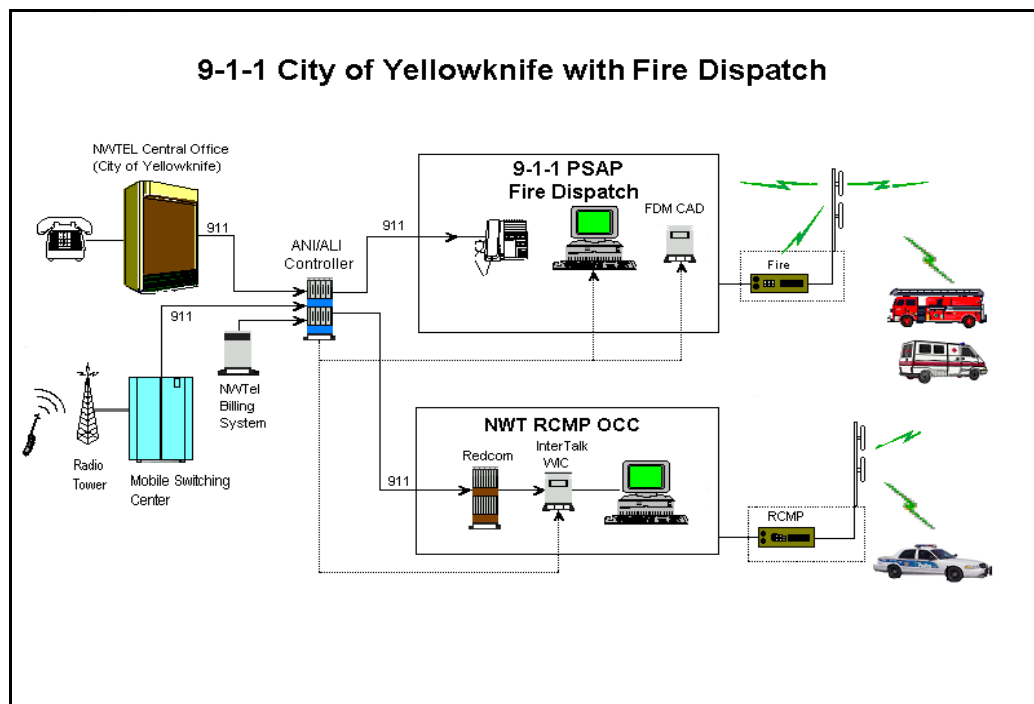

Figure A10: Call Routing for Yellowknife PSAP

Wireline Calls

When a 9-1-1 call is placed from a wireline telephone, typically from a home or business, it is recognized as a 9-1-1 call by the GTD-5 switch. The GTD 5 forwards the call to one of four specialized digital trunks that are connected to the Selective Router at the PSAP. These specialized SS7 digital l trunks, called 9-1-1 trunks, send the caller's telephone number to the Selective Router and then forward it to the ANI controller which decodes and sends a query to the ALI database computer. Location information (ALI) related to the number that generated the call is retrieved from the database which is updated nightly from NorthwesTel's billing system.

The 9-1-1 call and the address information associated with that call are sent by the ANI controller to the 9-1-1 PSAP workstation to answer and display the call. The 9-1-1 call is presented to the PSAP call taker who will hear ringing and see an icon on the CTI screen which is flashing indicating a 9-1-1 call. When the call is answered, the CTI workstation computer displays the caller's address information on the screen.

Upon determining that the caller requires the RCMP the call is transferred via the Selective Router to four 4 CAMA trunks to the RCMP Redcom/ Windows InterTalk Console (WIC) system. On answer at the RCMP OCC the caller, PSAP call taker and RCMP call taker are conferenced together and the PSAP call taker will hang up. Simultaneously, as the call is answered at the RCMP OCC the ALI database computer will send the caller's home address information and telephone number which is displayed on the WIC screen. The screen updating is not an automated process; the RCMP call taker will need to press a corresponding function key (F1 to F4) to get the ALI information which correlates to the line they are talking on.

For other communities all wireline 9-1-1 calls will route via NorthwesTel's local community DMS-10 or Redcom switch via digital transmission facilities and the Yellowknife C.O. to the Selective Router / ANI/ALI controller at the PSAP. From that point 9-1-1 calls from outside the City will route to the PSAP in the same way as Yellowknife calls. Call routing for 9-1-1 calls from cell phones and VoIP devices would also be the same for the other communities as for Yellowknife.

Downstream connections and call routing will depend on where fire dispatch for the communities is performed. For costing purposes it is assumed that downstream calls will be carried over the telephone network or radio-based dispatch facilities.

Since there are single telecommunications facility links between Yellowknife and the six communities, failure of one of these links would mean that 9-1-1 calls (or any other land line calls) from the affected community would not get through to the PSAP. Calls would be automatically routed to a local emergency agency number.

Call routing to and from the smaller communities in the universal coverage option has not been determined.

ANI/ALI Controller / Selective Router

The Selective Router supports Digital Trunks (SS7/PRI) which gives a faster setup time, faster call routing and supports wireless Phase 2 signalling requirements from the wireless service providers (WSP). It is recommended that wherever possible the central offices and WSPs use SS7 signalling as the preferred 9-1-1 trunk interface to the Selective Router. Where this technology is not supported then PRI trunks or CAMA (Centralized Automatic Message Accounting) trunks will be used. It is recommended that a minimum of two 9-1-1

trunks be provided from each central office switch that is supporting the dialling of 9-1-1. There is only one central office in Yellowknife.

ALI Computer

One ALI database computer located at the PSAP will interface to NWTel's billing system, CAD systems, printers and WSP Mobile Position Centers (MPC) using TCP/IP protocol on a dedicated network with a redundant ALI database computer in a different location for backup.

RCMP OCC

The RCMP OCC will require four 9-1-1 ALI CAMA lines, 4 CAMA trunks on the Redcom system, a CAD port on the WIC system, 9-1-1 printer port from the ALI database computer using the TCP/IP network.

PSAP Facilities

Space for 9-1-1 PSAP facilities and operation will likely require a purpose-built renovation to the Fire Hall unless some other location is found to be more practical. This will accommodate integrated 9-1-1 and fire/ EMS dispatch operation.

The Fire Hall is currently well served by fiber that links the City Hall and the RCMP OCC; it is also provided with a generator and UPS. It should also be noted the Yellowknife Fire/EMS has already begun the implementation of a fire record management system which is a key component for a dispatch operation. There is an associated CAD system that has yet to be implemented but it would have the required capacity to handle 9-1-1 and dispatch functions for the call volume from Yellowknife or the entire Northwest Territories.

It is recommended that the Fire Hall have at least three CTI workstations which are directly connected to the co-located ANI/ALI controller. Some of the existing administration numbers will need to be re-terminated on the ANI/ALI controller (e.g. bylaw enforcement and a new number for alarm companies) but there will also need to be some dedicated lines between the Fire Hall Toshiba PBX and the ANI/ALI controller for administration purposes. Some of the advantages of CTI workstations are:

- The administration phone system can be combined with the 9-1-1 system thereby reducing the number of telephone sets required by the call takers.

- The workstation includes an integrated call recorder that allows instant playback of calls, and the indexing of these recordings against incidents.

- 9-1-1 ANI/ALI information is exchanged easily with the CAD such that original ANI/ALI information is stored with the CAD record and may be compared to the actual incident address.

- Telecommunication Device for the Deaf (TDD) can be integrated with the telephone, including pre-programmed messages that reduce communications time.

The Fire Hall will require three workstation spaces, a dedicated 9-1-1 printer and a CAD port from the ANI controller using a TCP/IP network. The Fire UPS system will need to be upgraded to handle the PSAP and fire dispatch requirements.

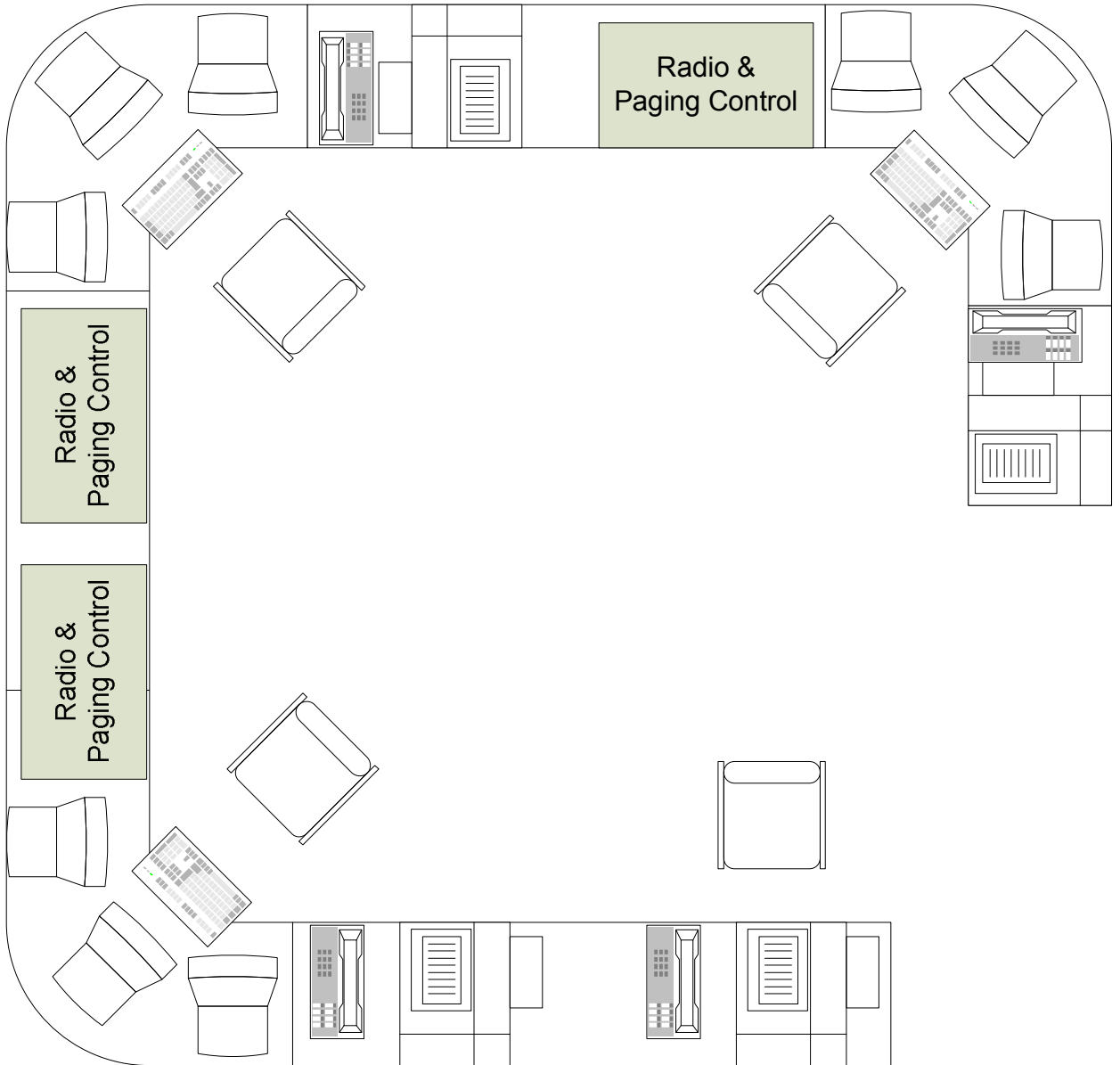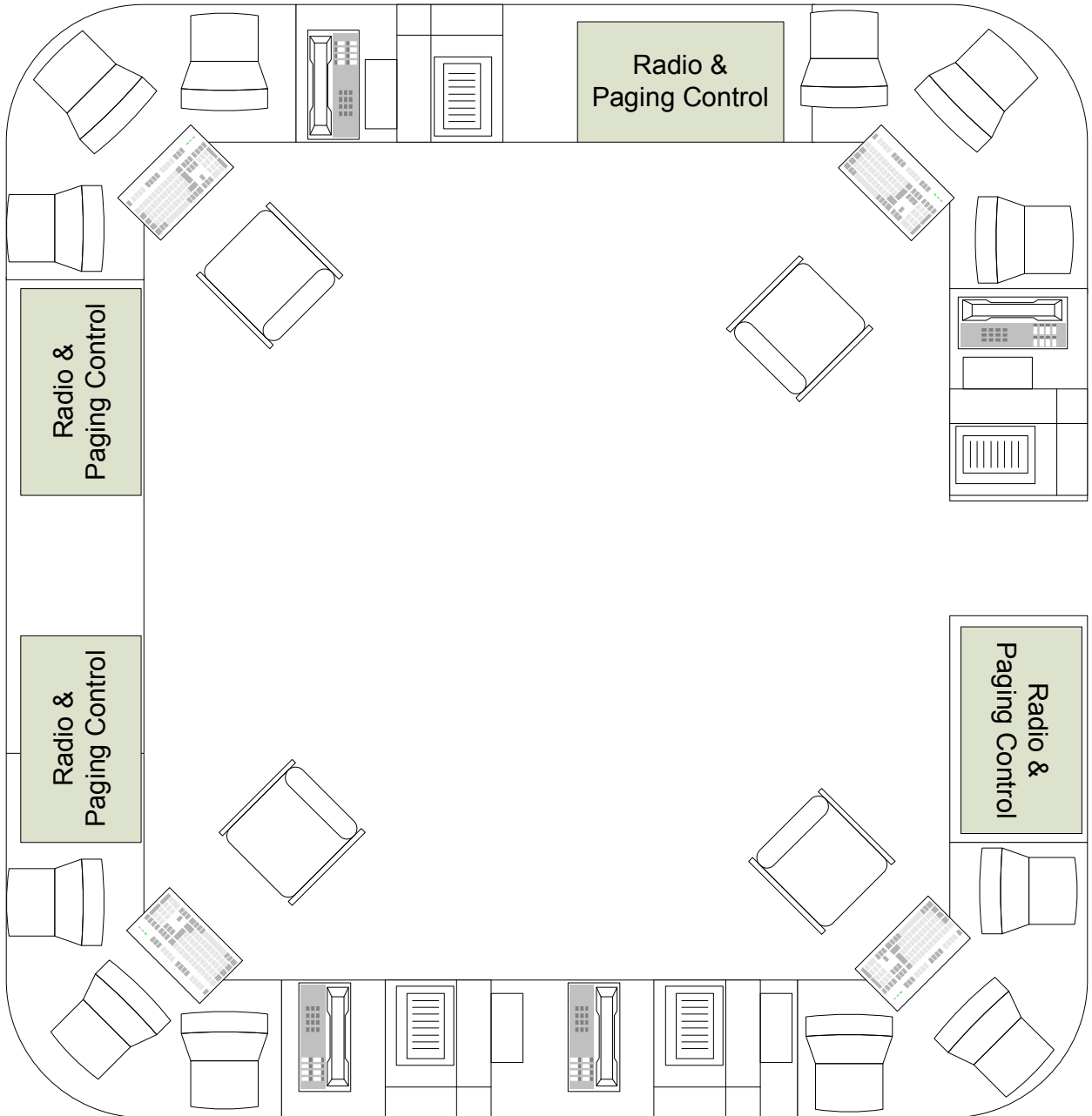Proposed general layouts for the Yellowknife PSAP are shown in Figures A11 and A12.

Figure A11: Consolidated Fire Dispatch and PSAP, minimum of 3 positions

**Figure A12: Consolidated Fire Dispatch and PSAP,
3 positions + 1 overflow & training position**

9-1-1 PSAP Staffing

The minimum E9-1-1 call center staff count to ensure that at least two call answer positions are staffed on a 24/7 basis can be calculated as follows:

- Required hours = 2 people x 24 hours x 7 days = 336 hrs per week
- Approximate available hours per full time employee, considering vacation, training, sickness, etc. = 37 hours per week
- Number of employees = 336/37 or approximately 9 (excluding fire dispatch functions)

A5: Costs

Initial Costs

(a) The approximate capital cost to establish a combined 9-1-1 / Fire & EMS Dispatch PSAP at the Fire Hall, including RCMP OCC cost impact, is shown in Table A7.

Table A7: PSAP Capital Costs for Yellowknife Coverage		
PSAP Component	**Notes & Assumptions**	**Approximate Cost ($)**
Call Center Building with HVAC, Security System, generator, etc.	Provide room and improvements in existing fire hall. No major building upgrades required.	150,000
Workstation furniture	Purchase – 3 positions	30,000
ANI/ALI Controller & Selective Router	CPE installed at PSAP. Cost based on a Plant CML quote for ECS-1000.	450,000
Terminals, screens, PCs	Purchase – 3 positions	Incl. above
Private Branch Exchange (PBX)	Existing Toshiba	Incl. above
Telephones	Purchase – 3 positions	Incl. above
ALI Database	Small PC server with back-up in another location	60,000
Computer Automated Dispatch (CAD) System with Interfaces to Police, Fire & EMS CAD systems	Features added to FDM CAD	15,000
Computer Telephone Integration (CTI) systems and equipment	Purchase	Incl. above
TCP/IP Network	Purchase	10,000
Voice Logging System	Use existing Eventide digital recorder	-
Instant Recall Recorder	Use existing Eventide digital recorder.	-
Records Management System	Included in FDM CAD	-
Uninterruptable Power Supply (UPS)	Purchase – replace multiple UPS units	25,000
Radio system interface	Included in Radio upgrade project	-
Misc (headsets, bells, chimes, etc.)		2000
RCMP OCC	Upgrades required for ALI display, etc.	68,000
NorthwesTel Network Enhancements, etc.	Covered by 9-1-1 tariff.	300,000
Contingency		100,000
	Total Capital Cost	1,210,000
Total excluding NorthwesTel components covered by 9-1-1 Tariff		910,000

(b) Address (ALI/MSAG) Database

The process for establishing an ALI database is described in detail in TM03 [3]. Although the database itself would likely reside in a server at the PSAP, NorthwesTel would play a prime role in refining the address data (from their billing system) and the City would assist in resolving incomplete address information (e.g., lot numbers). This has been confirmed in discussions with the carrier. It is estimated that about ½ person-year or $60,000 would need to be covered by the City's budget to assist with address refinement.

(c) Back-up PSAP

For the purpose of this cost estimate it is assumed that the RCMP OCC can provide full back-up functionality for the 9-1-1 PSAP (excluding the selective router) on a mutual basis without incurring significant additional cost.

(d) Other one-time costs

An allowance of an additional $200,000 for other, one-time miscellaneous costs including legal and technical consulting fees is recommended.

The total capital and other one-time costs to be covered by the City would therefore be approximately $1,170,000.

Annual Operating Costs

The approximate annual cost to operate a combined 9-1-1 / Fire & EMS Dispatch PSAP at the Fire Hall is shown in Table A8.

Table A8: Annual Operating Costs for Yellowknife Coverage		
Component	**Notes and Assumptions**	**Approximate Annual Cost ($)**
9-1-1 / Dispatch PSAP Staff	1 supervisor and 11 full time staff at $120K per FTE. This assumes no reduction in pump house staff with the transfer of all fire dispatch duties to the PSAP and (b) call answer/ dispatch standards can be met during off peak hours with two staffed positions.	1,440,000
NorthwesTel network maintenance , etc.	Covered by 9-1-1 tariff	25,000
PSAP facility, SR maintenance and utilities	10% of capital cost	70,000
Address database maintenance	½ FTE	60,000
Contingency		100,000
Total Operating Cost		1,695,000
Total excluding NorthwesTel components covered by 9-1-1 Tariff		1,670,000

If the costs of establishing a fire / EMS dispatch operation are subtracted from the combined PSAP costs in Tables A7 and A8, the incremental initial and annual costs for providing 9-1-1 in Yellowknife only are $958,000 and $570,000 respectively.

Estimated costs for the expanded E9-1-1 coverage option are higher than the Yellowknife-only option as described below. Cost impacts on downstream agencies in the communities are not expected to be significant since facilities and staff for handing calls to existing fire and EMS emergency numbers are already in place. Costs incurred by NorthwesTel and the cellular companies would be covered by 9-1-1 fees on phone and cell bills. For this option these fees are estimated at 60 cents and 30 cents per month respectively and would require approval by the CRTC.

Initial Costs for Expanded Coverage

Costs for minor enhancements or expansion of CTI, CAD and other PSAP equipment to handle the six additional communities are not expected to be significant.

The only major increase in initial costs is associated with refinement of addresses in the six communities. It is assumed that NorthwesTel will play a prime role in refining the address data from their billing system. The GNWT and involved municipal governments would need to assist in resolving incomplete address information (e.g., lot numbers). It is estimated that an additional ½ person-year or $60,000 in total would be required for this initial work.

Total initial cost for Yellowknife plus six communities, excluding dispatch improvements and costs covered by 9-1-1 fees, is therefore $958,000 plus $60,000 or $1,018,000.

Annual Operating Costs for Expanded Coverage

The cost for telecommunications circuits required to provide 9-1-1 in the six communities is an estimated $660,000 per year based on NorthwesTel digital private line rates and NENA recommendations for circuit quantities. This is enabling infrastructure and could be covered by GNWT as described below.

Excluding costs covered by GNWT and the 9-1-1 service fees the additional annual cost to include the six communities is estimated at $60,000 per year. This covers ½ FTE for ongoing address maintenance and could be shared between GNWT and the communities. The additional 9-1-1 / dispatch call volume is not expected to significantly impact PSAP staffing requirements or ongoing costs.

Total annual operating cost for Yellowknife plus six communities, excluding dispatch improvements and costs covered by 9-1-1 fees, is therefore $570,000 plus $660,000 plus $60,000 or $1,290,000 per year.

Table A9: Cost Estimate – Yellowknife plus Six Communities		
Component	**Initial Costs**	**Annual Costs**
NorthwesTel network, software and admin. costs (to be covered by a 9-1-1 fees on telephone and cell bills)	$300,000	$25,000
Yellowknife Fire/EMS dispatch improvements	$212,000	$1,100,000
Total excluded costs	$512,000	$1,125,000
NorthwesTel circuit costs for six communities	-	$660,000
Incremental PSAP and RCMP OCC facilities, call routing equipment and staffing at the City Fire / EMS dispatch center	$698,000	$410,000
Address refinement and other (per Tables A7 and A8 above)	$320,000	$220,000
Total Incremental Costs (excluding Yellowknife Fire/EMS dispatch improvements and costs covered by 9-1-1 phone and cell fees)	$1,018,000	$1,290,000

A6: Funding Sources

Funding for 9-1-1 services is derived from a number of sources. The oldest and most common form of funding is a surcharge on wireline telephone subscribers within given service area. In many areas, there is also a separate surcharge on wireless subscribers within the service area. Regrettably, neither of these models effectively provides the opportunity for other than wireline and wireless subscribers to participate in the financial support of public safety resources. The traveling public, remote VoIP service providers and others outside the service area make no contribution to the cost of maintenance of the 9-1-1 services to which they route callers. While the surcharge model had a measure of appropriateness in years past, the expansion of access to 9-1-1 service at the Public Safety Answering Point (PSAP) from other devices and technology has created a pattern of diminishing revenue amidst increased expectation of service. Consequently the need to fund 9-1-1 service from sources other than phone bill surcharges is continually increasing, particular in areas of low population density.

In the U.S. basic and enhanced 9-1-1 services are typically funded pursuant to federal and state laws that impose monthly fees on local and wireless telephone customers. Local governments such as cities and counties may also levy a fee, which may be in addition to, or in lieu of, the state fee. The fees are collected by local exchange and wireless carriers through monthly surcharges on customer telephone bills. The collected fees are remitted to 9-1-1 administrative bodies, which may be a state 9-1-1 board or local 9-1-1 agencies. These agencies disburse the funds to the PSAPs for 9-1-1 purposes as specified in the various statutes. Telephone companies and wireless carriers may be entitled to apply for and receive reimbursements for costs of compliance with laws requiring that their networks be compatible with 9-1-1 and enhanced 9-1-1. The amount of the fees varies widely by locality.. Fees may range from around $0.25 up to $3.00 per month per line. The average wireless 9-1-1 fee in the United States is around $0.72, which is based on the fees for each state as published by the National Emergency Number Association (NENA). Since the monthly fees do not vary by the customer's usage of the network, the fees are considered, in tax terms, as highly "regressive", i.e., the fees disproportionately burden low-volume users of the public switched network (PSN) as compared with high-volume users. Some states cap the number of lines subject to the fee for large multi-line businesses, thereby shifting more of the fee burden to low-volume single-line residential customers or wireless customers.

The U.S. Congress in 2004 authorized $250,000,000 USD in annual funding for the 9-1-1 program, but actual federal appropriations to state and local 9-1-1 agencies have been slow to materialize.

The telephone company costs to provide 9-1-1 are shown between the two blue lines in Figure A13 below. In Canada the rate per access line appears as a "9-1-1 Service" line item on the subscriber's telephone bill and covers the voice and data network portion of the service. This includes central office 9-1-1 access provisioning, network trunks to the Selective Router, selective routing software (ESZ tables), network trunks to each emergency response agency, 9-1-1 database and computers (Address Management System), ALI data circuits to each agency, installation, as well as ongoing maintenance and support.

PSAP costs to support the 9-1-1 caller covers everything below the bottom blue line in Figure A13. A Call Answer Levy (CAL) has often been applied to help offset these costs. The CAL appears as another line item on the subscriber's telephone bill.

Another approach is to have the telephone company bill the PSAP operator (e.g. local government) for network costs on a per working line basis and have this added to the PSAP costs that are billed as a 9-1-1 charge on property tax statements.
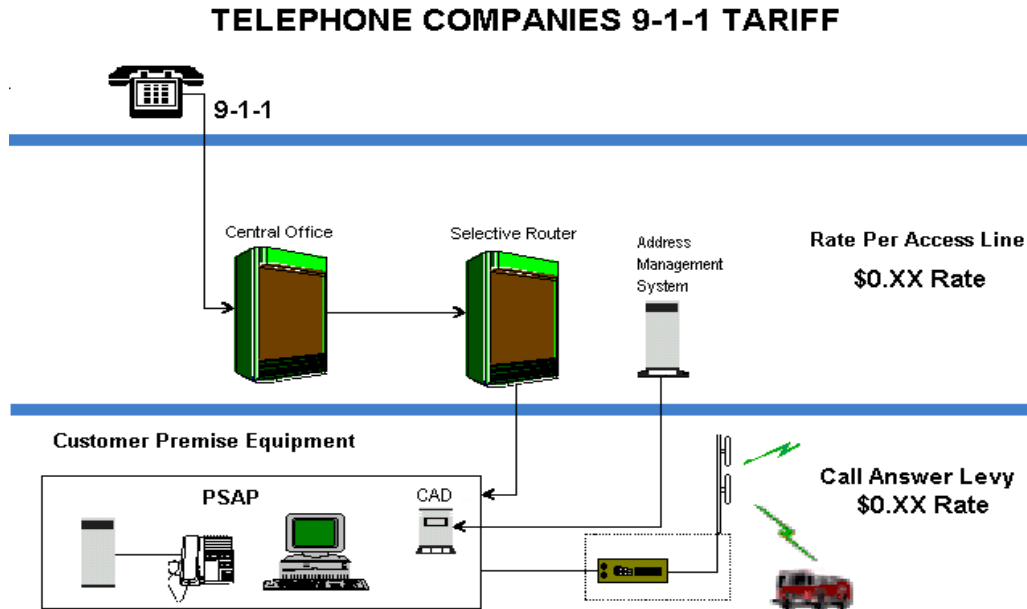

Figure A13: 9-1-1 Service Fee and Call Answer Levy

In Canada the Call Answer Levy relates only to the costs of the initial response to the 9-1-1 call and the effort to complete the downstream transfer to police, fire or EMS dispatchers. Examples of these costs are: staff wages and benefits, office space and furniture, administration overhead, PSAP customer premise equipment (e.g., as listed in Table A7) and ongoing equipment maintenance and support. The 9-1-1 Service Agreement signatory works with the local telephone company to establish the CAL rate. Most of the telephone companies that provide this service receive $0.07 per line per month for billing, collection and disbursing a monthly cheque to the signatory PSAP operator.

The following are examples of CAL rates in Canada.

Nova Scotia	$0.50 ($0.43 + $0.07)
Quebec	$0.47 ($0.39 + $0.07 + $0.01)
Alberta	$0.44 ($0.37 + $0.07)
BC Powell River	$0.69 ($0.62 + $0.07)
BC Nanaimo	$0.47 ($0.40 + $0.07)
BC Capital Regional District (Victoria)	$0.66 ($0.59 + $0.07)

Funding Sources for Yellowknife and NWT

Report TM04 [4] describes a number of possible funding sources to cover the costs of establishing and operating a 9-1-1 PSAP in Yellowknife. These are summarized in Table A10.

Table A10: Summary of Possible Funding Sources		
Option	**Pros**	**Cons**
Wireline and Wireless Telephone Customers via 9-1-1 Service Tariffs	• Certain source of funding • Defined CRTC tariff filing process	• Can only be applied to Telco and Cellco costs • Small customer base • Normally limited to $1/mo • May not cover all telecommunications costs
Wireline Telephone Customers via a Call Answer Levy	• Would help cover PSAP costs	• NWTel will not likely agree to collecting these fees • Would require legislation to obtain additional funds • Small customer base • Declining number of wireline users
VoIP Customers	• Growing numbers of users	• No process for nomadic VoIP services
City of Yellowknife	• Funding available • No restrictions on use of funds	• May require redirection of funds from other City programs
Other NWT Municipalities		• Minimal funding available
Government of Northwest Territories	• Funding available • No restrictions on use of funds	• May require redirection of funds from other GNWT programs
Federal Programs – INAC and ICP		• Existing programs are nearing expiry and are not generally applicable to 9-1-1
Nunavut 9-1-1 Hosting	• Could cover up to 1/3 of operating cost with minimal PSAP impact	• Nunavut currently has no plans for implementing 9-1-1 • Nunavut may prefer to have its own PSAP(s)
Alarm Monitoring	• Minimal PSAP impact • Better service could be provided	• Revenue potential is limited • May be seen as competition to the private sector

A7: Cost Sharing

As discussed in reference [4] there are many possible models for sharing the costs of providing 9-1-1 service in Yellowknife and other NWT communities. An approach that should be given serious consideration would be to have GNWT cover the total annual circuit costs associated with adding 9-1-1 coverage to the six recommended communities outside Yellowknife. The cost of this "enabling infrastructure" is about $666,000 per year.   The GNWT should also contribute to the PSAP capital and operating costs to reduce local tax impacts. The remaining costs which are not covered by GNWT or the monthly 9-1-1 service fees on land lines and cell phones could logically be allocated to the served communities based on population. This would mean that the City and other communities would pay roughly 59% and 41% of the remaining incremental capital ($818,000) and operating costs ($530,000 per year) respectively. As explained in Section A5 incremental costs exclude the costs of establishing a fire / EMS dispatch operation.

This allocation approach could be adjusted periodically to reflect changes in population and circuit costs.

Table A11: Proposed Allocation of Costs for Option 4		
Funding Source	**Initial Costs**	**Annual Costs**
GNWT	$200,000	$760,000
City of Yellowknife	$479,251	$310,517
Other Six Communities	$338,749	$219,483
Total	$1,018,000	$1,290,000

A8: Ownership, Governance and Organization

Options considered for ownership of the 9-1-1 PSAP and associated facilities included (i) City of Yellowknife Sole Ownership, (ii) GNWT Sole Ownership, and (iii) Shared/Joint Ownership. City ownership is recommended for the following reasons:

- The City Fire Hall is the recommended PSAP location

- The City's fire dispatch function should be consolidated with 9-1-1

- Based on population served the City will likely cover the majority of the net cost

The basic choice regarding governance structure is whether or not to establish a shareholder- owned corporation similar to E-Comm BC. Given that there are only three main stakeholders involved in this project, i.e. the City, GNWT and RCMP, a simple governance structure should be adequate. This would consist of a senior oversight body, a City managed PSAP, a management committee and a user committee. See Reference [4] for more details.

Table A12: Possible Governance Structures			
Ownership and Authority	City of Yellowknife	GNWT	Joint - City & GNWT
Oversight Body	Board of Directors representing the City and the RCMP plus GNWT if other communities are covered	Board of Directors representing GNWT, the City and the RCMP	Board of Directors representing GNWT, the City and the RCMP
Management	City Fire Department	A GNWT Department (e.g. PWS or MACA)	City Fire Department or a GNWT Department
Management / Operations Committee	• City (chair) • GNWT • RCMP • NWTel • PSAP manager • Community agency reps (as applicable)	• GNWT (chair) • City • RCMP • NWTel • PSAP manager • Community agency reps (as applicable)	• City (chair?) • GNWT • RCMP • NWTel • PSAP manager • Community agency reps (if applicable)
User Committee	Representatives from all affected agencies		
9-1-1 / Dispatch Operations	PSAP manager and staff		

As discussed in reference [4] the required governance and organizational structure is relatively simple if 9-1-1 and dispatch coverage is limited to the City and adjacent areas. It is assumed that the City would own and operate the 9-1-1 / dispatch PSAP. As a major stakeholder and client the RCMP must have direct involvement in decision making and it may be desirable to include the GNWT as well, particularly if coverage expansion to other communities is planned in the near future. The GNWT could also represent Dettah and the Ingraham Trail area.

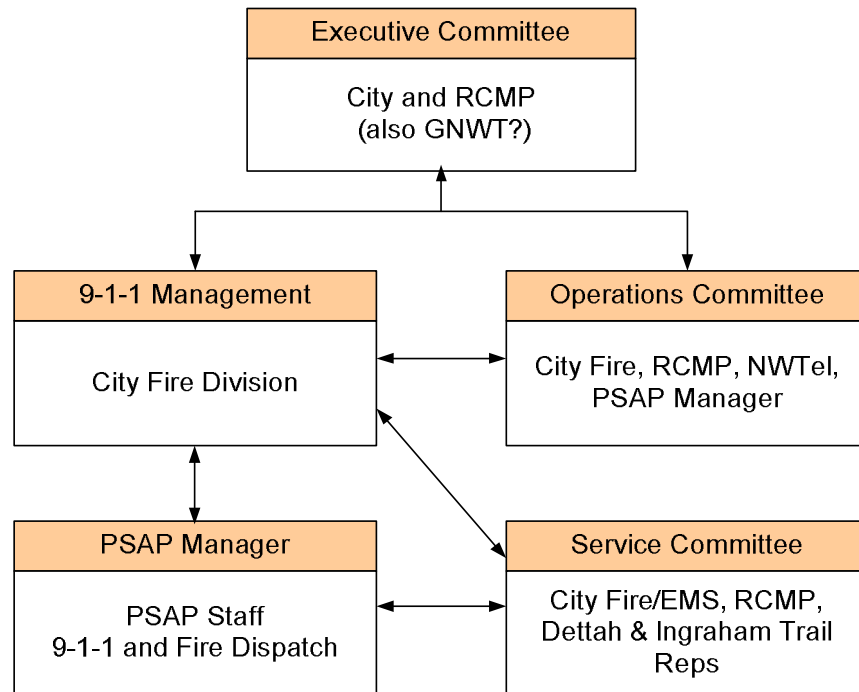The recommended governance and organizational structure is shown in Figure A14.

Figure A14: Governance and Organization – City E9-1-1 Only

If the PSAP is owned and operated by the City the governance and organizational structure for expanded 9-1-1 and dispatch coverage would be quite similar to the structure described for City–only service. However, representation from GNWT at all levels would need to be added and the included communities (e.g., Inuvik, Hay River) should also have representatives on the Service Committee and possibly the Board of Directors. The resulting recommended governance and organizational structure is shown in Figure A14.

As described in reference [4] another option would be to have the GNWT own the PSAP and have the City Fire department operate it on contract. In this case overall management would likely be GNWT responsibility with the PSAP manager reporting to a GNWT department.
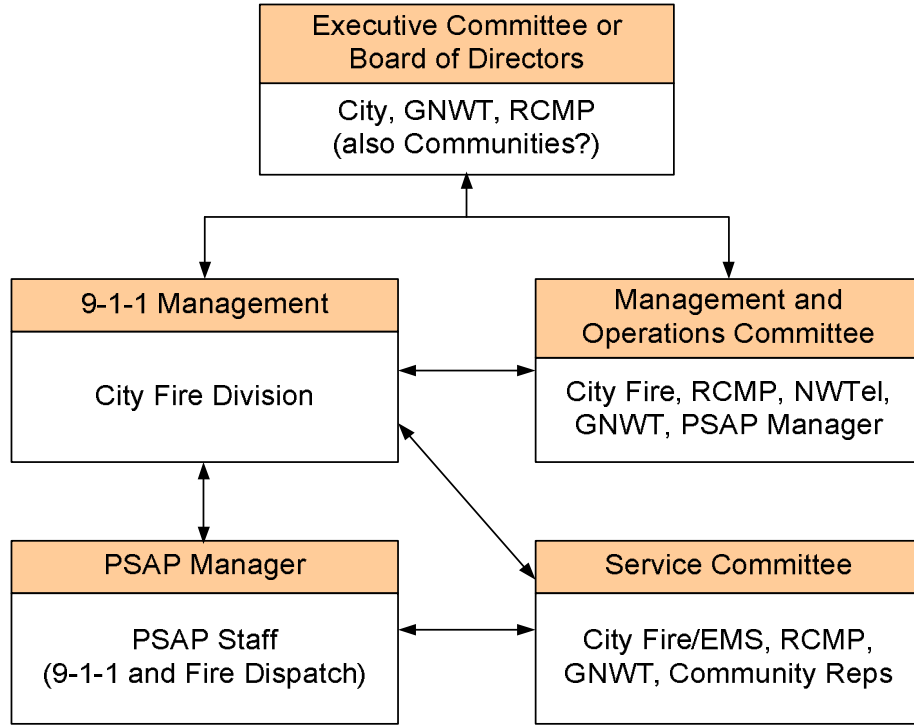
Figure A15: Governance and Organization – City plus Communities