Wildland Urban Interface: Addressing the Challenges of Implementing FireSmart in the City of Calgary

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Ryan McFadden
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Name:	**Ryan Mc Fadden**
Degree:	**M.P.P**
Title of :	**FireSmart: Addressing The Challenges Of Urban Policy Implementation**

Examining Committee:

Chair: **Nancy Olewiler**

Nancy Olewiler
Senior Supervisor

Kennedy Stewart
Supervisor

Doug McArthur
Internal Examiner

Date Approved: Friday, April 8 2005

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Abstract

As the City of Calgary expands into rural areas, communities will encounter Wildland Urban Interface (WUI), which is defined as any area where structures are located near or among combustible wildland fuels. With the exception of Calgary, much of Alberta and British Columbia have implemented FireSmart principles that reduce the risk of WUI fires. This study provides recommendations as to how the City of Calgary can address the challenges of implementing FireSmart principles. This study combines a multi-case review of successful FireSmart communities, and elite interviews to gather data. Best practices indicate that organizational capacity, development application procedures and WUI administrative responsibility are integral to develop a framework for implementation. Accordingly, this study recommends that institutional and procedural reforms are needed if the City of Calgary is to implement FireSmart principles.

Executive Summary

Whether near large urban areas or in remote rural locations, every year more and more people are retreating to peaceful surroundings and building their homes in the Wildland Urban Interface (WUI). For the purposes of this project, the WUI is any area where structures (residential, industrial, recreational, or agricultural) are located next to or among combustible wildland fuels. Such areas are prone to fire losses since fires that occur in wildland fuels can spread across the landscape and ignite flammable structures.

In 1997, the Partners in Protection, an Alberta based coalition of professionals representing federal, provincial, and municipal agencies developed *FireSmart: Protecting Your Community from Wildfire*. The intent of this manual is to educate the public about WUI issues, increase public safety, decrease the potential for property losses, and reduce public and private expenditures for evacuations and fire suppression. Across Alberta and British Columbia, municipalities have successfully implemented FireSmart principles in an effort to prevent WUI fire in and around their communities.

Recently in the City of Calgary, the Statesman Corporation filed a *Report to the Calgary Planning Commission* to develop the Wedgewoods, a 568-apartment unit complex on a heavily treed 7.8 Ha parcel of land on the western boundary of the City of Calgary in the community of Discovery Ridge. The City of Calgary Parks Department suggested that a FireSmart guided *Wildfire Hazard Assessment* should complement on overall biological impact assessment of the area prior to development. The results from the assessment indicated that the Structure and Site Hazard was an *extreme* fire hazard and the Area Hazard was rated as *moderate to extreme*.

The hazard assessment clearly indicated that the development was at risk from WUI fire, however; there was little opposition from City officials, the developer was restricted by the Land Use Bylaw from implementing a risk management plan, and there was no meaningful system of checks and balances to reduce the WUI fire risk. This study examines how the City of Calgary can address the challenges of implementing FireSmart principles in an effort to reduce the risk from WUI fire.

Investigative Framework

In attempting to examine how the City of Calgary can address the challenges of implementing FireSmart principles, this study analyzed three different communities, Canmore, Jasper and the City of Langford. Each case was chosen for its reputation as being a leader in developing a comprehensive response to the WUI problem. The goal of this analysis is to identify the various characteristics that have contributed to these communities implementing FireSmart principles and programs. The three main categories for investigating characteristics or indicators are: Organizational Capacity, Development Application Process, and WUI Administrative Responsibility.

The methodology used in this study has two major components: multi-case analysis, and elite interviews. Through extensive research, the evidence determined various factors that contributed to these communities implementing FireSmart principles to reduce WUI fire risk. Since much of this information involved finding out specific practices, approaches and opinions, elite interviewing was used to gather data on each case study.

The results of the analysis and elite interview process leads to a discussion and comparison of the similar and dissimilar characteristics of each case. A summary of best practices is developed and four alternatives are submitted for evaluation in terms of their ability to contribute to the implementation of FireSmart principles. This requires a matrix of criteria that assesses each alternative in relation to acceptance, cost, effectiveness, administrative feasibility, implementation cycle, and interdepartmental coordination. The outcomes of the criteria analysis offers the City of Calgary four alternatives to develop a systemic framework that will enable the implementation of FireSmart principles that will protect communities from WUI fire risk.

These alternatives are offered as mutually exclusive opportunities, but each alternative is an important step in creating a systemic framework that will implement FireSmart principles that will protect communities from WUI fire risk. The decision process is not about which alternative is better that the other, rather the City must decide the degree of commitment and complexity they are willing to employ to achieve a systemic framework. This idea is explored in the *Alternative* section of this study.

Findings and Recommendations

The results of the case study analysis and the elite interview process reveal similarities among the successful communities that provide guidance for the City of Calgary to address the WUI issue. The findings suggest that the City of Calgary's effort to address WUI fire is substandard in terms of stakeholder participation, expert consultation and cooperation. Successful program design also exhibits a top-down approach, where the WUI initiative was an issue of priority at the senior level of the local government. In addition, each case completed a WUI hazard assessment of their community. This information led them to make important decisions as to the degree of regulation that each community required, assess the various municipal tools available to restrict development in WUI hazard areas, and develop a minimum standard for new development. Finally, the results show that each community had a delegated authority that was responsible for reviewing new developments, approving WUI mitigation plans, and was empowered by legislation to be the ultimate approval authority. As a result of the analysis the following recommendations for best practices are:

1. Establish the risk from WUI fire. This includes completing a Community Level WUI Hazard Assessment for the City of Calgary. The results of this study will provide baseline evidence for determining the scope of a WUI project, define the communities at risk, and enable the City to focus its resources on these communities specifically. The next step involves the development of a comprehensive WUI Review Committee that involves the various stakeholders of the communities at risk, and includes Calgary Parks, Calgary Fire, Land Use Planning and Development, Alberta Sustainable Resource Development, Community Associations and or their Aldermen, Environmental Groups, Utility Companies, and Developer and Building Associations (Urban Development Institute - UDI, Builders Owners and Managers Association-BOMA, Calgary Region Home Builders Association-CRHBA).

2. Adjust the development permit application process to include a review by a delegated WUI official that has authority to make recommendations for WUI fire issues or concerns.

3. Amend the City of Calgary regulatory framework that stipulates the conditions of the development permit application process by reviewing other municipalities' approaches to addressing WUI through their Land Use Bylaws. Review methods

such as requiring new developments in WUI fire identified areas to submit a hazard assessment as a condition of the application process, and implementing special tax assessments for living in high risk areas. This information should lead to the amendment of the Land Use Bylaw to give regulatory and enforcement powers to the approving authority in consideration of WUI issues or concerns.

Dedication

To my family for the opportunity, to Melanie for her support, and to everyone for their love.

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Table of Contents

Approval ii

Abstract iii

Executive Summary iv

Investigative Framework v

Findings and Recommendations vi

Dedication viii

Acknowledgements ix

Table of Contents x

List of Figures xiii

List of Tables xiv

1 Introduction 1

1.1 Policy Problem 1

1.2 Study Outline 2

2 Background 3

2.1 Reducing the WUI Risk 4

2.2 Why is Wildland Urban Interface a Problem Worth Considering in the City of Calgary 5

2.3 Factors to Consider 6

2.3.1 Home Ignitability 6

2.3.2 WUI Risk Perception 7

2.3.3 Suppression Capabilities 9

2.4 FireSmart 11

2.4.1 Next Steps 12

3 Methodology 13

3.1 Rationale for Case Selection 13

3.1.1 Canmore 16

3.1.2 Jasper 16
3.1.3 Langford 17
3.1.4 Calgary 17
3.2 Investigative Framework 18
3.2.1 Elite Interviews 18
3.2.2 Stop Light Model 19
3.2.3 Organizational Capacity 21
3.2.4 Development Application Process 22
3.2.5 WUI Administrative Responsibility 23

4 Case Study Analysis 25

4.1 Organizational Capacity 25
4.1.1 FireSmart Cases 26
4.1.2 Calgary 28
4.1.3 Summary of Findings 29
4.1.4 First Steps for Success 30
4.1.5 Identify Common Goals 31
4.1.6 Bottom-Up Approach 33
4.2 Development Application Process 33
4.2.1 FireSmart Cases 34
4.2.2 Calgary 36
4.2.3 Summary of Findings 37
4.2.4 Enhancing Municipal Tools to Protect Communities from WUI Fire 37
4.2.5 Land Use Bylaw 38
4.3 WUI Administrative Responsibility 39
4.3.1 FireSmart Cases 39
4.3.2 Calgary 41
4.3.3 Summary of Findings 42
4.3.4 Checks and Balances 42
4.3.5 Approving Authority 43
4.3.6 Long Term Management 44
4.4 Summary of Best Practices Drawn from the Case Studies 44

5 Analysis of Alternatives 46

5.1 Issue Definition and Policy Objectives 46
5.1.1 Degree of Commitment and Complexity 46
5.2 Alternatives 47

5.2.1 Status Quo 48
5.2.2 Alternative 1 – Establish the Risk 49
5.2.3 Alternative 2 – Delegate WUI Approval Authority 50
5.2.4 Alternative 3 – Amend the Land Use Bylaw 50

6 Evaluation 52

6.1 Criteria for Assessing Alternatives 52
6.1.1 Projected Outcomes 53
6.1.2 Summary of Criteria Evaluation 55
6.1.3 Summary of Alternative Considerations 57
6.2 Recommendations 58
6.2.1 Recommendation #1 58
6.2.2 Recommendation #2 59
6.2.3 Recommendation #3 59

7 Conclusion 61

Appendices 64

Appendix A: City of Calgary Population Growth Map 65
Appendix B: Discovery Ridge 66
Appendix C: ASRD Management Area 72
Appendix D: Elite Interview Information 73
Appendix E: City of Langford Development 77
Appendix F: City of Calgary Summary of Circulation Replies 80

Bibliography 81

Works Cited 81
Public Documents 88
Interviews 88

List of Figures

Figure 1: Question Categories 20
Figure 2: Realizing Common Goals to Achieve Success 32
Figure 3:Choosing Alternatives Based on the Degree of Commitment and Complexity 47
Figure 4: Alternative Continuum to Reach a Comprehensive Systemic Framework 60
Figure 5: Projected Population Growth in Developing Areas in the City of Calgary 65
Figure 6: Aerial Photo of Discovery Ridge and the Wedgewoods Apartment Complex 66
Figure 7: Discovery Ridge Wildland Urban Interface: West of Wedgewoods Apartment Complex 67
Figure 8: Discovery Ridge Townhouse: West of Wedgewoods Apartment Complex 68
Figure 9: Wedgewoods Apartment Complex Discovery Ridge 69
Figure 10: Wedgewoods Apartment Complex Discovery Ridge 70
Figure 11: Single Detached Dwelling Discovery Ridge: West of Wedgewoods Apartment Complex 71
Figure 12: Alberta Sustainable Resource Development Management Area 72
Figure 13: City of Langford Hazard Assessment Map 79

List of Tables

Table 1: Case Study Rationale 15
Table 2: Elite Interviews 19
Table 3: Organizational Capacity Questions 22
Table 4: Development Application Process Questions 23
Table 5: Determining WUI Administrative Responsibility Questions 24
Table 6: Requirements for Successful Organizational Capacity 26
Table 7: WUI Group Participants & Stakeholders in Each Case Study 31
Table 8: Development Permit Process 34
Table 9: Determining Administrative Responsibility for WUI 39
Table 10: Criteria Definition and Measurement 52
Table 11: Projected Outcomes of the Criteria Evaluation Process 53
Table 12: Summary of Criteria Evaluation 56
Table 13: Elite Interview Information 73
Table 14: Extra Questions for Elite Interviews 74
Table 15: Development Permit Area Guideline Recommendations for New Developments: Part 1 77
Table 16: Development Permit Area Guideline Recommendations for New Developments: Part 2 78
Table 17: Summary of Circulation Replies for Discovery Ridge Land Use Amendment LOC2001-0041 80

1 Introduction

Whether near large urban areas or in remote rural locations, every year more and more people are retreating to peaceful surroundings and building their homes in the Wildland Urban Interface (WUI).[1] Living in these areas means living with fire (Partners in Protection, 2003b). In 1997, the Partners in Protection, an Alberta based coalition of professionals representing federal, provincial, and municipal agencies developed *FireSmart: Protecting Your Community from Wildfire.* FireSmart is an all-encompassing concept that was developed to reduce the threat from wildfire in the WUI. The FireSmart manual focuses on seven disciplines of the WUI and it is suggested that each area must be addressed to ensure success. These areas are fuel management, education, interagency cooperation, legislation, development, planning, and training.

The intent of this manual is to educate the public about WUI issues, increase public safety, decrease the potential for property losses, and reduce public and private expenditures for evacuations and fire suppression. Although FireSmart is presented as a voluntary policy instrument, the manual's recommendations go beyond public information and provide a continuum of approaches that affect many of the regulatory processes that are controlled by municipalities. FireSmart has been adopted as the industry standard in terms of reducing the risk from WUI fire; accordingly, communities across Canada are engaged in FireSmart projects.

1.1 Policy Problem

On April 17, 2003, Statesman Corporation filed a *Report to the Calgary Planning Commission* to develop *The Wedgewoods*, a 568-apartment unit complex on a heavily treed 7.8Ha parcel of land on the western boundary of the City of Calgary in the community of Discovery Ridge (Calgary Planning Commission, 2003, p.2) & (Appendix B: Figure 6). The City of

[1] For the purposes of this project, the Wildland Urban Interface (WUI) is any area where structures (residential, industrial, recreational, or agricultural) are located next to or among combustible wildland fuels. Such areas are prone to fire losses since fires that occur in wildland fuels can spread across the landscape and ignite flammable structures.

Calgary Parks Department suggested that a FireSmart guided *Wildfire Hazard Assessment* should complement on overall biological impact assessment of the area prior to development. The results from the assessment indicated that the Structure and Site Hazard was an *extreme* fire hazard and the Area Hazard was rated as *moderate to extreme* (IBI Group, 2003, p.17). Further, the consulting firm stated that, "the resulting ratings generally reflect the make-up of the adjacent forest stands on the study site[...]in several cases the structures on the study site comes as close as two metres to existing tree cover " (Appendix B: Figure 6-11). Even though the risk was identified, "restrictions placed on the areas beyond the construction boundary (established in the land use bylaw) restrict any modification to vegetation in these areas for reasons of fire hazard reduction of otherwise" (IBI Group, 2003, p.17). The results from this hazard assessment clearly indicate that the development was at risk from WUI fire, however; there was little opposition from City officials, the developer was restricted by the Land Use Bylaw from implementing a risk management plan, and there was no meaningful system of checks and balances to reduce the WUI fire risk. This study explores ***how the City of Calgary can address the challenges of implementing FireSmart principles?***

1.2 Study Outline

This study is organized into seven sections, beginning in section one with the introduction to the policy problem. Section two of this study explains why WUI is worth considering and explores the problem by reviewing some of the major considerations for implementing WUI principles. The arguments presented in section two are important to this study as they provide the context and challenges that all communities must address. Section three sets out the investigative framework used to systematically asses the case studies reviewed for this study. Section four provides a summary of findings that identifies specific institutional and procedural practises within the City of Calgary that require re-evaluation as to their efficacy. Section five defines the alternatives that are developed from the summary of best practices that are drawn from each case study. Section six is the most important section as it defines the criteria to evaluate each alternative, and provides the recommendations based on the results. The study concludes in section seven with a conclusion and final analysis.

2 Background

For thousands of years, human beings have lived in close association with the forest. Covering nearly half the Canadian landscape, the forest has been and continues to be essential to our environment, our diverse cultural composition, and our economy (National Forest Strategy Coalition, 2003, p.6). Fire is an important natural disturbance in most of Canada's forest and grassland ecosystems. However, the impact of wildfires can be either positive or negative depending on societal values and the subsequent spatial and temporal resource management objectives of the area. Traditionally, Canadian fire management agencies have focused on the prevention and suppression of wildfires in an attempt to protect life, property, and natural resources.

In 2003, interface fires in British Columbia caused the destruction of 334 homes and many businesses in the Interior, and more than 45,000 people were evacuated from their communities. The total cost of the firestorm in 2003 that hit the Interior of British Columbia was estimated at $700 million, the most expensive forest fire on record (Filmon, 2003, p.5). This includes property losses and the cost of fighting the fires. The Insurance Bureau of Canada called it the single largest insurance loss for a wildfire in Canada with insured property losses totalling at least $250 million (Environment Canada, 2003a).

As a result of the fires in 2003, a Provincial Review was undertaken by the Honourable Gary Filmon. To evaluate the overall response to the emergencies and to make recommendations for improvement, a Provincial Review Team was established to evaluate the overall response to the emergency and to make recommendations for improvement in time for the next fire season (Filmon Report, 2003, p.5). One of the recommendations of the Review Team was to adopt the FireSmart standard for community protection both for private and public property. In addition, it was recommended that this standard should be applied to all new subdivision developments (Filmon Report, 2003, p.29).

In Alberta, there have been less publicized WUI interface fire events, but no less significant in terms of impacts. Most recently, the Lost Creek fire in the Crowsnest Pass of 2003, consumed over 21,000 hectares (51,800 acres) of land and the fire threatened communities, industry and wildlife, and resulted in the evacuation of over 2,000 residents (Canadian Press,

2003). In 2001, an early and severe fire season resulted in unprecedented community losses in both the forested and agriculture areas of central Alberta. The number of structures lost throughout central Alberta in May 2001 totaled approximately 75 (plus) structures lost, of which 21 were homes (Alberta Sustainable Resource Development, 2001, p. 2).

2.1 Reducing the WUI Risk

In Alberta, the Ministry of Sustainable Resource Development (ASRD), Forest Protection Division has a mandate to protect the multiple values received from forests within the Forest Protection Area of the province by working cooperatively with municipalities, industry, and other stakeholders to prevent and suppress wildfires. As indicated by the map, the City of Calgary is situated on the Wildfire Management Area Boundary (Appendix C: Figure 12). One of the key strategies is to reduce the risk and potential damage caused by wildfires within the Forest Protection Area by actively incorporating FireSmart practices and principles within communities, in cooperation with community stakeholders.

Municipalities are responsible for dealing with fires within cities, towns and villages in the Forest Protection Area. These responsibilities flow from the Forest and Prairie Protection Act, which applies to all lands in Alberta except lands in a city, town or village located in the Forest Protection Area; and any portion of lands in a municipal district located outside the Forest Protection Area, such as the City of Calgary homes (Chisholm Fire Review Committee, 2001, p.18). In addition, the City of Calgary would also be responsible for assessing the WUI fire hazard and developing a comprehensive response to the associated risk.

The threat of life and property losses during wildland fire events is a significant issue for provincial and municipal fire authorities and municipal planning departments who must consider residential development within and adjacent to wildlands. Reducing the risk from wildfire in the WUI area is a complex issue involving a diverse but highly interconnected set of individuals and organizations. This includes for example, property owners and residents, municipal and wildland fire protection personnel, other emergency staff, resource managers, researchers, land-use planners, developers, and building contractors, elected officials and other leaders (Hirsch, 2000, p.4).

2.2 Why is Wildland Urban Interface a Problem Worth Considering in the City of Calgary

The dangers from interface fire are well established. Despite many determined efforts to resolve the problem, incidents continue to become more common and increase in terms of economic, societal and personal impacts. Despite the fact that we can identify WUI fire risk, policy has failed to proactively mitigate the hazard. Robert Mutch, a retired Fire Researcher for the United States Department of Agriculture: Forest Service notes, "The Okanagan Park Fire in Kelowna 2003 can be in some ways considered as an abrupt and brutal audit of our actions at a moment's notice," (Mutch, 2004, Slide No. 3/51).

Prevention and control of interface fires presents many unique challenges. These challenges demand that communities take collective responsibility for the problem and that we develop new attitudes towards fire (Partners in Protection, 2003, Introduction). Decision makers evaluating policies to reduce wildfire damage understand that their success will likely depend on the support of WUI homeowners, yet little is known about how homeowners in fire prone areas perceive wildland fire, much less what policies they are likely to prefer and why (Winter & Fried, 2000, p.34).

From a policy perspective, there is enormous emphasis on managing the suppression response, but virtually no emphasis on managing the land's inherent wildfire risk. Rarely do we manage the land in ways that are consistent with the dynamics of their fire regimes. By ignoring this fact, we are unintentionally managing the resource *for* catastrophic fire (Williams, 2004, p.5). Historically, government has been in the habit of managing everything but wildfire risk. We manage fire regimes for watershed values, endangered species habitat, visual quality, and homesites; but we are not managing these high-risk landscapes to mitigate wildfire risk. Author Patrick Lagadec states, "The ability to deal with a crisis situation is largely dependent on the structures that have been developed before chaos arrives," (Lagadec, 1993).

The City of Calgary has over 3500 hectares of city parkland. Within this area, there are a wide variety of habitats ranging from moist conifer forest, native grassland, aspen woodlands, all with an array of fire risk and ecological conditions. The community of Discovery Ridge is unique in the sense that most of the City is not situated within or near a large stand of forest. However, most of the major development projects for new subdivisions along the Western edge of the City are approaching WUI areas as they move into the foothills of the Rocky Mountains (Appendix A: Figure 5). To ensure that these communities are safe from WUI fire, it is essential that there is an effective assessment process in place to protect new development, and to reduce

the risk on existing natural areas and parks.

2.3 Factors to Consider

2.3.1 Home Ignitability

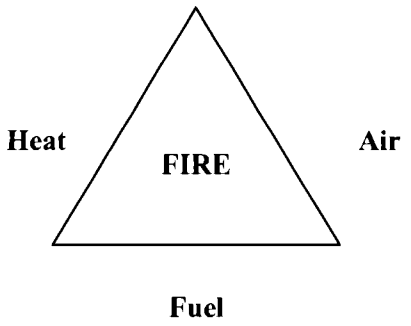
Fire spreads as a continually propagating process, not as a moving mass. Unlike a flash flood or an avalanche where a mass engulfs objects in its path, fire spreads because locations along the path meet the requirements for combustion (Cohen, 1999, p.190). This is an important point for people living in the WUI to consider. The flammables adjacent to a home can be managed with the home's materials and a design that is chosen to minimize potential firebrand ignitions.[2]

C.P. Butler, a senior physicist at the Stanford Research Institute, describes the WUI problem as, "The fire interface is any point where the fuel feeding a wildfire changes from natural wildland fuel to man-made urban fuel [...] for this to happen, wildland fire must be close enough for its flying fire brands or flames to contact the flammable parts of the structure" (Butler, 1974). As Jack Cohen, research scientist at the Fire Sciences Laboratory in the Forest Service's Rocky Mountain Research Station points out, Butler provides important references to the characteristics of this problem.

Fires burn and ignitions occur only if a sufficient supply of each factor is present. Cohen identifies homes as potential fuel and indicates that the distance between wildland fire and the home is an important factor for structure ignition. How close the fire is to the home relates to how much heat the structure will receive (Cohen 1999, p.189). These two factors, the homes and fire proximity, represent the fuel and heat sides of the fire triangle, respectively. The fire triangle, fuel heat and oxygen, represent the critical factors for combustion.

[2] Firebrands are pieces of burning wood that are carried in the air by convection ahead of the flame front, resulting in the spread of forest fire.

Figure 1: Fire Triangle



Data Source: Adapted from Alberta Environment Training Centre. (n.d.). Fire intelligence and fire behaviour: An introduction to fire behaviour. Retrieved October 12, 2004, from, http://www3.gov.ab.ca/srd/forests/resedu/etc/ifb.pdf

Cohen's work on the Structure Ignition Assessment Model (SIAM) assesses the potential ignitability of a structure related to the WUI fire context. Results show that losses can be effectively reduced by focusing mitigation efforts on the structure and its immediate surroundings. Thus, the responsibility for effectively reducing home ignitability resides with the property owner. However, municipalities should perform due diligence in identifying communities or areas of potential risk in order to assist homeowners in effectively reducing and maintaining low WUI risk.

2.3.2 WUI Risk Perception

An important aspect to consider in this evaluation is the element of risk. Fire managers must answer two questions:

1. How do WUI homeowners perceive wildfire risk?
2. Which risk reduction strategies will they support (politically, behaviourally, or financially)?

Psychometric research has found that risk perception and the acceptability of hazards such as the destruction of homes by wildfire are related to attributes of the hazard and the magnitude of the risk (Winter & Fried, 2000, p.34).[3] Slovic (1987), for example, proposed that people evaluate risk based on controllability, voluntariness, catastrophic potential, and degree of

[3] Psychometrics is the field of study (connected to psychology and statistics) of measuring "psychological" aspects of a person such as knowledge, skills, abilities, or personality

outcome uncertainty (Hiramatsu & Kugihara, 2002; Fischhoff, B., et al, 1981).[4]

Residents in the interface area may not be aware or fully appreciate the interface danger and the possible consequences. When individuals misperceive risks or rely on decision rules that fail to conform to the traditional utility maximization paradigm, their behaviour may differ from what policy experts expect. The literature is replete with evidence that individuals routinely express biased probability estimates when confronted with hazards (Slovic 1987; Kahneman & Tversky 1979).

A study conducted by Brian Blanchard examined the community perceptions of wildland fire risk and fire hazard reduction strategies at the wildland-urban interface in the Northeastern United States (Blanchard, 2003, p.288). The results of his survey showed that survey respondents did not have a high awareness of the risk from wildland fire. This finding is not uncommon. Stew Walkinshaw commented that, "If I were to go to the people of Canmore, and even though it has only been 14 or 15 months since the fires in Kelowna burnt over 250 homes down and if I were to tell people now, that they need to do something because of what happened in Kelowna, I don't think that it would register on the Richter scale" (Walkinshaw, 2005, Interview).

The survey respondents did demonstrate however, an understanding of how the surrounding landscape influences risk from wildland fire. Further, respondents who reported past personal experience with wildland fire have a significantly higher awareness of the risk from wildland fire than do respondents who reported no experience with wildland fire. Dr. Paul Woodard, a professor at the University of Alberta in the Department of Renewable Resources who specializes in fire management and fire ecology claims; that this attribute may exacerbate the problem of educating urban residents to the risks from WUI fire. He states,

> Residents in the WUI communities are usually convinced that they are in a fire prone area because they see lots of fire, they see smoke from their windows, and they see wildland fire crews in their communities during the summer months. Calgary is a different story; they do not see it (WUI) happen. In fact, 90 percent of the people are probably going to be subjected to a house or an urban fire situation, not a WUI fire, and so they feel that WUI does not pertain to them (Woodard, 2005, Interview).

Most people perceive WUI as a rurally focused problem. However, most cities have large natural areas and intricate park systems that have similar fuel types and potential for fire

[4] Controllability is a qualitative attribute of risk. Voluntary chosen risks (motorcycling, mountain biking) have a level of acceptance that is 1000 times as high as that of an involuntary chosen, or societal risk. Catastrophic potential is defined as dread risk," i.e., perceived lack of control, dread, fatal consequences and the inequitable distribution of risks and benefits

risk. The one advantage that a city has is that the vegetation is usually limited in size and continuity. However, these areas have excluded fire for long periods, which can lead to higher accumulations of fuel. This in turn, can lead to a higher chance of ignition because of the increased number of users, and a higher chance that the resulting fire will involve more than one structure due to the density of the adjacent risks such as homes, and other infrastructure.

Many of the residents in these areas often have made a choice to live there based on the aesthetic values that they attribute to their surroundings. Residents might not know how to reduce the risk of WUI fire without sacrificing the natural setting or visual attractiveness of the area. One of the negative side-effects of this preference for pristine forest conditions has led fire managers to develop polices that have led to many years of successful fire suppression that has unfortunately created decadent forests with increased continuity of fuel available for future fires.

Residents may also have a false sense of security about protection from interface fires or feel that it is the responsibility of their local fire department or provincial/territorial agency. Alan Westhaver, a Vegetation Fire Specialist for the Jasper National Park Service and founder of the FireSmart-Forestwise Community Protection and Forest Restoration project suggests that, "I guess my experience is that most people will accept risk up until the fire starts and then they expect superhuman feats out of fire departments and they get all upset when homes do burn and they end up pointing fingers" (Westhaver, 2005, Interview).

While the fury of a wildfire may be frightening, it is a reality that every community must deal with. Wildfire is a community problem that needs a community solution. It will take the efforts of political leaders, community planners, and members of the public and private sector to solve WUI issues and protect communities such as Discovery Ridge.

2.3.3 Suppression Capabilities

Since 1980, 139,000 people have been evacuated because of wildfires across Canada in 240 separate evacuations (Wilson, 2004). Rob Buchan, a Planner with the City of Langford suggests that land use and demographic trends are resulting in more homes being built in high fire risk areas. The growing incursion of development into urban-rural areas has been increasing the risk for potential WUI fires.

The problem is not with our suppression capabilities, in fact, in British Columbia the Ministry of Forests Protection Branch claims that 94 percent of all fires are contained before they reach a size of four hectares (Ministry of Forests: Protection, 2004). Jerry Williams, the retiring

Director for Fire and Aviation Services, United States Department of Agriculture claims that in the US, the suppression rate can be as high as 99 percent. However, within this one percent are the 'fire complexes or mega-fires", which can account for up to 85 percent of the total fire-suppression related expenditures and 95 percent of the total burned acres (Williams, 2004, p.3). Jerry Williams goes on to remark that,

> Every year, we in the Fire Services answer with better trained fire fighters, more modern equipment, and new technology. Every year, the scale and scope of catastrophic wildfires only grows. As wildland fire professionals it is time we ask if we are not inexorably drawn to a program policy that is attempting to match more extensive wildfires with a larger, yet, suppression force (Williams, 2004, p.4).

For example, in California, the combined operating budgets for wildfire preparedness between federal, tribal, state, and local jurisdictions, is over $3 billion per year. With a $3 billion per year wildfire preparedness budget, California fields the largest fire department in the United States; and arguably the largest fire department in the world (Williams, 2004, p.5). It has, by any measure, enormous fire fighting capacity, but every few years it is not near enough. In October 2004, in Southern California, over a 10-day period, fire fighters were hammered with over 900 starts. Remarkably, only 14 of them became large incidents, but those 14 wildfires burned close to three quarters of a million acres, destroyed 3,600 homes, and killed 24 people, including one fire fighter, and suppression costs exceeded $200 million. In addition, disruption to commerce was estimated at hundreds of millions, and damage to watersheds, roads, transmission lines, community infrastructure, and private property were billions more (Williams, 2004, p.5). Jerry Williams states that from his observation and experience, nearly all of the homes that burned in California October 2004 were homes that were meant to burn.

> They were vulnerable to wildfire. Homes that were lost were vulnerable because brush clearances were inadequate and construction materials were combustible. In many cases, homeowners wanted it that way! Perhaps tragically, the very attributes that people wanted were the very factors that put them at risk (Williams, 2004, p.6).

Unknowingly, the biomass or vegetation that screened neighbours and provided a sense of privacy or seclusion were the very factors that put people at risk. In contrast, communities that were saved or spared had enacted strict building codes and kept brush and fuel away from homes. Williams states, "We have to ask if we need to focus on a policy that is 'owned' by the Fire Services or should there be a policy that requires the attention of our political leaders and the communities that they represent?"(Williams, 2004, p.6)

2.4 FireSmart

In 1990, an Alberta based coalition of professionals representing federal, provincial, and municipal agencies developed *FireSmart: Protecting You Community from Wildfire.* The intent of this manual was to increase public safety, decrease the potential for property losses, and reduce public and private expenditures for evacuations and fire suppression. The material is founded on scientific research but is written in a non-technical style aimed at a wide range of potential users, including the general public.

Kelvin Hirsch is a Fire Researcher for the Canadian Forest Service Natural Resources Canada at the Northern Forestry Centre and was one of the contributing partners involved in the development of FireSmart. He states,

> FireSmart was designed as a philosophy, and it is very much a grass roots approach. FireSmart is also about empowering the public and providing an opportunity to take responsibility and action through cooperative partnerships (Hirsch, 2005, Interview).

FireSmart focuses on how individuals and communities can work together to reduce the risk of loss from interface fires in Canada. It provides practical tools and information for use by interface residents, municipal officials, land-use planners, structural and wildland fire fighters, and industries that operate in the WUI. Primary topics include a description of interface issues, evaluation of interface hazards, mitigation strategies and techniques, emergency response for agencies and individuals, training for interface fire fighters, community education programs, and regional planning solutions.

Formal development of the FireSmart manual did not begin, however, until 1997 when essential seed money and significant in-kind support was provided by three main agencies: Alberta Environment-Land and Forest Service (Alberta Sustainable Resource Development), Canadian Heritage-Parks Canada, and Natural Resources Canada-Canadian Forest Service. This assistance served as the catalyst to move the project beyond the conceptualization stage.

Through FireSmart, Partners in Protection encourage community-based initiatives to reduce the risk of fire losses and enhance the safety in the Wildland Urban Interface. They recommend a three-phase program for use by interface fire community members in resolving their fire problems. The FireSmart manual is designed to meet the following areas: The first stage is to *Assess the Situation* (Issues, Wildfire Hazard Assessment System), second stage is to *Resolve Existing Problems* (Solutions and Mitigation), and third *Avoid Future Problems* (Emergency Measures, Wildland Urban Interface Training, Communications and Public

Education, Land Use Planning, Communities Taking Action) (Partners in Protection, 2003a, p.2).

Provinces across Canada from the Yukon to Nova Scotia, have adopted the Partners in Protection, FireSmart program as the national standard in WUI hazard assessment. The production of *FireSmart: Protecting Your Community from Wildfire* has shown that it is possible to bring the ideas and resources of numerous government organizations, associations and private corporations together to address a common, citizen centered issue.

2.4.1 Next Steps

The background section has presented a few key facts. Firstly, WUI fire is a serious threat to communities, and municipalities need to develop a comprehensive response to address the issue. The research suggests that there needs to be a shift in the way we protect communities from reactive fire suppression to proactive planning and development constraints, and employing the principles of FireSmart is an effective tool to manage WUI fire around your home. However, homeowners' perception of risk may influence their response or actions to mitigate risk. Interface fire is escalating as communities expand to accommodate population growth.

The next section applies this information by structuring the methodology of analysis. By looking at specific case studies, this study reviews how different communities have dealt with some of the previously identified concerns, and aid in the development of the questions used in the elite interview process.

3 Methodology

The methodology used in this study has two major components: multi-case analysis, and elite interviews. The multi-case analysis examines three communities that have used different approaches to implement FireSmart principles and protect their communities from WUI fire risk. The case studies are the Town of Canmore, Alberta, the Town of Jasper, Alberta, and the City of Langford, Vancouver Island, British Columbia. These cases are compared to the City of Calgary's participation in the development of the community of Discovery Ridge, specifically a high density apartment complex (The Wedgewoods) within the area that has identified as being at risk for WUI fire (Appendix B: Figure 6).

The goal of this analysis is to identify the various characteristics that have contributed to these communities implementing FireSmart principles and programs. By contrasting similar variables across cases, the information provides a standardized assessment of the efficacy of the tools that municipalities use, or the methods that they employ to establish, and ultimately implement programs. The following section provides a rationale and brief outline of the various characteristics of each case study. Included, is a description of the elite interview process and the various hypotheses that guide the investigative framework. A detail of the question development and selection method is introduced in a model that is termed the 'stop light' approach. Finally, these 'best guesses' provide a reference point to commence the investigation, and details of this process comprise the latter half of this section.

3.1 Rationale for Case Selection

Implementing FireSmart principles in an urban centre offers significant challenges. Each case study offers insight into the various tools and techniques that any municipality, regardless of its size, location, or urban/rural mix can adopt. Although the case studies are dissimilar in size to

the City of Calgary, the institutional and procedural methods are similar.[5] The following chart outlines some of the variables considered in choosing each case. A brief review of each case is presented in this section, however; the details of each case are revealed in the summary of findings section in order to provide examples for the analysis. The next section outlines the investigative framework behind the elite interviewing process, and identifies the interviewees. It also outlines how the hypotheses have contributed to designing the questions used in the analysis.

[5] The size difference among the cases has been considered. It was suggested that because the three FireSmart cases are smaller in terms of population and area, that this would imply that the study is comparing 'apples to oranges'. However, what is important is that the each FireSmart case uses the same institutional and procedural methods for government (e.g. Mayor, Council, Planning Department, and Fire Department). This would suggest that the multi-case comparison is small 'apples' to a large 'apple'.

Table 1: Case Study Rationale

	Canmore	**Jasper**	**Langford**	**Calgary**
WUI Projects	• Bow Corridor WUI Plan (2000) • Canmore WUI Plan (2002)	• FireSmart-Firewise Community Protection and Forest Restoration Project (1999)	• Interface Fire Hazard Planning Model (2002)	• WUI Fire Risk Assessment Pilot Project (2004)
Project Lead	Stew Walkinshaw is the Wildland Urban Interface Program Manager for Alberta, and Manager of the Southern Rockies Wildfire Management Area	Alan Westhaver is a Fire and Vegetation Specialist for Jasper National Parks	Rob Buchan is a Municipal Planner for the City of Langford, and proponent for WUI safety	Partnership between Calgary Parks Department and Calgary Fire Department
Considerations	• Comparable risk to the City of Kelowna, BC • Major resort and community development in the WUI • Recreational community for many residents of Calgary	• Extensive public consultation and participation • High profile success story • Capped growth, but addressing established communities	• Wide variety of municipal tools • Recipient of an Award of Excellence from the Canadian Institute of Planners for their WUI approach • Expanding development into WUI	• Extensive development on western perimeter of the City is encroaching on WUI area • Communities in WUI such as Discovery Ridge, are comprised of high value properties • Many established communities within the City are facing WUI risk
Community qualities	• 14,000 residents • Kananaskis Country, South West Alberta • Urban/Rural WUI Mix	• 5,000 residents • National Park, West Central Alberta • Urban/Rural WUI Mix	• 20,000 residents • Vancouver Island • Urban/Rural WUI Mix	• 900, 000 (+) residents • South Central Alberta • Large urban core expanding into rural municipalities

3.1.1 Canmore

Over 14,000 permanent residents live in the Town of Canmore, which is located 45 minutes west of Calgary in Kananaskis Country on the edge of Banff National Park. In 2000, the Wildfire Sub-Committee of the Bow Corridor Ecosystem Advisory Group consisting of representatives from Alberta Sustainable Resource Development, Community Development, Town of Canmore, and Parks Canada in consultation with the Municipal District of Bighorn, developed the *Bow Corridor WUI Plan.* The goal of the plan was to provide a document that would guide government officials, land developers, and the public in creating FireSmart developments within the Bow Corridor, while retaining and/or enhancing the integrity of the forested environment and wildlife habitat. This plan included a comprehensive WUI hazard assessment of the area that delegated levels of WUI risk to specific areas of the community. This has allowed ASRD officials and town planners to cooperatively develop management plans to reduce WUI fire risk. Since then, the community has continued to work with developers and residents to address the WUI problem through various risk mitigation projects, and regulatory process procedures. This case is a good example of how a high risk community can implement policies to adequately assess WUI risk, and ensure that new development conforms to WUI principles. Canmore is also a good example of how a community is challenged by the lack of public perception or acknowledgement of risk.

3.1.2 Jasper

Jasper is the largest and most northerly Canadian Rocky Mountain National Park, part of a spectacular World Heritage Site. Located 3.5 hours west of Edmonton, and four hours northwest of Calgary, Jasper has just over 5,000 residents, and 2.9 million people visit annually (Westhaver, 2004). Past fire management policies (1930-1980) have led to over half a century of 'successful' fire control in the Montane of Jasper National Park. Ironically, the exclusion of fire only exacerbated the problem by significantly changing natural disturbance regimes, increasing the massive accumulations of living and dead forest fuels, and forest encroachment has led to lost habitats and species (Westhaver, 2004).

Over the past 30 years, evidence has accumulated that total fire exclusion is neither economically feasible nor ecologically desirable This has led to a shift in fire management strategies from the simple suppression paradigm to an array of paradigms, ranging from fire detection, prevention and suppression in areas of extreme risk to life and property, such as urban-rural interfaces, to a focus on economic efficiency of fire protection for timber resources, to fire

accommodation or acceptance in maintenance of natural ecosystems (Thompson, et al. 1998, p.1). Recently, this had led Parks to restore fire to park ecosystems through planned or random ignition prescribed fire, in turn, this has facilitated the implementation of a science-based approach to community wildfire protection founded in knowledge of ecosystems, wildlife and fire behaviour known as the FireSmart-Forestwise program. As the results show, Jasper is a good case for the City of Calgary to study, as an example of how to generate public support for implementation of FireSmart principles.

3.1.3 Langford

The City of Langford (formerly District) is located on the southern end of Vancouver Island in the Capital Regional District, British Columbia, and has over 20,000 residents. It has a land base of approximately 4,146 hectares, which is characterized by a mixture of developed, forested, and urban rural interface areas. In 2002, the City of Langford developed a model process for municipalities to address WUI. This case examines a comprehensive regulatory approach to control for WUI fire risk, and reveals that in some cases, a strong regulatory framework is necessary to implement FireSmart principles. This community has done extensive analysis on the tools available to a municipality, and can offer the City of Calgary some valuable options to address WUI.

3.1.4 Calgary

The City of Calgary has over 3500 hectares of city parkland, and within this area, there are a wide variety of habitats ranging from moist conifer forest, native grassland, aspen woodlands, all with an array of fire risk and ecological conditions. In 2004, the City of Calgary initiated the WUI Fire Risk Assessment Pilot Project (Pilot Project) to assess the level of WUI fire risk in Calgary's parks and communities. A partnership was created that involved the City of Calgary Parks Department Natural Areas, and the Calgary Fire Department. The goal of the *Pilot Project* was to first identify areas of WUI risk and then to adapt the principles of the FireSmart manual to meet the needs of both Natural Areas and the Calgary Fire Department. Unfortunately, for various reasons the project remains incomplete and the City of Calgary has failed to develop a process that would ensure that no more communities are built without adequate consideration for WUI fire. Without a WUI Hazard Assessment, the level and areas at risk remain unspecified. Across Alberta and British Columbia, FireSmart programs and principles have been

implemented. The City of Calgary has the opportunity to learn from other communities' efforts to implement FireSmart before more communities in Calgary are at risk from WUI fire.

3.2 Investigative Framework

There are various hypothesises to be made as to how the City of Calgary can address the challenges of implementing FireSmart principles. Sceptics may ask the question, is Calgary even at risk for a WUI fire event. It is important to realize that there are many similarities between the City of Calgary and the selected cases, and as a result, there are invaluable lessons to be learned for an adaptive approach to implementing FireSmart principles. Based on experiential learning, the three main hypothesises that have directed the research of this study are:

1. If there is greater organizational capacity, then there will be a greater chance of implementing FireSmart principles
2. If there is a more rigorous governing of the development application process, then there will be a greater chance of implementing FireSmart principles
3. If there is more authority delegated to departments with an interest in protecting communities from WUI fire, then there will be a greater the chance of implementing FireSmart principles

3.2.1 Elite Interviews

In addition to multi-case analysis, elite interviews were used to collect primary data for this study. The substantive value of interviewing is that it can complement secondary sources where relevant published information is incomplete. Further, it can be used to elucidate and complement studies of elite decision-making by providing additional information about motives that help explain actions and constraints in policy-making and implementation. The next step involved constructing an investigative framework that consisted of exploratory questions relating to the hypotheses.

Initially a list of potential participants in the interview process were identified as either experts in WUI, managers of lead departments, developers of WUI management programs in Alberta, or members of the 2004 City of Calgary hazard assessment Pilot Project (Appendix D: Table 13). Various constraints, most importantly, the time of year (December/January) affected the number of official elite interviews available for this project. The goal of this study was to interview a cross section of the identified experts, most importantly, those that had first hand

knowledge of the various case studies that were compared. This was achieved by interviewing Stew Walkinshaw (Canmore), Alan Westhaver (Jasper), Rob Buchan (Langford), and Jennifer Symcox (Calgary). As each interview was conducted and the information was synthesized, an iterative process developed, in which initial interviews guided subsequent meetings, this has been described by Robson, (1993) as 'snowball sampling'.[6] The actual list of interviews included in the study is detailed in the following table:

Table 2: Elite Interviews

Name	Title	Organization
Rob Buchan	Municipal Planner	City of Langford
Ron Chamney	Senior Fire Fighter Environmental Impact	Calgary Fire Department
Kelvin Hirsch	Research Management Advisor	Canadian Forest Service NRCAN
Steven de Keijzer	Planner	Town of Canmore
Greg Mathieson	Safety Codes	Calgary Fire Department
Gary Reid	Community Safety Officer	Calgary Fire Department
Jennifer Symcox	Natural Areas Project Coordinator	Resource Management Parks City of Calgary
Stew Walkinshaw	Fire Manager Southern Rockies Wildfire Management Area	Alberta Sustainable Resource Development
Alan Westhaver	Jasper National Park Vegetation Fire Specialist and Project Manager	Parks Canada
Paul Woodard	Professor Forest Fire Management and Ecological Effects	Department of Renewable Resources University of Alberta

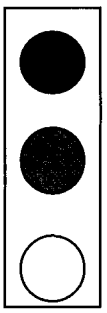
3.2.2 Stop Light Model

Question development began very randomly as different questions were created in an effort to collect as much information as possible through the elite interview process. There was no major focus at this stage other than general 'brainstorming'. The questions were ordered into four main groups: Calgary Parks Department, Calgary Fire Department, Planning, and Alberta Sustainable Resource Development. These questions were further categorized and colour coded

[6] The City of Langford originally was not identified as a FireSmart case. However, both Alan Westhaver, and Kelvin Hirsch suggested that I should review the work of Rob Buchan and the City of Langford. This is what I refer to as 'snowball sampling'. Many of the core interviews also led to information or suggestions for subsequent interviews for example, Stew Walkinshaw (Canmore) guided me to Steven de Keijzer (Canmore Planner) for more specific information.

into four subsections. Borrowing the simple principle of a 'stop light' the questions were ordered as either, Red, Yellow, Green.[7] The following figure further explains this concept.

Figure 1: Question Categories



Red - Ask question this question at the end as they might guard their answer

Yellow - This question may require more time to get the right amount of detail

Green - Must ask questions[8]

Any question that did not require an elite interview, and could be found through other sources of information was categorized as blue (Appendix D: Table 14). Once these questions were ordered by category (e.g. Calgary Parks, Calgary Fire) and categorized by colour (e.g. green, yellow, red), the hypotheses or best guesses determined the three main categories for investigating characteristics or indicators that contribute to implementing FireSmart principles, they are: Organizational Capacity, Development Application Process, and WUI Responsibility. The selected questions are outlined in the next subsections 4.2.3 to 4.2.5. Each category is comprised of an array of 'green and yellow' questions from the master list, and they attempt to reveal the elements of each case study's approach to WUI. The respondent's answers detail the various similarities or dissimilarities among the selected case studies, and the City of Calgary. Since each case study applies the same institutional and procedural approach, questions that were defined as Calgary Fire could be used in an interview with a member of the Canmore Fire Department. This assumption was applied to each category.

The 'Stop Light Model' was also used to gather information to many of the remaining questions that were developed in the early 'brainstorming' session. As each interview was

[7] The 'stop light model' is an original concept in determining the order of which questions to ask each interviewee, however; the idea came from watching a program that was teaching obese children to eat healthy foods. The Traffic Light Diet splits foods into three groups based on a combination of how high in fat and calories they are, and their relative nutrition value. To follow the diet you simply eat foods according to the traffic light system: Green foods, eat as much as you like, Amber foods, eat moderate amounts, and Red foods eat very occasionally or in small amounts.

[8] The true colour has been removed for printing purposes.

constrained by time, this method allowed for a priority approach. It was essential that each of the core questions were asked, and if time allowed, extra questions could be taken from the green, yellow or red section. Choosing which section questions would be asked from required a personal assessment of the interviewee's attention, interest and availability. If it was perceived that the interviewee was indicating through their body language or quick responses to questions that they were in a rush or intimating that they wanted to finish up the interview, subsequent questions were taken from the 'green' section. If the interview was relaxed and appeared to not be constrained by time, a 'yellow' question would be chosen. If the interviewee was open and participating in casual uninhibited conversation, than a 'red' question would be asked.

Each interview was recorded and transcribed to aid in the retention of important information. Due to the many different localities of the communities, some of the interviews were conducted over the phone, while most were in person. Generally, most of the individuals interviewed were very open with their comments and very willing to participate and share their experiences.

3.2.3 Organizational Capacity

For groups to work together their needs, motives, and expectations should be identified, compatible, and managed in order to achieve the desired outcomes and goals of a project. This would entail some level of organizational capacity. Organizational capacity should measure a group's ability to adapt to its external environment and respond to the requests from its stakeholders. It should also be measured by some ability to cooperate and maintain inter-organizational relationships.

The City of Calgary's WUI Pilot Project was a cooperative effort between two departments with distinct mandates (Calgary Parks & Calgary Fire Department). Initially, the *Pilot Project* started with good momentum, but was marred by the fact that it was a low-level priority for both departments. Due to this lack of high level attention and priority, the *Pilot Project* failed to include a broad spectrum of input from the various stakeholders involved. The results of this analysis should show that the successful case studies have engaged in broader support, work more cooperatively, and have a legitimate organization that is focused on WUI in their municipality. Table 3 outlines the questions that were asked about organizational capacity.

Table 3: Organizational Capacity Questions

Questions				
Have you completed a Community Level WUI Hazard Assessment	Do you have a WUI committee in your municipality	How many stakeholders comprise your WUI committee	How would you characterize the level of cooperation of the WUI committee	How would you describe the approach for initiating WUI hazard assessment

3.2.4 Development Application Process

The City of Calgary's Land Use Planning Policy's goal is to collaboratively develop, recommend, promote and implement strategic and effective land use and transportation plans and policies to sustain and enhance the quality of life in Calgary. The Land Use Bylaw 2P80 is the heart of the land use redesignation and development permit approval processes. It controls the use of all land in Calgary, and is adopted by Council and can only be changed by Council. The Land Use Bylaw sets out procedures to process and decide on a change of land use, development permit appeals, lists permitted and discretionary uses and development rules, and divides the city into a series of land use districts (City of Calgary, 2004a).

The current Land Use Bylaw 2P80 has provided the regulatory framework for all land use and development in Calgary for the last 24 years. During this time, it has been amended frequently in an effort to address changing trends in development, to fix technical problems as they arise, and to accommodate new Council policies. However, Calgary has grown significantly in this time and the Bylaw has not been able to keep up with the amount and pace of change taking place. As a result, the Land Use Bylaw is no longer able to guide development and land use in a comprehensive and efficient manner, nor is it well positioned to accommodate future needs (City of Calgary, 2004b). More specifically, the Land Use Bylaw does not protect for natural hazards such as wildfire, in comparison, there are comprehensive requirements for development in and around floodways and floodplains that are based on 1/100 year predictions.

There are many checks and balances in the development process, and by revising these control measures, the City of Calgary could develop an all-encompassing approach to hazard management. The results of this analysis should show that the Land Use Bylaw is an important tool that successful municipalities have used to control for WUI hazard. Table 4 outlines the questions that were asked about the development application process.

Table 4: Development Application Process Questions

Questions		
Have you changed the Development Permit process to include a review of WUI hazards	Is a WUI hazard assessment a requirement for a new development	If you identify an area as high risk would you restrict development

3.2.5 WUI Administrative Responsibility

There are two aspects of WUI responsibility to consider here. First is the declaration of who is responsible for signing off and approving the WUI Hazard Assessment. This could be the responsibility of one department or a coalition of departments that has specific requirements or conditions that need to be met prior to approval. In the City of Calgary, the Parks Department was responsible for the final approval of the WUI Hazard Assessment. The Calgary Fire Department added their input in terms of addressing some of the structural concerns of the building in relation to the *Alberta Building and Fire Code*. Table 5 lists the questions asked about administrative responsibility.

On paper, these two departments seem to be the appropriate authority for success, however; because of the mandate priorities of Parks, and the limited role that the Fire Department plays in approvals, they have not been able to work together to adequately assess the WUI hazard potential in Calgary. Successful case studies should show that those departments that are responsible for approving WUI Hazard Assessment require defined control measures to ensure community safety.

The second aspect of responsibility is defined as who is responsible for the long-term maintenance of any fuel reduction program that is a requirement of decreasing the WUI fire risk. Successful fuel management prescriptions or programs require that there is a long-term commitment as vegetation invariably will grow back and the level of risk will always have to be re-assessed. This commitment requires both time and money, both of which can be valuable in a municipality that is trying to meet diverse needs and programs. The City of Calgary has raised concerns regarding these issues, specifically; which department would be ultimately responsible in terms of providing the budget and manpower, what role should the public play, and would there be issues because of the different priorities of Parks and the Fire Department.

The results of this analysis should show that this is not a unique problem to the City of Calgary, and that these issues are legitimate concerns of any municipality. The information

should provide insight into the different approaches and concerns that the City of Calgary should address in their assessment of engaging in a fuel reduction program.

Table 5: Determining WUI Administrative Responsibility Questions

Questions		
Who is the final approving authority of new developments	Who is responsible for approving WUI hazard assessment	Who is responsible for the maintenance of fuel reduction

In summary, this study is primarily concerned with providing the City of Calgary with insight into the various approaches and best practices that should be considered when implementing FireSmart principles. Accordingly, the case study analysis in the following section reviews in detail the similarities and dissimilarities among community approaches.

4 Case Study Analysis

This section summarizes the findings of the multi-case analysis and the elite interview process. Each section begins with a matrix that contrasts the case studies by comparing their responses to the questions outlined in the *Investigative Framework* section. This is followed by a written summary of findings from general questions and primary research that was conducted to examine and compare the details of each case. To aid in this comparison, the data is organized into two groups: FireSmart case studies (Canmore, Jasper, Langford) and the City of Calgary. The cases are grouped together as FireSmart cases, because each community has adopted particular methods, ranging from voluntary to regulatory, that are outlined in the FireSmart manual as way to reduce WUI fire risk. Each section concludes with a discussion of findings and leads to preliminary next steps that are presented in the *Summary of Best Practices Drawn from the Case Studies* Sec.5.4.

4.1 Organizational Capacity

In this section, the questions to assess organizational capacity focus on the ability of a community to address WUI fire through the application of specific institutional and procedural methods. In terms of institutional methods, each case was assessed on its capacity to establish a comprehensive WUI review committee comprised of community stakeholders that were cooperative and productive. Procedural questions focused on asking if a Community Level WUI Hazard Assessment was completed, and it was determined for each case, where the initiative to assess WUI fire risk was initiated. The following table summarizes these findings:

Table 6: Requirements for Successful Organizational Capacity

	Have you completed a Community Level WUI Hazard Assessment	Do you have a WUI committee in your municipality	How many stakeholders comprise your WUI committee	How would you characterize the level of cooperation of the WUI committee	How would you describe the approach for initiating WUI hazard assessment
Calgary	No	Disbanded	1 to 5	Uncooperative	Bottom-up
Canmore	Yes	Yes	6 to 10	Cooperative	Top-down
Jasper	Yes	Yes	Over 20	Cooperative	Top-down
Langford	Yes	Yes	6 to 10	Cooperative	Top-down

4.1.1 FireSmart Cases

In 2002, Stew Walkinshaw, the Wildland Urban Interface Program Manager for Alberta, and Manager of the Southern Rockies Wildfire Management Area, completed a Wildland Urban Interface Plan for the Town of Canmore. The Plan was a condensed version of the Bow Corridor WUI Plan, and it was completed at the request of Fire Chief Brent Pederson, of the Town of Canmore, Emergency Services Department. As Steven de Keijzer, a Planner with the Town of Canmore explains,

> Chief Brent Pederson was the real reason that the issue of WUI was brought to the attention of the Town and why these kinds of issues are in the policy documents. He has been aware of this stuff for as long as he has been Fire Chief, which is about seven or eight years, and that is one of the reasons why Canmore has had some of these policies in place, even before FireSmart came out (De Keijzer, 2005, Interview).

Stew Walkinshaw suggests that, "towns should proceed by hiring a WUI consultant that has the capacity to conduct hazard assessment, and then include partners who have the capacity to provide manpower and support by sitting on WUI task forces or committees to ensure technical accuracy" (Walkinshaw, 2005, Interview).

Begun in 1999, and embraced as a Foothills Model Forest project in 2002, the FireSmart–ForestWise Communities project in Jasper has enjoyed strong public buy-in from the outset. Its dual goal: to restore ecological conditions for wildlife and reduce wildfire threats to residential and commercial developments within the park, commenced with lots of public information and a series of small-scale demonstration sites (Foothills Model Forest, 2004). The FireSmart-

Forestwise project is considered by most in the industry as the 'ideal' type for FireSmart success. It has been able to combine research, restoration, education and stewardship to reduce the risk of wildfire and to restore local forests.

Jasper has had considerable success due in part to its ability to engage the public through comprehensive partnerships that have resulted in the development of the Jasper Interface Steering Team (JIST). (Refer to Section 5.1.4: Table 7). Worth noting, is that the JIST participants include not only stakeholders, but also decision makers, opinion makers, interest groups and industry. The Steering Committee facilitates formal communication and spokesperson roles where members become advocates and provide important links to the community at large. Alan Westhaver states:

> We have citizens at large, the major environmental group, in-town and out of town groups of hotel owners, 22 different groups and they are all supportive and even the ones that were potentially not supportive, we went after them and focused on them. We went out of our way to take them into the field and make presentations to them so that they could look at things and really solicit that they be partners and they be at the table. This approach gives them a chance to level their concerns and it gives us a chance to answer their concerns. It is better than lobbing grenades over the wall (Westhaver, 2005, Interview).

Rob Buchan, a Municipal Planner and Deputy Approving Officer for the City of Langford recalls, "the Fire Chief advised the City that the biggest risk to hazard would be from interface fire hazard" (Buchan, 2005, Interview). Council, acting on the advice of the City's Fire Chief, requested staff to prepare an *Interface Fire Hazard Plan.* The project began with a literature search for the range of issues and tools available to local government to address the interface fire hazard. A committee was established with a Council member acting as chair. The committee involved residents living in high risk interface fire hazard areas and developers in the planning process, as well as municipal staff from engineering, building, fire, and planning departments (Refer to Section 5.1.4: Table 7). Drafts of the document were referred for comment to the Provincial Wildfire Committee, Ministry of Forests, Office of the Fire Commissioner, Home Builders Association, Provincial Emergency Program, and the Insurance Board of BC (Buchan, 2004, p.2). Once a literature review had been completed and the interface fire hazard area had been mapped, an open house was held for residents from all the identified high and extreme interface fire hazard areas to review the material and discuss the issues. This meeting confirmed that the interface fire hazard was of significant concern to residents of those high-risk areas. Rob Buchan asserts that one of the reasons for their success in the community has been:

> The staff has established a great deal of trust and respect with the politicians. They trust in what we say and that helps immensely. The development community here, relatively speaking, has a great amount of trust as well, because we find ways to make it work for them as well, and that is a sincere attitude from us (Buchan, 2005, Interview).

4.1.2 Calgary

The case study review indicates that there are essential organizational steps to assess WUI fire risk. In the case of Calgary, there are significant gaps in their capacity to structure a comprehensive approach to implement FireSmart principles. Firstly, Calgary has not completed a Community Level WUI Hazard Assessment. However, in the case of Discovery Ridge, Parks suggested that further analysis was needed prior to their support and consent of the project. Of interest to this project was the requirement that a Wildfire Hazard Assessment be completed for the area and structure. Once the fire risk had been assessed and approved by the Fire Department and Parks, a management strategy would subsequently be developed with input from Parks staff and the Fire Department that identified solutions and mitigative approaches to reduce the hazard posed by interface fire.

A Wildfire Hazard Assessment was completed by IBI Group Consulting using the FireSmart manual. There are two major components of the FireSmart assessment; *Structure and Site Hazard Assessment Form,* and the *Area Hazard Assessment Form,* which assesses factors that influence potential fire behaviour. By adding the cumulative point totals you can determine what the level of risk is for the overall *building* and *site*, as well as the overall *area* hazard level. A table is provided by FireSmart to establish if the hazard level is low, moderate, high, or extreme (FireSmart, 1999, p.2-4, & p. 2-18). The Structural and Site Hazard Assessment produced a rating of between 41 and 50, which is considered an *extreme* hazard, and the Area Hazard Assessment produced a rating of between 15 and 30, which is considered a *Moderate to High* Hazard (IBI, 2003, p. 17).[9]

Another component of the FireSmart assessment is the Fire Ignition and Prevention Checklist and a Fire Suppression Checklist. The study site scored favourably with only one

[9] However, if you refer to the pictures provided in the FireSmart manual to assess *Ladder Fuel* composition, it could be suggested that the evaluation by IBI is incorrect. Based on a site visit of the *entire* interface area that included a tour with a Forest Officer from Alberta Sustainable Resource Development, a member of the Calgary Fire Department, a former Parks employee and a Forestry consultant that is an expert in WUI assessment, it was apparent that the *Ladder Fuels* factor was *Scattered* to *Abundant*, thus resulting in *Moderate to High* rating of the Area Hazard Assessment Form to be changed to *Moderate to Extreme.*

instance of concern, that being *the potential for human caused fires, which was related to the close proximity of the site to high population densities.* The resulting ratings generally reflect the make-up of the adjacent forest stands on the study site. IBI claims that, "The ratings calculated within the first ten metres of the building were high because the FireSmart Manual considers the objective of this zone to be an environment that will not support fire of any kind")IBI, 2003, p.17). *In several cases the structures on the study site come as close as two metres to existing tree cover.*

Another issue to consider is that there seems to be no lead department in Calgary that is organizing the WUI review. Ron Chamney, a fire fighter with the City of Calgary and one of the Directors for Partners in Protection eluded that the City of Calgary's Fire Chief, Wayne Morris tasked a committee to explore the issue of WUI as it relates to their own Department. This entailed the review of training requirements, personal protective gear upgrades, WUI equipment inventory, and developing a budget proposal for a formalized WUI position and associated program costs.

On the City of Calgary Parks side, Jennifer Symcox, Natural Areas Project Coordinator and member of the Partners in Protection Conference/Workshop/Education Committee, had a raised awareness in the area of WUI, and because of their participation in the Discovery Ridge project Natural Areas wanted to ensure that they were taking the necessary precautions. However the project started, the point here, is that these are the only two groups involved, and they seem to be as far apart as possible. Jennifer Symcox expressed her concern for the project in claiming that:

> Lately, I am worried that CFD is doing their own FireSmart thing [...] both groups need to come to the table with an open mind and try to work out something that will achieve the most bang for the our buck. We also need a manger from each side coming together and announcing that this is going to happen. When it comes from a high level, people are allocated, money is allocated and it gets done. However, to move forward, a common approach has to be developed and agreed upon, because I am concerned that there is not enough dialogue between the two groups (Symcox, 2005, Interview).

4.1.3 Summary of Findings

Results of the case study comparison of organizational capacity concede that there is a common link among FireSmart cases. The most important step in each case was that all the FireSmart cases have conducted a Community Level WUI Hazard Assessment. In addition, each FireSmart case shows that they have been able to increase their capacity by organizing a

comprehensive WUI stakeholder committee that is based on trust and communication, and was initiated by an identified manger through a top-down approach. The next section discusses the necessary next steps for the City of Calgary to address WUI fire risk.

4.1.4 First Steps for Success

Generally, people living in WUI area have limited knowledge of wildland fire, and may not fully appreciate its potential intensity, the limits of fire suppression, their responsibilities and the role and responsibilities of government agencies. Wildland urban interface issues affect many departments within the City of Calgary such as Parks, Fire Department, Land Use and Planning, and City Council. External to the City there are various other actors to consider such as utilities, developers, homeowners and potential buyers. To manage WUI issues effectively, information sharing among departments and with those most directly affected is critical.

Each case study has shown that the key initial step towards a comprehensive WUI program is to conduct a Community Level WUI Hazard Assessment. This is essential as it provides important baseline information that is useful in many different ways. Firstly, it establishes the level of risk, and in which areas of the community. This will allow departments to develop a plan of attack, and prioritize resources to the appropriate areas. Secondly, by identifying the areas at risk, you can strategically target the specific communities with education and public consultation.

The next step is to establish a broad group of stakeholders that are representative of various interests in the identified communities at risk. This will enhance the ability of those tasked with implementation to determine the degree of support and commitment from all parties. It is also an important process to define similar goals and interests. As Kelvin Hirsch states:

> A systems based approach is key. If everybody is doing their own tunnel vision approach then it will only create conflicts. Whereas, if you say, here are your goals and here are our goals, and you do the Venn diagram thing, you can realize common goals (Hirsch, 2005, Interview).

The following table details the members of each WUI Committee in each of the four cases. It shows that the FireSmart cases have invited a broad range of interests to the table including opposing interests. The information reveals that Calgary's approach to partnerships should be expanded (Refer to Section 5.1.4: Table 7).

Table 7: WUI Group Participants & Stakeholders in Each Case Study

WUI Group Participants & Stakeholders	
Calgary	• City of Calgary Parks Natural Areas & Calgary Fire Department
Canmore	• Town of Canmore Emergency Services, Municipal District of Bighorn No.8, Alberta Sustainable Resource Development: Forest Protection, Division, Fish and Wildlife Division, Public Lands Division, Alberta Community Development Public Parks and Protected Areas, Parks Canada Banff National Park Warden Service
Jasper	• Jasper Tourism and Commerce, Lake Edith Fire Prevention Committee, Outlying Commercial Accommodation Association, Jasper Hotel Association, Jasper Volunteer Fire Brigade, Jasper Environmental Association, Town of Hinton, ATCO Electric, Fairmont Jasper Park Lodge, RCMP, Foothills Model Forest, Alberta Sustainable Resource Development and Parks Canada
Langford	• City of Langford Council Member, Residents of Identified High Risk Communities, Municipal Engineering and Building Staff, Fire Department, Planning Department, Provincial Wildfire Committee, Ministry of Forests (MOF), Provincial Emergency Program (PEP), Insurance Board of British Columbia, Home Builders Association

4.1.5 Identify Common Goals

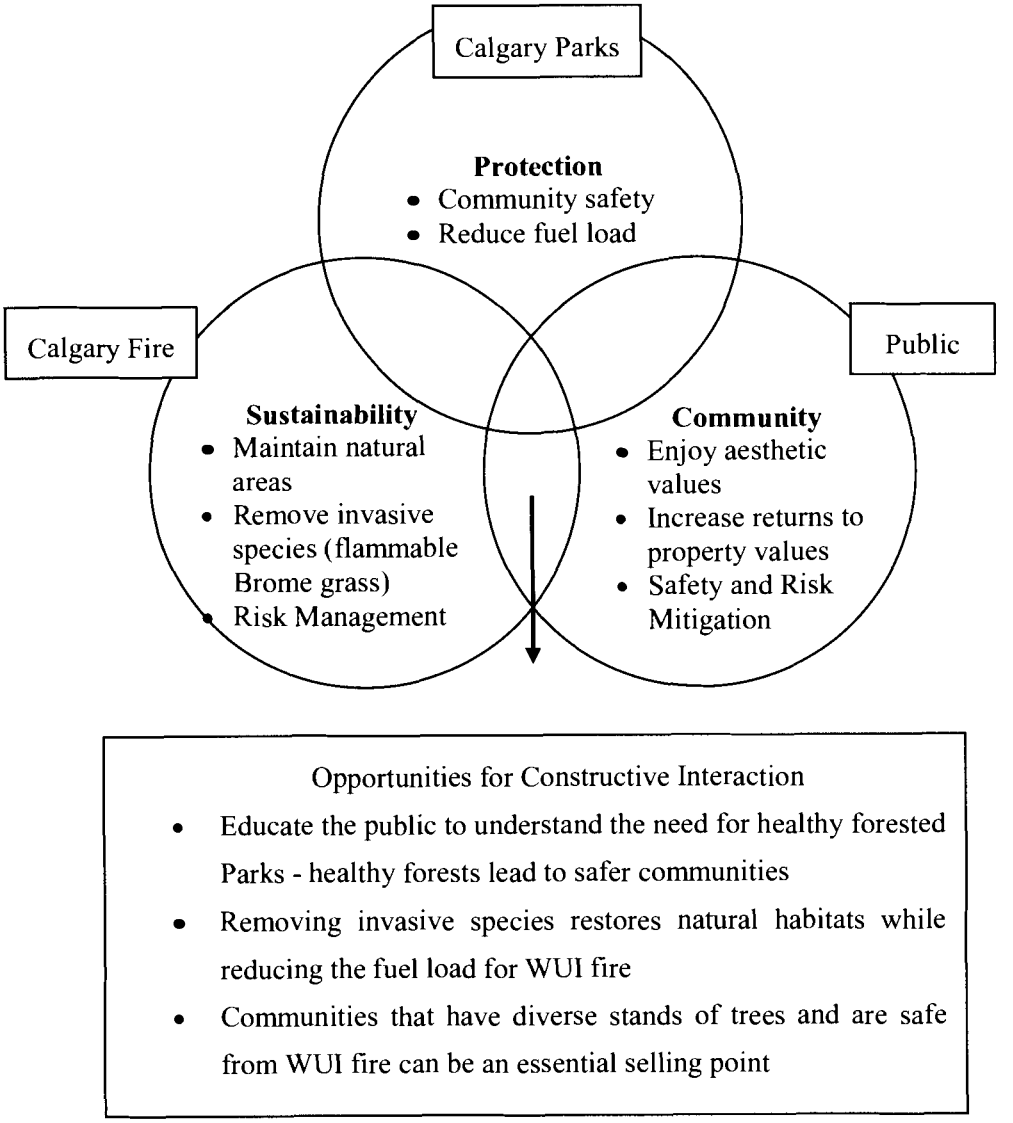
Calgary Parks has a mandate to protect the diversity and integrity of Natural Areas within the City in their most natural state. This involves detailed management plans that can accommodate and educate multi-use visitors, while ensuring that the environment is protected to ensure sustainability. On the other hand, the Calgary Fire Department has a mandate to protect life and property over any other issue. On initial review, this frames the problem so that each proponent has conflicting priorities to address the issue of WUI fire. In order to move forward with this problem, it is necessary to reframe the issue.

Prior to the establishment of Discovery Ridge, horses and cattle had extensively grazed portions of the area and unfortunately, non-native grasslands have been introduced in various areas of the park due largely to agricultural practices. The majority of the non-native grassland is dominated by smooth brome grass, which is a highly invasive forage crop that threatens not only grasslands but also the understorey of the forest. Various types of brome grass are regarded as hazardous as they can change an area's fire regime by increasing fuel loads, thus increasing the spread and intensity of fires (United States Department of Agriculture, 2005).

As Jennifer Symcox points out, "I think that in our natural areas, brome and certain non-native species are significantly contributing to the fire risk and by managing those better we

would be meeting mutual goals [...] reducing the fire risk and improving the health of natural areas." (Symcox, 2005, Interview)

Figure 2: Realizing Common Goals to Achieve Success



In would be beneficial for this 'Venn Diagram' approach to be used as a means to draw stakeholders together to agree to common interests. This would enable an adequate assessment of the various interests, motivations and interpretation of the problem to be revealed, and provide a reference point for constructive interaction.

4.1.6 Bottom-Up Approach

Another important aspect to consider is that in Calgary the initiative was limited by the fact that it was primarily a bottom-up approach. Even though Calgary's Fire Chief had proposed that they begin to examine this issue, there was not a similar "leader' on Parks side. The case studies have shown that to establish a successful program, it requires strong leadership, and defined interest from those that make decisions. Kelvin Hirsch says:

> We should be targeting the early adopters or movers and shakers, which I would call the critical people in organizations. I would advocate a very strategic approach [...] different people in different places such as land use managers, mayors, developers, but you start to build it that way until it becomes the norm. We can't forget that FireSmart was always about empowerment, its not about government telling people what to do, but it should be about giving people enough information to take responsibility, and to be able to take action in a partnership way (Hirsch, 2005, Interview)

Through the decoding of information, another theme revealed itself as an important point from various sources and that is the notion of time. Both the City of Calgary Parks Department and the Calgary Fire Department have mentioned that within such large bureaucracies, their ability to multi-task is essential, but eventually priorities are delegated from a higher level. It is apparent that management plays an important role in defining these priorities, and allocating the funds and human resources for any initiative to have a chance at being successful.

4.2 Development Application Process

One of the most efficient ways to avoid or minimize potential wildland urban interface problems is by establishing and implementing WUI specific land-use planning and development guidelines. The questions in this section are designed to determine if communities have taken steps to amend the development application process for new developments to consider WUI risk by requiring applicants to conduct a WUI Hazard Assessment. In addition, these questions determine if communities are recognizing WUI as a natural hazard that affords protection, akin to most municipalities' efforts to control development and protect communities from floods. The following table summarizes these findings:

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Table 8: Development Permit Process

	Have you changed the Development Permit process to include a review of WUI hazards	Is a WUI hazard assessment a requirement for a new development	If you identify an area as high risk would you restrict development
Calgary	No	No	No
Canmore	Yes	Yes	Yes
Jasper	Under Consideration	Under Consideration	Under Consideration
Langford	Yes	Yes	Yes

4.2.1 FireSmart Cases

In Canmore, the Municipal Development Plan (MDP) provides the policies and guidelines that will direct the future growth and development of the Town of Canmore (Town of Canmore, 2004). The Land Use Bylaw is the regulatory instrument for implementing the policies of the MDP on a more detailed site-specific basis. Under Section 2.5 of the MDP, Future Growth Policies, "*Where appropriate, new subdivision and development applications deemed to be located within the WUI shall submit a Wildfire Risk Assessment Plan in accordance with the requirements of the Town of Canmore*" (Town of Canmore, 2004, Sec.2.5(H).

In addition to the Wildfire Risk Assessment, the developer must provide a risk management plan that provides an overall plan for mitigation, and the Town suggests that the architectural guidelines adhere to the minimum standards set out in FireSmart (e.g. do not use wood shake roofing material). As a municipality, they cannot require the developer to not use certain materials as long as they meet Alberta Building Safety Codes, but they can require specific materials under the Land Use Bylaw. Steven de Keijzer states:

> The MDP came out in 1998, we were aware of some of the issues of WUI at the time but FireSmart really helped to focus these issues. FireSmart gave us a lot of the specific directives both in terms of what we require from landscape materials around the house, to clearings for the different interface zones [...] basically, we look to the developer to give us a detailed analysis of the proposal and we now have a standard to assess the application (De Keijzer, Interview).

Steven de Keijzer relays some important advice, "One thing that we have learned is that we require the developers to do the mitigations upfront prior to the registration of the subdivisions, because people buy homes based on the expectation that what they see is what they

get. If you attempt to do hazard mitigation in an area that they consider parkland, you will get a political uproar" (De Keijzer, 2005, Interview).

The Town of Jasper is in a national park, which means that all development is strictly controlled. In 2001, the Jasper Community Land Use Plan (Plan) established comprehensive policies and planning actions designed to guide future development and land use. The Plan focused on four main principles: no-net-negative environmental impact, appropriate use guidelines, responsible growth management strategy, and leadership in environmental stewardship and heritage conservation (National Park and National Historic Sites of Canada, 2001, p.8). In terms of WUI, the Plan calls for landscape management and building material policies to be reviewed and amended as necessary to minimize risk from wildfire. In addition, a community-based strategy for protecting against wildfire that both restores forest structure in the Three Valley Confluence Area and improves public safety will be developed (National Park and National Historic Sites of Canada, 2001, p18).

To ensure that the park remains as wilderness, the boundaries of the town are fixed; the town cannot grow any larger. Almost no land is available for further development, and housing is already scarce for those who live and work in the town. However, the Town has controlled structural appearance by using bylaws and architectural guidelines that restrict building materials, which are important municipal tools for WUI.

Alan Westhaver will be the first to admit that the zoning situation in Jasper is not perfect. The Jasper Interface Review (JIST) Committee has struck a Bylaw Review Committee that sat down with Town administrators and they went through the bylaws and architectural guidelines, line by line. There has been very good progress in adapting specific bylaws to consider WUI risk, however; the biggest hurdle to consider is the preservation of historic buildings in the Park. Adoption of the *Architectural Guidelines Motif for the Town of Jasper* ensures that any new developments are consistent with Jasper's identity as a Rocky Mountain national park community (National Park and National Historic Sites of Canada, 2001, p.13). Alan Westhaver states:

> Wooden shakes may have been the motif of the day, but people are beginning to see the light of day. We are pushing towards a ban on untreated cedar shakes. Certainly it was the law 15 years ago when the latest development went in that they had to have wooden roofs, and that will never happen again, but we are not at the stage of *thall shall not* (Westhaver, 2005, Interview).

The City of Langford has adopted a similar approach to new developments as has been exemplified by the Town of Canmore. In 1998, the Provincial Government of British Columbia

amended the former *Municipal Act* in 1998 to permit the designation of Development Permit Areas for addressing the WUl fire hazard. However, in the City of Langford, extensive risk analysis and the completion of the *Interface Fire Hazard Planning Model* convinced Council to adopt the *Development Permit Area Guidelines for Interface Fire Hazards* that stipulates:

> The City of Langford has designated all lands shown as *extreme* or *high* hazard as a Development Permit Area pursuant to provisions in the *Local Government Act.* The justification for this designation is to ensure that Council has the ability to regulate development within *high* and *extreme* wildfire hazard risk areas in a way that minimizes the risk associated with these hazards (City of Langford, 1996, Appendix:N).

The objective of this Development Permit Area designation is to ensure that development within the interface fire hazard area is managed in a way that minimizes the risk of damage to property or people from interface fire hazards; and managed in a way that mitigates interface fire hazards while still addressing environmental issues. The Development Permit Area Guidelines are comprehensive and a few are listed in the appendix (Appendix E: Table 15).

The Development Permit process and guidelines have had a significant impact on new neighbourhood plans within and or adjacent to high-hazard interface fire areas. In comparison to other municipalities, Langford has adopted a 'heavier hand' in terms of using regulation as an important tool to reduce WUI fire risk. In Western Canada there is a general ethos against regulation. However as Rob Buchan points out, it can be more efficient:

> Disseminating information door to door can be very labour intensive. We have done far more through regulation with very little labour. If you can make the outer limits of your community FireSmart, than the ones on the inside that are not as FireSmart all of a sudden become the fire break for the old ones. If there is a reason for regulation and there is a public benefit, then that is what we should do, that is why we have been given those tools. Maybe we just need to call it empowerment and encouragement (Buchan, 2005, Interview).

4.2.2 Calgary

During the interview process, I received recommendations from both the City of Calgary Parks Department and the Calgary Fire Department to speak to a specific individual in the Calgary Planning Department. After numerous emails and phone calls I spoke with this individual to find out that they were unable, or unwilling to answer any of my questions. I was then referred to two other Planners within the department, who in turn referred me back to my first contact. A subsequent email was then sent to the Planning Manager outlining my needs and concerns that no one could answer my questions, I received no response.

Fortunately, a review of the Calgary Land Use Bylaw 2P80 provides the relevant answers. The process to obtain a Development Permit in the City of Calgary is very thorough and extensive compared to the other case studies. However, within the City of Calgary Land Use Bylaw, there is no codification of rules or regulations that acknowledges WUI hazard assessment or WUI fire risk potential. As for the WUI Hazard Assessment, The Wedgewoods apartment complex development in Discovery Ridge was required to complete a hazard assessment at the request of Parks, not because it was a condition or building in a WUI area. In fact, the hazard assessment was only a minor consideration for a much larger biological impact assessment. The City was much more concerned with preserving the Natural Area as opposed to protecting the community from WUI fire.

4.2.3 Summary of Findings

The most significant finding of this section is that those communities that have established successful FireSmart programs, have used municipal regulatory tools such as Land Use Bylaws, and Development Permit Requirements to protect against WUI fire risk. In Canmore and Langford, each community has stated that a WUI Hazard Assessment is a requirement for new developments, especially; if the proposal is located in an area that was previously identified as being at risk from WUI fire. For example in Appendix E: Figure 13, a map was created by the City of Langford as a result of a Community Level WUI Hazard Assessment. The map categorizes the municipality into their various levels of risk. The Development Permit process requires that development within areas of *moderate* to *extreme* hazard conduct a WUI Hazard Assessment. Information provided by both the Community Level WUI Hazard Assessment and the site specific WUI Hazard Assessment conveys to the developer and City Planners, information to prescribe a risk mitigation plan. The next section discusses changes that should be considered to enhance the ability of the Land Use Bylaw to implement FireSmart principles.

4.2.4 Enhancing Municipal Tools to Protect Communities from WUI Fire

Every municipality is governed by a set of polices that outlines the process for development and future growth. As the City of Langford discovered through its *Interface Fire Hazard Planning Model*, there are various tools available to local governments to aid in the prevention and planning for WUI fire risk, such as Land Use Bylaws, Development Permits and Restrictive Covenants. Each tool has a specific role to play in the development process, but each

can also acts as a guiding instrument to ensure that WUI is an important consideration throughout the entire process.

4.2.5 Land Use Bylaw

Each of the FireSmart municipalities has employed the Land Use Bylaw as the primary regulatory instrument to control for WUI fire risk. Although, each case study has applied this tool with different degrees of coercion and control, the intended outcome of restricting development in an identified WUI area is consistent. Land Use Bylaws should require such things as WUI Hazard Assessments, Landscape Design Guidelines, and FireSmart Architectural Guidelines, prior to development approval. As Jennifer Symcox states,

> I would like to see FireSmart guidelines integrated into the development requirements, so if the developer decides to go into a particular area, that area has to be assessed for fire risk, just like other criteria [...] for example, you cannot develop in the flood plain. In some areas it would be low risk and some areas it would be high, but in areas that it is high risk there are often major incentives for that developer to build there and people want to live there [...] so it is just the cost of doing business (Symcox, 2005, Interview).

Anyone that reads the City of Calgary Land Use Bylaw will acknowledge its panoptic collection of sections, rules and regulations. However, even the City will attest that it can no longer guide development and land use in a comprehensive and efficient manner since its inception 24 years ago. The Land Use Bylaw contains explicit details of the development process and process for review and or appeal in all types of areas, except WUI. Stew Walkinshaw offers a candid portrayal of the uphill battle that communities must face to deal with the problem of WUI.

> Unless you have something in your land use bylaw that says that the developer has to manage fuels [...] it's his land, he can do whatever he wants to do with it. The Three Sisters subdivision in Canmore was thinned quite heavily; it had a big buffer around the whole community and was the most functional fuel modification I had ever seen. It was well thinned and well cleaned up and really functional, then they expanded their development and are now developing in the thinned area, which now backs on to the unthinned area. You just have to shake your head (Walkinshaw, 2005, Interview).

4.3 WUI Administrative Responsibility

In every administration there are a series of checks and balances to ensure due diligence has been followed. The questions in this section are designed to first identify who has the responsibility to approve new developments, which department is responsible for approving the WUI Hazard Assessment if required, and finally, who is responsible for the long-term maintenance of any fuel reduction prescription. The results identify how the various case studies have delegated administrative responsibility, and provide information for the City of Calgary to address inefficiencies within their system. In the following chart, the City of Calgary has an 'unspecified' answer under one of the questions. This is because the City of Calgary does not have a WUI Hazard Assessment requirement, and thus, no one is responsible for the approval of one. The following table summarizes these findings:

Table 9: Determining Administrative Responsibility for WUI

	Who is the final approving authority of new developments	**Who is responsible for approving WUI hazard assessment**	**Who is responsible for the maintenance of fuel reduction**
Calgary	Planning Department	Unspecified	Developer
Canmore	Fire Department	Fire Department	Residents
Jasper	Planning Department	Parks	Parks
Langford	Planning Department	Planning Department	Residents

4.3.1 FireSmart Cases

In Canmore, once the WUI hazard assessment is complete, it goes to Fire Chief, Brent Pederson for his approval. If the management plan does not meet the requirements of Emergency Services, the developer must improve the plan, prior to the Fire Chief officially endorsing the project. This arrangement guarantees that the person with the most expertise in FireSmart is appropriately assessing the risk.

Maintenance is as important as the initial fire management plan. As Steven de Keijzer states, "Nothing succeeds, like succession. Trees and brush grow back so someone has to deal with the maintenance aspect" (De Keijzer, 2005, Interview). Unfortunately, as the system is setup, there are no mechanisms that require an on-going maintenance commitment. Steven de Keijzer (2005) continues. "We certainly have the "hammer" up front in terms of the subdivision stage and basically we ensure that initially those guidelines are met."

In the Municipality of Jasper, developments are reviewed by both Parks Canada and by the Town Council. This means that the review process is strengthened by having 'two sets of eyes' evaluate the development application. The fire codes standard is a federal standard, which is enforced by Parks, but any concerns that Parks may have in terms of the development is more along the lines of recommendations. Although development is very regulated in the Park, there is a legislated boundary and there is very little undeveloped space within that boundary.

Most of the major fuel reduction projects that have been completed fall within the jurisdiction of Parks as they attempt to build a defensible space around the Town. Any projects that are within the town would be the responsibility of the Town to maintain, although, Parks would be involved due to their expertise and resources.

A review of the Langford case indicates that the Planning Department approves the list of conditions that relate to the *City of Langford's Development Permit Guidelines for Interface Fire Hazards*. Since development permit guidelines for interface hazards have been established for extreme or high hazard areas, the approving authority has been delegated to Rob Buchan of the Planning Department. He works with developers to review the project proposals and offers expertise in addressing WUI risk mitigation. The City of Langford has adopted a system of Development Permits and Covenants to ensure that the issue of maintenance is covered. Rob Buchan explains:

> The restrictive covenant was a tool available to the municipality that allowed us to get another thing on title in addition to the Development Permit. Its purpose was to say, hey, we are in a Development Permit area and you have to maintain your vegetation in the fuel free zone, and if you don't there is a rent charge that can be applied to the property tax assessment. That is the 'stick approach'. These tools allow you to ensure that maintenance is ongoing (Buchan, 2005, Interview).

Langford has also gone as far as to set special taxation rates for living in areas that require extensive and annual maintenance to ensure the risk from WUI fire is controlled. This

allows residents of the community to be the principle beneficiaries of the mitigation programs, and to discourage free riders.

4.3.2 Calgary

In Calgary, before construction begins on a new community, developers are required to go through an intensive approval process, which involves various City of Calgary Departments, the public / Stakeholders, and finally City Council. The plan will describe the proposed zoning for the site, the proposed road layout, park locations and sizes, natural areas, surrounding context, conceptual servicing, etc. Copies are circulated to various Departments within the City of Calgary (Planning, Sewers, Streets, Parks, etc), as well as a variety of other organizations (school boards, Utility Companies, Fire Department, etc). The City's Corporate Planning Applications Group (CPAG) is responsible for the review process.

The plan is then reviewed by the various departments/organizations (this process can take many months), and comments are then returned for the developer to address. At this point CPAG has the opportunity to provide advisory comments as a courtesy to the applicant and property owner. The application is brought before a group known as the Calgary Planning Commission (CPC) who review the plan and, if satisfied, recommend approval and forward the plan to a Public Hearing of Council. Once the Council discussion is complete, Council members will vote to approve or reject the application (Urban Development Institute, 2004).

In the case of Calgary, Parks was identified as the final approving authority of the WUI Hazard Assessment that was completed for Discovery Ridge. However, the mandate and interests of Parks were in conflict with the overall assessment. This is exemplified in a letter from the Assistant Manager of Resource Management, Parks to the developer Statesman Corporation, which states,

> The fire plan needs reworking including consideration of the forest health. Trimming of branches to two metres within 30 metres is unacceptable considering the small size of area unless this can be referenced as a standard (Resource Management Parks, 2002).

According to the Partners in Protection, removing tree branches to a height of two metres within 30 metres, is a FireSmart standard. To be fair to Parks, they were attempting to preserve as much Natural Area as possible. This would suggest that a Parks was not the appropriate department to make this kind of decision.

Finally, in Discovery Ridge, the City identified that the developer would be responsible for any maintenance for WUI mitigation, but there is no bylaw to enforce this statement. As indicated in the *Introduction* section, even though the risk was identified, "restrictions placed on the areas beyond the construction boundary (established in the land use bylaw) restrict any modification to vegetation in these areas for reasons of fire hazard reduction of otherwise" (IBI Group, 2003, p.17). This restriction would include long-term maintenance. By default, Parks would have the mandate and responsibility to ensure that the area surrounding the Wedgewoods apartment complex was safe from WUI fire risk, as a majority of the area falls within Griffith Woods Park.

4.3.3 Summary of Findings

This section reveals that in each of the FireSmart cases, the final approval authority for a new development or subdivision in that community renders their decision in terms of the communities' response to mitigating WUI fire risk. Another important factor is that each of the FireSmart cases has a delegated official that is responsible for approving the WUI Hazard Assessment. The results also show that long term mitigation is a factor to consider in WUI risk reduction. In each of the cases, the communities have each taken a different approach to addressing this concern. The next section identifies areas where the City of Calgary should review their system of analysis to ensure that developments are safe from WUI fire.

4.3.4 Checks and Balances

Each new development must go through a process of review before receiving final authority to begin construction. Within this review is a system of checks and balances. As Greg Mathieson of the Calgary Fire Department explains, it is common practice for the Planning Department to circulate new subdivision applications or development permits to the CFD and various other departments.

> We are given the opportunity to comment on it, but we don't have to. Planning sends us a copy and we get to look it over and make comments back from what we understand might be from the perspective of the fire department. Most of the comments are non-binding. We are basically concerned with structural fire codes, and community access (Mathieson, 2005, Interview).

In Appendix F: Table 16, a table is provided that is an exact copy of the summary of circulation replies for the proposed Discovery Ridge Land Use Amendment to accommodate

high-density multi-family residential development, which was later identified as having medium to extreme WUI fire risk. Each department registered *NO* objection to the development. This table shows that although other City departments had the opportunity to review the development application, there were no concerns raised at this stage of the development. Most importantly, the Calgary Fire Department raised *no objection*. As outlined by Greg Mathieson in the previous paragraph, this is because they are not approving the development with respect to WUI, but for structural code conformity. The current system of checks and balances failed to determine that the Wedgewoods apartment complex would be at risk from WUI fire.

4.3.5 Approving Authority

The FireSmart cases have shown that the approving authority for new developments have been a champion of WUI fire prevention. In Canmore, it is Fire Chief Rob Pedersen, and in the City of Langford, it is Rob Buchan of the Planning Department. Granted, the extensive and intricate bureaucracy of the City of Calgary plays an important role in the review and approval of subdivision applications and development permits, however; there needs to be more delegated authority for WUI considerations within departments such as Parks and CFD. With this authority comes responsibility. The question remains, do these departments have the capacity, training and budget to perform these extended tasks.

FireSmart is a voluntary instrument and has no effective powers without regulation. In regards to the development of Discovery Ridge, the WUI hazard assessment was completed only because both Parks and CFD suggested it needed to be done. Greg Mathieson of the Calgary Fire Department said that even though they had concerns, they could not force the developer to use setbacks to reduce the WUI fire risk. "FireSmart is just a guideline; it doesn't mean they even have to read it" (Mathieson, 2005, Interview). Without a commitment from the City of Calgary, and Council, in particular, WUI issues and FireSmart programs will continue to be overlooked. This will ultimately require the amendment of the Land Use Bylaw. As Ron Chamney of the Calgary Fire Department explains:

> If you have a legislated standard that address access routes or defines proximity to other structures, and if you know that it is written in the Land Use Bylaws, then you can be sure that your contractors will adhere to the rules and the structure will be built accordingly. Until that is done, contractors will only listen to our concerns out of the kindness of the hearts (Chamney, 2005, Interview).

4.3.6 Long Term Management

The FireSmart cases of Canmore and Langford reveal two different approaches to long-term WUI management. Canmore only requires fuel reduction to occur once, prior to development, whereas the City of Langford has adopted a taxation system to ensure that mitigation is ongoing. Langford has adopted a covenant, which is a condition of the development permit in an effort to address on-going or long-term maintenance of vegetation. They have found that covenants are difficult to enforce over time, but they have adopted a number of approaches:

1. Use a system of fines, where the covenantee (i.e., the local government) can fine the covenantor (property owner) for every day that the covenant is violated. This is achieved by using a rent clause in the covenant.
2. Make adjacent properties party to the same covenant. This approach may not appeal to all local governments as it encourages concerned neighbours to report on their neighbours.
3. Include a clause that requires reports on a regular basis on the status of the vegetation surrounding residential buildings. As an incentive, an annual rent charge is part of the covenant. This rent is suspended if the report is provided. (The rent charge can be applied to the property taxes if not paid.) (District of Langford, 2002, p.22)

4.4 Summary of Best Practices Drawn from the Case Studies

1. Establishing the level of risk is the most important common link among each case. The Community Level WUI Hazard Assessment determines baseline evidence that is necessary for implementing FireSmart principles. Most importantly, it provides 'next steps' for developing a WUI specific policy response for the community.
2. Successful implementation requires broad support and input from a wide variety of stakeholders. Wildland urban interface policy impacts developers, various departments within the City, and residents, both within established communities and new homeowners at the City's edge.
3. Education and information is imperative to raise awareness of WUI issues. FireSmart is an excellent resource to educate not only the public, but also City of

Calgary departments. With enhanced education, communication becomes a powerful tool to unite interests towards reducing WUI fire risk.

4. It should be assumed that the public will discount the perception of personal risk from WUI fire. It is important to target communities at risk with enough evidence and information that allows them to make the right choices to reduce the risk from WUI fire.
5. Regulation can be an effective tool to reduce the risk from WUI fire, and ensure that FireSmart principles are implemented.
6. For regulation to be effective, checks and balances must have a legitimate purpose.
7. Finally, those responsible for control and evaluation, must have an interest in the cause, and have legitimate authority provided for in the regulatory framework.

5 Analysis of Alternatives

5.1 Issue Definition and Policy Objectives

Everyone is interested in making good decisions. More precisely, decision makers are interested in making decisions that have good outcomes (Buchanan, 1999). This section of the study provides the City of Calgary with an analysis of the alternative processes that can provide for the implementation of FireSmart principles. The alternatives emanate from the results of the comparative analysis of each of the case studies presented in section four. The analysis in this section addresses the following:

The City of Calgary requires a systemic framework to implement FireSmart principles that will protect communities from WUI fire risk.[10]

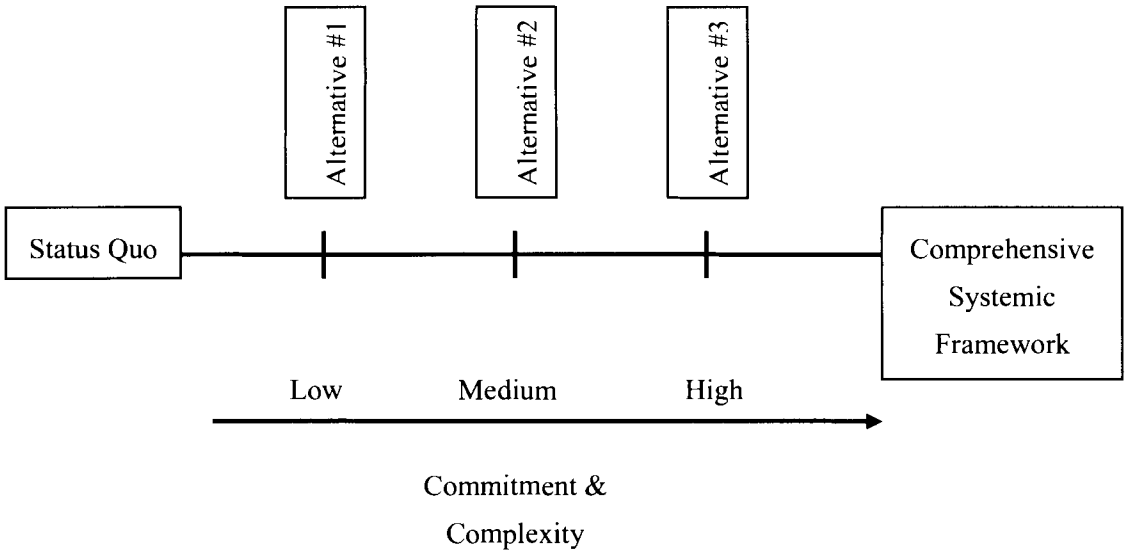
There are both institutional and procedural components of a systemic framework that are required for implementing FireSmart principles. While the case studies presented in this analysis have used common approaches to address WUI fire, there are various considerations in evaluating the appropriate mechanisms.

5.1.1 Degree of Commitment and Complexity

Each alternative is offered as an important step along a continuum of choices towards a comprehensive systemic framework (Figure 4). The determining factor for the City to consider is to what degree of commitment are they willing to devote and the level of complexity they require to address WUI fire risk.

[10] By definition, systemic refers to: affecting or relating to a system as a whole.

Figure 3: Choosing Alternatives Based on the Degree of Commitment and Complexity



The City may decide that the WUI problem requires a simple solution that reflects low commitment and low complexity; in this case, they would choose Alternative #1. However, if the City decides that they are willing to commit long-term resources and are willing to implement a complex approach to reduce the risk from WUI fire, than they should decide to implement all Alternatives along the continuum including Alternative #3. An all-inclusive summary is provided at the end section 7.2.3: Figure 5.

The objective of this section is to identify the available alternatives that the City should evaluate to reduce WUI fire risk, and then provide recommendations for the City to consider. This section begins by identifying the alternative components of the systemic framework, and presents some of the key issues and considerations that will frame the analysis.

5.2 Alternatives

Institutional and procedural approaches to WUI affect a community's ability to implement FireSmart principles. The case studies presented in this study were evaluated with respect to a three approaches that encapsulate both institutional and procedural concepts: organizational capacity, development application process, and WUI administrative responsibility. When designing a systemic framework to implement FireSmart principles, the analysis suggests

that the City of Calgary should consider three alternatives that will correct the status quo approach. The alternatives are:

1. Commission an initiative to establish the risk from WUI fire in the City of Calgary
2. Delegate WUI approval authority to the Calgary Fire Department
3. Amend the Land Use Bylaw to include WUI Hazard Assessment as a condition of the development application process

Each alternative is evaluated independently for its specific merits and ability to support the implementation of FireSmart principles. However, as this study has identified that these alternatives are a collection of the 'best practices' of each case study and exist along a continuum towards a systemic framework, the characteristics of each alternative are presented in the order that they should be implemented. The details of each alternative are presented in the next section.

5.2.1 Status Quo

The status quo alternative is not an option that will achieve implementation of FireSmart principles. However, it is necessary to identify the consequences of continuing to following this course of action.

5.2.1.1 Key Issues

- The level of risk from WUI fire will not be determined, and as a result, no organizational plan can be developed effectively
- Communication and cooperation among departments will continue to be uncoordinated
- A WUI education program will be costly as there is no justification or evidence for strategic targeting
- Wildland Urban Interface fire will remain a low priority on the City agenda
- The development process will ignore WUI fire risk, and communities will continue to expand into WUI areas with no minimum standard of assessment or protection
- The public will remain unaware of the risk of living in the WUI and an important

opportunity to gain their support will be lost

- The risk that fire will destroy homes will increase because people are not aware of the associated risks from WUI fire
- The City may be negligent if it fails to perform due diligence in communities that are at risk from WUI fire by not implementing any alternatives

5.2.2 Alternative 1 – Establish the Risk

This alternative is the primary first step towards the implementation of FireSmart principles. The foundation of this alternative is the Community Level WUI Hazard Assessment. The next step is to develop a comprehensive WUI Review Committee comprised of a broad base of experts and stakeholders. The final component of this alternative is for the WUI Review Committee to present to City Council the findings of the Community Level WUI Hazard Assessment study in order to appoint a WUI Task Force.

5.2.2.1 Key Issues

- A Community Level WUI Hazard Assessment will provide baseline information and evidence that can be used to determine study scope, prioritize at risk communities, estimate projected costs, target education material, identify stakeholder groups, and most importantly, identify next steps.
- A WUI Review Committee should include departments that are directly affected by WUI policy development such as, Calgary Land Use Planning & Policy, Calgary Parks, Calgary Fire Department, Council member, and Developer Associations. The Community Level WUI Hazard Assessment will determine which communities are at risk. With this information, community associations, residents, and municipalities that abut the hazard area can be invited to get involved with the general core Review Committee. This Committee would be responsible for addressing the immediate needs of the communities at risk. This would include public consultation, information exhortation, implement risk management plans, and develop emergency response plans.
- The WUI Task Force can contribute to the development of a systemic framework by focusing its efforts addressing the long-term issues of WUI. This would entail contributing information and support for departmental WUI budgets

considerations, and facilitate WUI research.

5.2.3 Alternative 2 – Delegate WUI Approval Authority

A regulatory system is only effective if there are checks and balances to monitor each step of the process. This alternative suggests that to ensure FireSmart principles are considered and implemented, the City of Calgary must delegate WUI approval authority.

5.2.3.1 Key Issues

- All development permit applications must go through the same process for approval; this includes a circulation to specific City departments for comment and review. The City should delegate an authority that would review the development application from a WUI perspective. Currently, the Calgary Fire Department reviews applications for structural fire considerations, which does not specifically include WUI.
- The designated authority would also have the responsibility of signing off on WUI Hazard Assessments of new developments. This would force the authority to conduct due diligence and ensure that communities are safe, and the City reduces their exposure to liability.
- In the case studies, the approval authority was delegated to one individual. The size and complexity of the City of Calgary may necessitate a committee comprised of an individual from Calgary Parks, Fire, and Planning to ensure that all interests are met.

5.2.4 Alternative 3 – Amend the Land Use Bylaw

The Land Use Bylaw 2P80 is the heart of the land use redesignation and development permit approval processes, and is an important tool for implementing the policies of the Municipal Development Plan, Area Structure Plans, Area Redevelopment Plans, and other policy studies. This alternative is important for implementing FireSmart principles because the Land Use Bylaw is a regulatory tool that creates rules for governing development standards.

5.2.4.1 Key Issues

- The Land Use Bylaw controls the use of all land in Calgary, subsequently; it is adopted by Council and can only be changed by Council. This gives support for having a member of Council involved in the WUI Review Committee as they can provide important insight and advice on proposals that will require Council support.
- Council has recognized the current Land Use Bylaw as being outdated for the needs of a growing City. Council has identified a review and update of the Land Use Bylaw as a priority, and has recently approved a major work program to review and rewrite the Bylaw. This project provides an opportunity for WUI standards to be included in all future development within the City.

This section has presented three alternatives and the status quo. Each alternative offers a range of methods or approaches to implement FireSmart principles. The next section will define criteria to evaluate each alternative. The results of this evaluation present the various tradeoffs and implications that the City of Calgary should consider before changing the status quo.

6 Evaluation

6.1 Criteria for Assessing Alternatives

Criteria are the measurable dimensions of objectives. When evaluating each alternative, the City of Calgary should consider the following criteria:

Table 10: Criteria Definition and Measurement

Criteria	Definition	Measurement
Acceptance	The alternative should encourage support from different stakeholders outside of the City of Calgary administration	Positive/Negative/Not Applicable
Cost	The alternative should evaluate costs relative to the other alternatives	Low/Medium/High
Effectiveness	The alternative should meet the real or perceived needs of the City to reduce WUI fire risk	Positive/Negative/Not Applicable
Administrative Feasibility	The alternative should promote support from the City of Calgary departments	Positive/Negative/Not Applicable
Implementation Cycle	The alternative should determine the length of time required for organization and implementation	Short-Term/Long-Term
Interdepartmental Coordination	The alternative should support cooperation and communication among City departments	Positive/Negative/Not Applicable

While these criteria may be over generalized or underspecified, it is possible to present the City of Calgary with an analysis of the general trade-offs and considerations that they should include in their decision analysis. A breakdown of the various outcomes is achieved by assessing each alternative against the criteria outlined above. It should be noted that this process is a simple predicative process that casts a possible model of future behaviour. The outcomes are best guesses without actually testing each alternative. The following subsection contains an assessment of each alternative with respect to these criteria.

6.1.1 Projected Outcomes

Table 11: Projected Outcomes of the Criteria Evaluation Process

	Alternatives			
Criteria	**(1) Status Quo**	**(2) Establish the Risk**	**(3) Amend the Land Use Bylaw**	**(4) Delegate WUI Responsibility**
Acceptance	(N/A) Most stakeholders are probably unaware of WUI (-) Developers initially would support no change	(+) This alternative would bring all stakeholders to the table and would generate very broad support through education and information (+) Review Committee would be a venue to raise all concerns and provide a forum for discussion	(+) Residents would have safer communities (+/-) Developers would face an equal burden and be aware of the costs and constraints prior to development (-) Requires negotiation with Building Associations	(+) A delegated authority would ensure that residents or developers have an identified resource that is responsible for approval (+) This would reduce miscommunication and would create broad support
Cost	(Low) Direct costs as there is no change (High) Intangible costs if a community is involved in a WUI fire (legal, displacement, economic, social) (High) Tangible costs as the Calgary Fire Department continues to spend WUI budget without prioritizing resources	(Low) direct cost to complete WUI Hazard Assessment ($20-25,000) (Low) Direct cost to create a Review Committee of stakeholders (Medium) Indirect time and organization costs	(Low) Direct cost as Council has already committed resources for a bylaw review (Medium) Time cost to collect enough information to present to review committee to lobby for WUI to be considered	(Low/Medium) Might require an assessment of salary for added responsibility (Low) There is no change to the process, only a delegation of responsibility
Effectiveness	(-) This option will ensure that WUI risk is not addressed	(+) WUI Hazard Assessment will identify risk and provide evidence (+) Review Committee will determine next steps to reduce	(+) Ensure protection of future developments (+) Codify minimum standard to provide regulatory power for approval and	(+) Guarantee that development application goes through the appropriate checks and balances to safeguard communities

	Alternatives			
Criteria	**(1) Status Quo**	**(2) Establish the Risk**	**(3) Amend the Land Use Bylaw**	**(4) Delegate WUI Responsibility**
		risk (+) Task Force will complete framework by addressing long-term goals	assessment	
Administrative Feasibility	(-) Some departments are presently addressing WUI without support from other departments (-) Does not define common interests or support information sharing	(+) Findings of WUI Hazard Assessment could define roles and responsibilities (+) Evidence could engage particular departments to admit that WUI is important (+) Review Committee creates support by bringing all interests together (+) Council would have the necessary evidence to make a decision	(+) Parks and Fire would have their interests protected through regulation (-) Planning would have to negotiate with Building Association for support, and may have an interest not to amend bylaw (+/-) Aldermen would have to listen to their constituents, but may be swayed to support business	(+/-) May create a power struggle, that might be balanced by a committee (+) Would alleviate finder pointing in the event a WUI fire occurs
Implementation Cycle	(Short) No change	(Short) WUI Hazard Assessment is aided by computer and ortho-maps would take a month or two to complete (Short) Review Committee could be organized immediately (Long) Task Force cold be organized as a result of a presentation of data to Council	(Long) The bylaw review is expected to reach a decision by 2006	(Short) Circulation of development applications already occurs, this option requires that one person or a committee review for WUI activity

	Alternatives			
Criteria	**(1) Status Quo**	**(2) Establish the Risk**	**(3) Amend the Land Use Bylaw**	**(4) Delegate WUI Responsibility**
Interdepartmental Coordination	(-) This alternative currently does not support interdepartmental communication	(+) WUI Hazard Assessment would define common interests (+) Review Committee would encourage dialogue and create a forum to develop a common message (+) Task Force would oversee the communication framework	(+) This alternative would end disputes among departments (+) Would empower departments with enforcement capacity (+) Bylaw design process would require communication and cooperation	(+) Central authority would communicate one message to all departments (+) Would create long-term cooperation as departments have an independent mediator for concerns or questions

6.1.2 Summary of Criteria Evaluation

Table 12, below, provides a summary of the projected outcomes as a result of the criteria analysis of each alternative. In the table, the description of each outcome relates to the measurement narrative in section 7.1, Table 10. If one of the boxes in the criteria evaluation had more than one measurement, the average measure is used.[11] A detailed analysis of the summary results is presented in the section following this table. When reviewing these results, the analyst must interpret the results not as a trade-off between alternatives in the sense that the City must pick one over the other, but as factors that the City should be aware of in moving along the continuum to a systemic framework. The criteria indicate areas where the City may experience obstacles or negative responses that they will have to address along the way.

[11] If a box has two (+) indicators and one (-) indicator, the appropriate input in the summary table would be (+).

Table 12: Summary of Criteria Evaluation

	Alternatives			
Criteria	**(1) Establish the Risk**	**(2) Delegate WUI Responsibility**	**(3) Amend the Land Use Bylaw**	**(X) Status Quo**
Acceptance	(+)	(+)	(+/-)	(-)
Cost	Low	Low	Low/Medium	High
Effectiveness	(+)	(+)	(+)	(-)
Administrative Feasibility	(+)	(+)	(+/-)	(-)
Implementation Cycle	Short	Medium	Long	Short
Interdepartmental Coordination	(+)	(+)	(+)	(-)

6.1.3 Summary of Alternative Considerations

- The status quo alternative is not a viable alternative to reach the objective of implementing FireSmart principles.
- The case studies have shown that establishing the risk is the critical starting point for developing a systemic framework to implement FireSmart principles. The criteria evaluation matrix results indicate that this alternative will have positive support both within City departments and from the collection of stakeholders involved. The results also show that the relative costs are low, and implementation and organization time would be short. Finally, this alternative would support interdepartmental cooperation and communication.
- Delegating WUI responsibility is a good alternative because it redefines practices and processes that are already in place. This alternative is positive in terms of acceptance, effectiveness, administrative feasibility, and interdepartmental coordination. The implementation cycle is short, as it only requires an appointment of approval authority. This alternative might require a committee approach to facilitate a balanced approach to ensure that multiple needs are met. This alternative does not require anymore work than is already expected under the regular circulation of development applications, and so should have a low costs unless the union decides that the added responsibility requires a reassessment of wages.
- Amending the Land Use Bylaw is a necessary long-term goal. It would be effective in meeting the outlined objective, and would increase interdepartmental cooperation and communication as a necessary process to design an effective amendment. However, the negative aspect of this alternative is that the implementation cycle is long, and there would be some difficulty as the City would have to negotiate with the Builders Association to ensure support, which would affect both acceptance and administrative feasibility.

6.2 Recommendations

The summary table and explanation in the previous section has established a proxy evaluation of the alternatives in regards to criteria that provide a variety of outcomes that the City of Calgary must consider. The analysis is summarized below in the form of three recommendations that the City should consider to implement FireSmart principles.

6.2.1 Recommendation #1

As a top priority, the City of Calgary should establish the risk from WUI fire. This approach should include and consider:

1. Complete a Community Level WUI Hazard Assessment to identify the communities at risk.
2. Create a comprehensive WUI Review Committee that includes Calgary Parks, Calgary Fire, Land Use Planning and Development, Alberta Sustainable Resource Development, Community Associations and or their Aldermen, Environmental Groups, Utility Companies, and Developer and Building Associations (Urban Development Institute - UDI, Builders Owners and Managers Association-BOMA, Calgary Region Home Builders Association-CRHBA), the Municipal District of Rocky View (borders Calgary on the North, West and East sides), and the Municipal District of Foothills (South border)
3. Task the WUI Review Committee to develop a strategic plan. This plan should include a risk mitigation plan for high-risk areas, public consultation to inform the public of the management plan and to determine support, and develop education and information material based on FireSmart principles. This strategic plan should culminate into a presentation to City Council in an effort to get WUI on the agenda and appoint a WUI Task Force to provide long-term policy advice.
4. Calgary Fire Department should use the information from the Community Level WUI Hazard Assessment and pre-position WUI equipment and resources in areas of higher risk. They should also engage in a self-assessment of response capabilities and equipment requirements by working with WUI trained staff from Alberta Sustainable Resource Development.
5. Calgary Fire Department should take advantage of internal expertise and use the

Community Safety Division to deliver education programs to the community.

6.2.2 Recommendation #2

The City of Calgary should delegate WUI approval authority. This approach should include and consider:

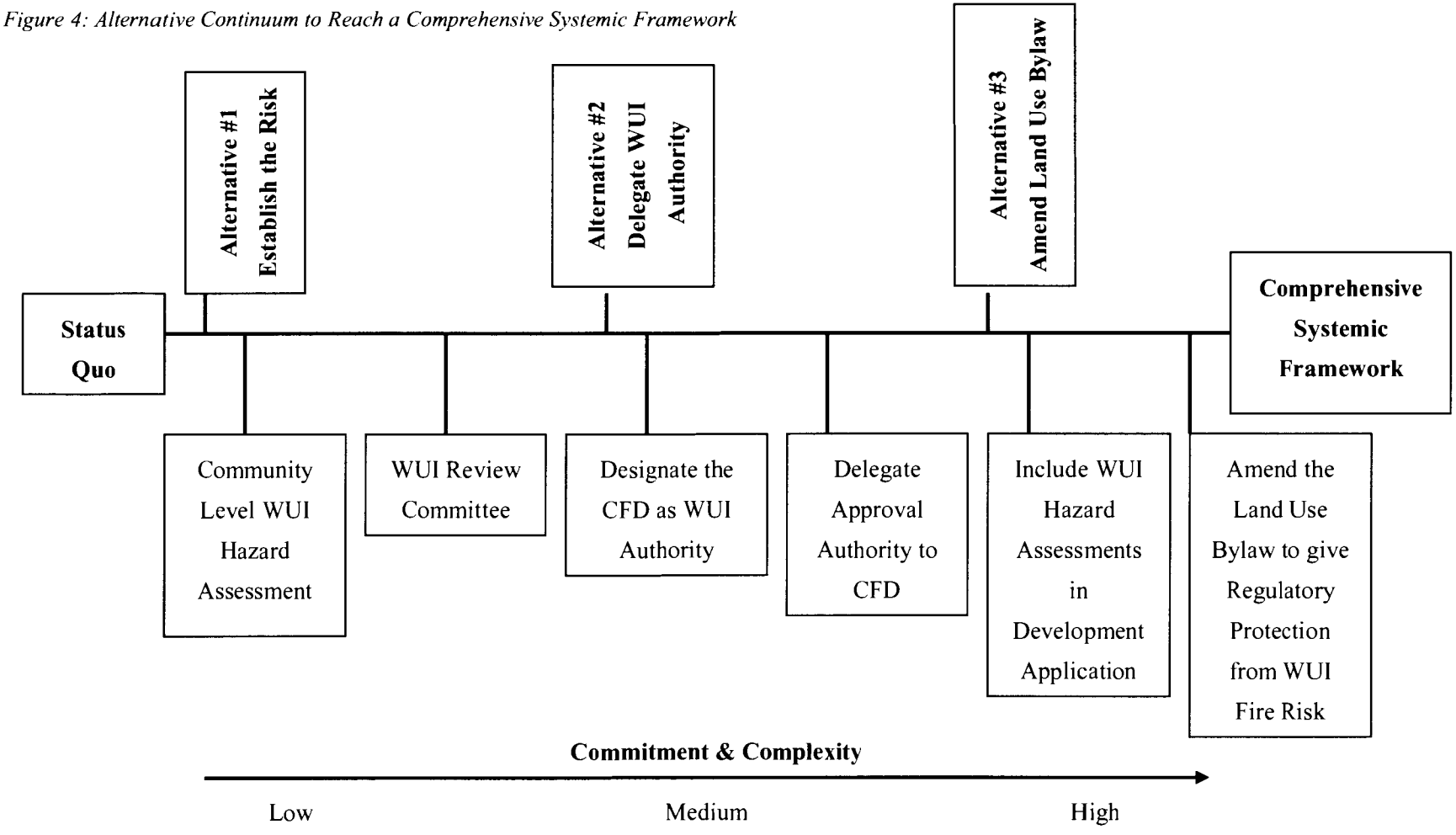
1. Identify a department, committee, or individual that will be responsible for reviewing WUI specific development applications. This alternative may require an amendment to the Land Use Bylaw to ensure enforcement authority.
2. If the approving authority is not supported by the Land Use Bylaw, they still have the power to make an 'official' objection on any application that will ultimately go before Council for final approval. As a minimum this will ensure that due diligence has been followed compared to the status quo practice of no authority.

6.2.3 Recommendation #3

The City of Calgary should take the lead in ensuring WUI community safety by amending the regulatory framework. This approach should include and consider:

1. Review other municipalities' approaches to addressing WUI in their Land Use Bylaws. Determine the level of coercion needed to ensure community safety through public forums and information exhortation.
2. Adjust the development permit application process to include a review by a delegated WUI official that has authority to make recommendations for WUI fire issues or concerns
3. Amend the Land Use Bylaw to give regulatory and enforcement powers to the approving authority in consideration of WUI issues or concerns

Figure 4: Alternative Continuum to Reach a Comprehensive Systemic Framework



7 Conclusion

The most important point revealed in this study seems to be that without a WUI hazard assessment; there is no evidence to speak truth to power. Comments from elite interviews and analysis of the case studies have shown that the initiative for a successful FireSmart program must come from a political leader, or department manager, who has the authority and information to make an objective decision to investigate the WUI issue. Without this direction, WUI will remain a low priority

Partners in Protection encourage community-based initiatives to reduce the risk of fire losses and enhance safety in the WUI. The case studies have shown that to be successful in establishing FireSmart principles, support from the community is essential. There are various methods to gain support for FireSmart programs. These methods can include education programs to stimulate awareness and to generate interest in learning more about the issue. Other examples include demonstration projects for communities to get hands on experience that will enable individuals to address WUI risk mitigation in and around their homes or recreation properties.

Wildland Urban Interface is a multifaceted problem that requires many partners at the table. Each case study has demonstrated that this issue requires expertise at all levels of government and should involve as many stakeholders as possible to cast the seeds of information. Those groups or individuals that balk at the idea that the City of Calgary is not at risk for WUI fire should be targeted early in the process and encouraged to raise their concerns. Extra effort will be required to gain their support but if you can convince the outsiders to join the group everyone else will follow.

As the number of stakeholders at the table increases, so do the interests. Participants have their own reason for being there and it might not be to establish a FireSmart program. One of the major roadblocks to completing the Pilot Project this past summer was that each department was reluctant to focus on the goal, and instead was devoted to protecting their mandate to the detriment of the Project. To ensure success, participants must be willing to frame the problem to understand each perspective at the table. Consideration of common goals and interests will be the driver for success.

The City of Calgary can gain some valuable insight by reviewing what other municipalities have endured and achieved in their efforts to protect their communities from WUI. It might be argued that these municipalities had more incentive because they are all within continuous stands of forest or timber, and residents have a greater respect for FireSmart principles as a way to protect their homes. However, there is extensive evidence to show that even residents that have experienced WUI fire first hand are still reluctant to use fuel reduction techniques in an around their homes. Lessons can be learned from studying various cases that will enable the City of Calgary to develop a FireSmart program that meets their specific needs.

The City of Calgary has a legal and moral obligation to perform due diligence when they develop new communities. If appropriate measures such as a regulatory framework review and delegated approval authority commitments are taken, a minimum standard for WUI safety will be enforceable. Not only will homeowners benefit from this added security, but also developers could reduce liability, expand their marketability, and have a level regulatory environment, as every developer will be subject to the same requirements.

The City of Calgary has the opportunity to take advantage of a critical policy window. The Land Use Bylaw Review involves creating a framework for each set of districts in the Land Use Bylaw. The framework outlines the purpose, intent and principles guiding the uses and rules. The process for preparing each framework involves consultation with stakeholders, along with research and analysis of existing development, trends, and the strengths and weaknesses of the current Bylaw. As each framework is complete, a committee of Council will review and consider it, before proceeding to drafting the detailed districts. When all the new districts are complete, Council will consider the new Land Use Bylaw for approval. This is scheduled for 2006. Experts have identified the Land Use Bylaw as an essential tool in dealing with WUI. It is essential to complete a WUI hazard assessment and to develop a database of information and research to present to Council in an effort to amend the Bylaw to consider WUI fire risk.

FireSmart was developed to give communities and individuals across Canada the information and tools they need to confront Wildland Urban Interface fire protection issues. The manual has an extensive collection of research and information from numerous industry experts. Many municipalities have adopted FireSmart principles in varying degrees, but what is consistent are the major themes that the manual presents, such as fire resistant design and building materials, landscape and house maintenance, and most importantly a fuel free zone surrounding the structure at risk.

FireSmart was designed as a voluntary policy instrument that supports community-based approaches to reducing the risk from WUI fire. Through the elite interview process, there have been numerous comments that FireSmart was never intended to be enforced and regulated by government. However, the analysis has shown that the principles of FireSmart require commitment from community leaders and legislators to ensure that communities are protected from WUI fire risk. In the case of Langford, the City has decided that FireSmart is important to the community and used regulation as the instrument to induce change. Contrary to the advice of many experts, this approach is working.

FireSmart is too important to let the public decide if it is a good idea to implement. Literature and experience dictate that the public is willing to live in high-risk areas even when they are aware of the risk at hand. When Stew Walkinshaw was asked a question regarding how do you get the public interested in FireSmart, he responded:

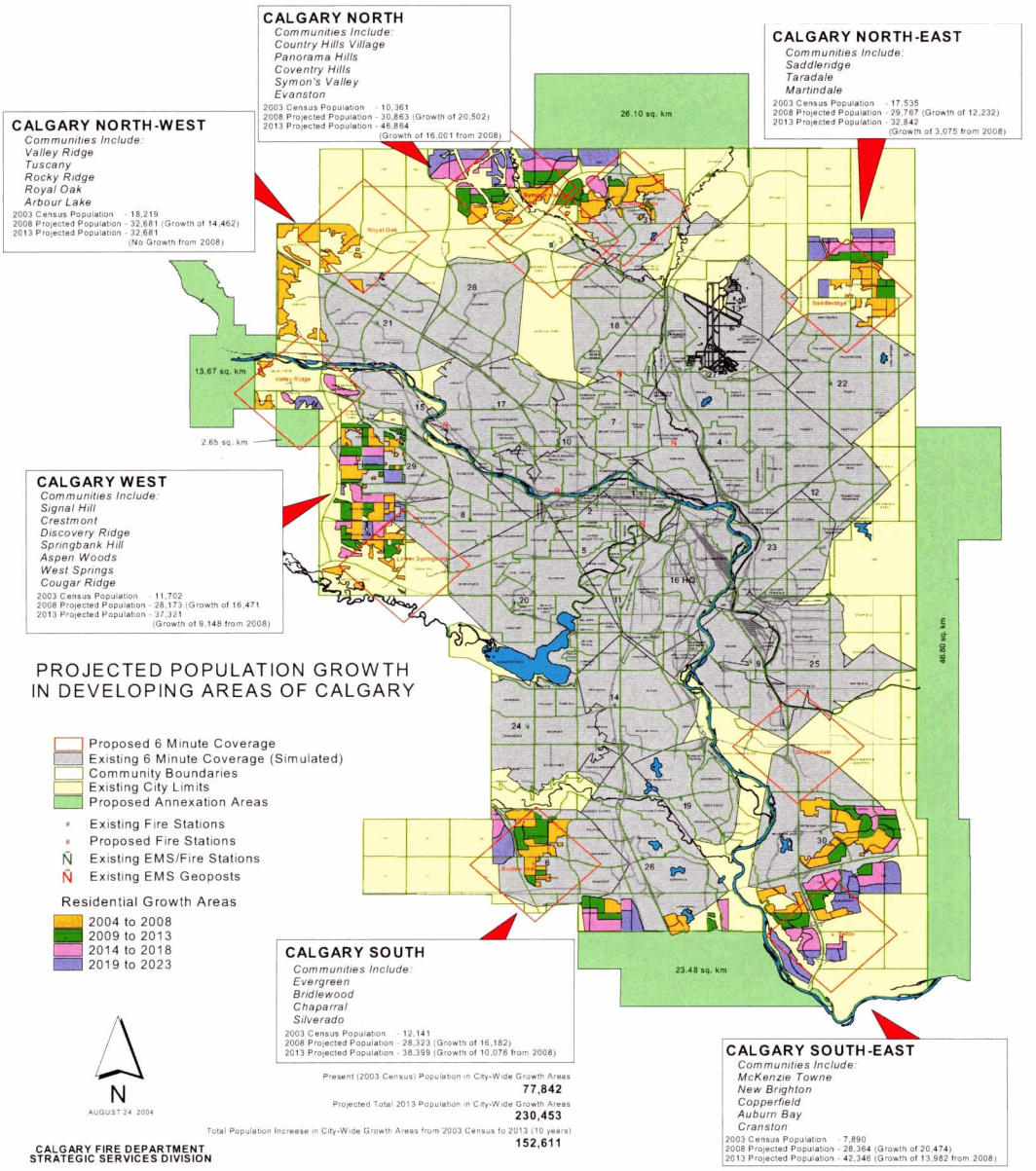
> That's the million dollar question, I don't know, it is very frustrating. I have been doing this for about 10 or 12 years now and I am not having any success in getting people excited about it. People want to live in the trees and they are prepared to take the risk. And although we jump up on our high horse and say that we want to save your house because we know more about it then you do, people don't want to hear that. You don't want to use fear factor, but how do you educate the public that this really is a problem? (Walkinshaw, 2005, Interview)

If communities are actually committed to reducing the risk from WUI fire, they will consider regulatory mechanisms. FireSmart identifies these alternatives in the final chapters of the manual, perhaps its time to bring them to the front.

Appendices

Appendix A: City of Calgary Population Growth Map

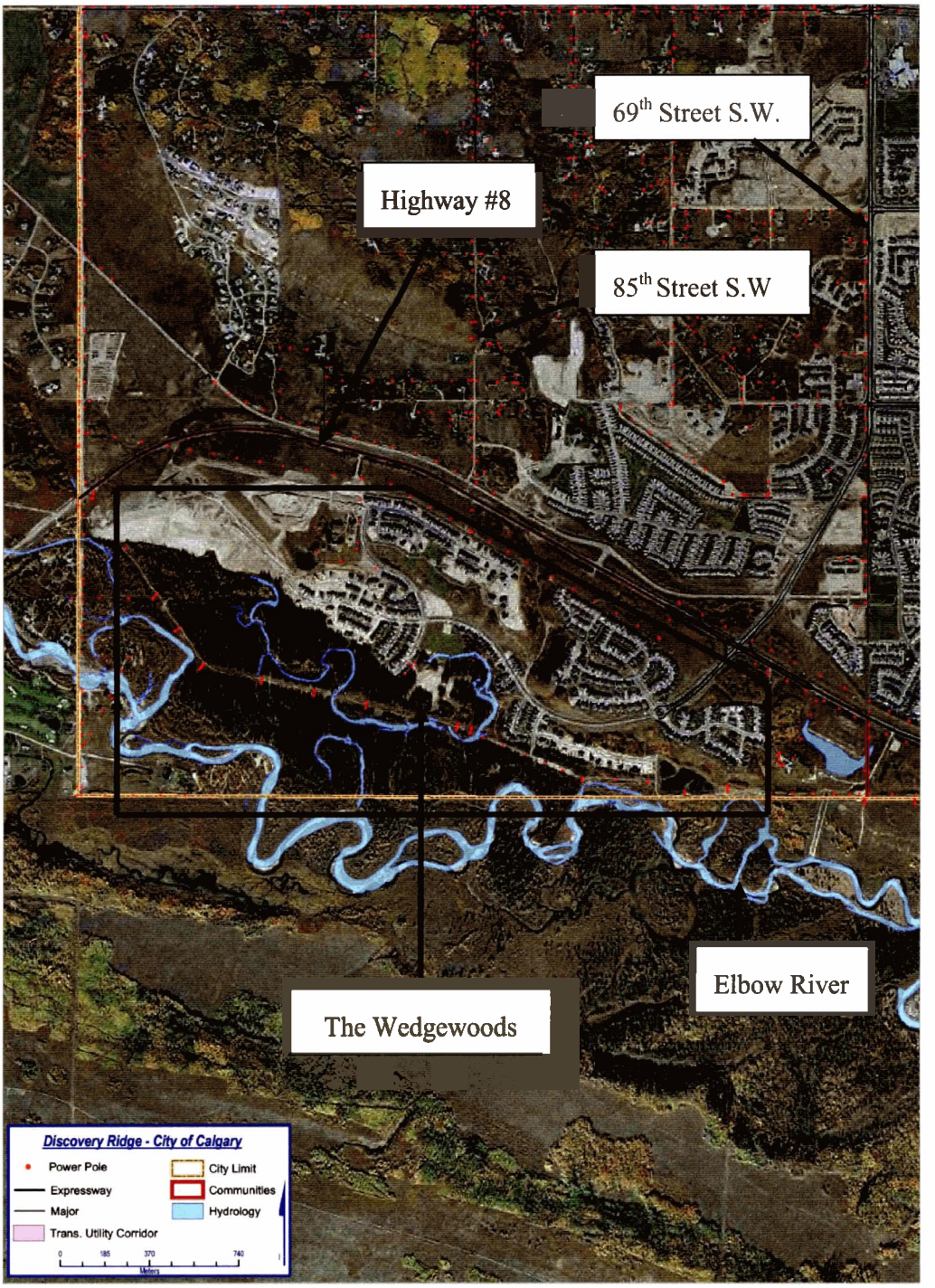
Figure 5: Projected Population Growth in Developing Areas in the City of Calgary



Source: McBride B. (2004). Projected population growth in developing areas of Calgary. Calgary Fire Department: Strategic Service Division. Permission was obtained in advance for the use and publication of this map from the Calgary Fire Department: Strategic Services Division.

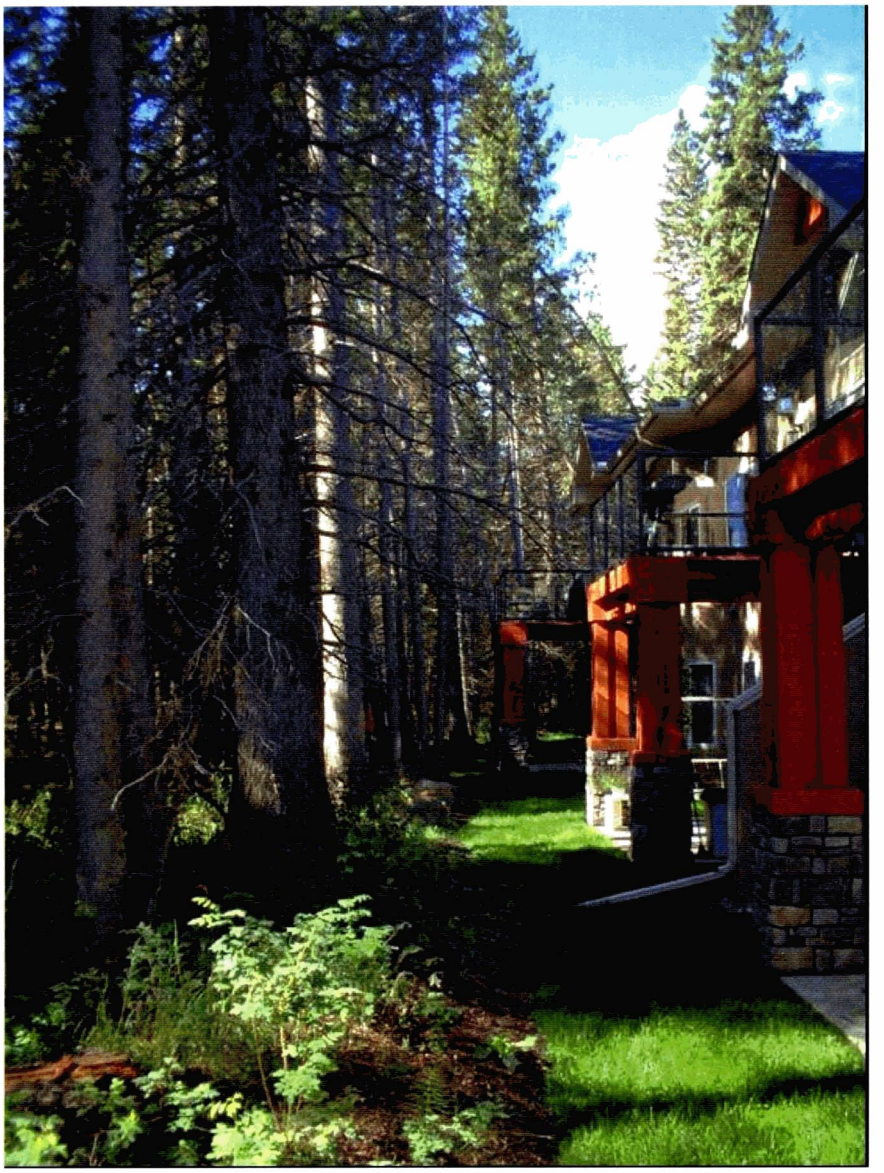
Appendix B: Discovery Ridge

Figure 6: Aerial Photo of Discovery Ridge and the Wedgewoods Apartment Complex



Source: McBride, B. (2004). Discovery Ridge: City of Calgary. Permission was obtained in advance for the use and publication of this map from the Calgary Fire Department: Strategic Services Division.

Figure 7: Discovery Ridge Wildland Urban Interface: West of Wedgewoods Apartment Complex



Source: Ryan McFadden, 2004.

Figure 8: Discovery Ridge Townhouse: West of Wedgewoods Apartment Complex

Source: Ryan McFadden, 2004.

Figure 9: Wedgewoods Apartment Complex Discovery Ridge

Source: Ryan McFadden 2004.

Figure 10: Wedgewoods Apartment Complex Discovery Ridge

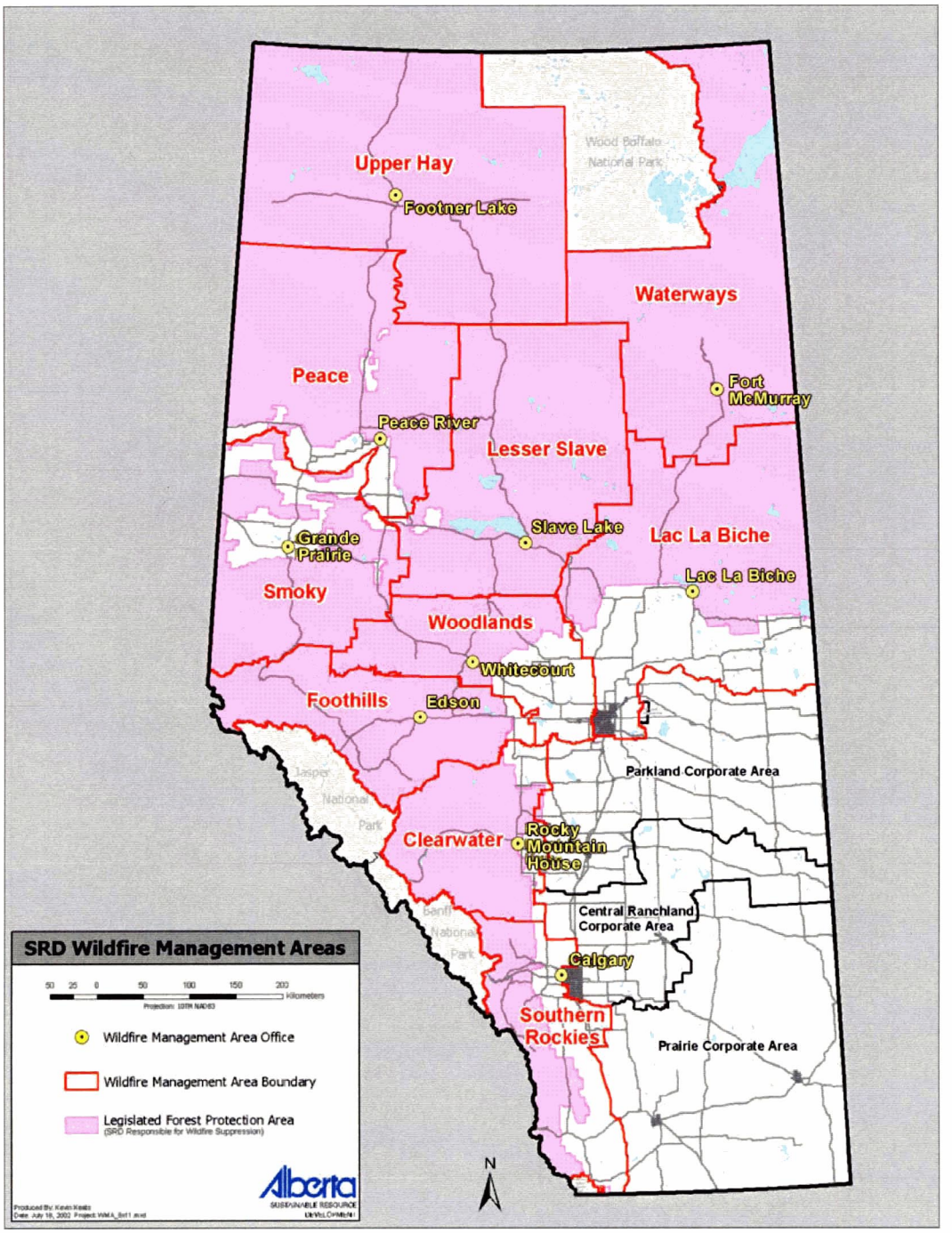
Source: Ryan McFadden 2004.

Figure 11: Single Detached Dwelling Discovery Ridge: West of Wedgewoods Apartment Complex

Source: Ryan McFadden 2004.

Appendix C: ASRD Management Area

Figure 12: Alberta Sustainable Resource Development Management Area



Source: Alberta Sustainable Resource Development, Crown Copyright, 2002-2004 Retrieved February 11, 2005, from http://www3.gov.ab.ca/srd/wildfires/fpd/maps_wfa.cfm.

Appendix D: Elite Interview Information

Table 13: Elite Interview Information

	Town of Canmore	
Name	**Title**	**Organization**
Stew Walkinshaw	Fire Manager Southern Rockies Wildfire Management Area	Alberta Sustainable Resource Development
Steven de Keijzer	Town Planner	Canmore
	Town of Jasper	
Name	**Title**	**Organization**
Alan Westhaver	Jasper National Park Vegetation Fire Specialist and Project Manager	Parks Canada
	City of Calgary	
Name	**Title**	**Organization**
Jennifer Symcox	Natural Areas Project Coordinator	Resource Management Parks
Dave Elphinstone	Natural Areas Manager	Resource Management Parks
Gary Reid	Community Safety Officer	Calgary Fire Department
Ron Chamney	Senior Fire Fighter Environmental Impact	Calgary Fire Department
Greg Mathieson	Safety Codes	Calgary Fire Department
	City of Langford	
Name	**Title**	**Organization**
Rob Buchan	Municipal Planner	City of Langford
	Supplemental Interviews	
Name	**Title**	**Organization**
Kelvin Hirsch	Research Management Advisor	Canadian Forest Service NRCAN
Bart McAnally	Forest Officer II Southern Rockies Wildfire Management Area	Alberta Sustainable Resource Development
Paul Woodard Ph.D	Professor Forest Fire Management and Ecological Effects	Department of Renewable Resources
	Interviewees that Provided Secondary Sources	
Name	**Title**	**Organization**
Rick Arthur	President	Partners in Protection
Pete Bothwell	Forestry Officer Canadian Forest Service Northern Forestry Centre	Natural Resources Canada
Bruce McBride	Geomatics Cartographer, GIS Mapping Land Information	City of Calgary (CFD)
Dave Williams	District Chief Wildland Urban Interface	Calgary Fire Department
Marie-Pierre Rogeau	Wildland Disturbance Consultant	Consultant

Table 14: Extra Questions for Elite Interviews

Category	Questions	
Calgary Parks	Blue	• How does Parks' mandate relate to fire risk
	Green	• Do you think Calgary has urban interface fire risk • Does fire risk take precedence over any mandate or priority considerations • If you designate a community or park as having a high risk for urban interface fire, what would be your response • What are the priorities of Parks • Do you think the public should be consulted for their input
	Yellow	• How would you manage the various interests that may be effected by designating a community as high risk (CFD, Council, Parks, Communications) • What kinds of consultation would you consider • When is an appropriate time to involve the public • How does ecological health and fire risk reduction overlap
	Red	• What communities are at risk, and why • Are there any areas that you would consider a priority • Do you think that there is any interdepartmental hierarchy that would impact your response to risk • Do you feel that you could make a recommendation to Planning that would be supported • Are there other City departments that impact your ability to mitigate fire risk • How would you manage the various interests that may be effected by designating a community as high risk (CFD, Council, Parks, Communications)
Calgary Fire	Blue	• Does the mandate for CFD cover urban interface • Does the CFD have the right resources to respond to urban interface fires • Does the CFD train its new recruits for urban interface response • Does the fire code apply to external building materials • Is there a high incidence of urban interface fire
	Green	• What role does the CFD play in the review/evaluation of new developments • What criteria does the CFD use to evaluate fire safety in a community • If the CFD identifies that a development is high risk, what are the next steps • Is it general practice for the CFD to review new developments for fire risk • What does the CFD do in regards to assessing urban interface for existing communities • How has the CFD responded to the increased awareness of urban interface fire (Kelowna) • Is it CFD's role to conduct urban interface fire assessment • What information do you think is lacking to ensure that CFD is responding quickly and efficiently to urban interface fires

		• Most municipalities have development standards bylaws tat outline the requirements and specifications with respect to roads, water distribution, and other components of subdivision development. Do you think that the development standards for fire protection are based on the risk of fires originating inside structures, not from the wildlands surrounding the structures • Which departments would CFD work with to mitigate the urban interface fire risk • What does urban interface fire mean to you
	Yellow	• Do you feel that the City is doing enough to address this issue
	Red	• No questions
Planning	Blue	• What is the process that developers have to go through to get approval for a new development
	Green	• What risks do you consider when evaluating a new development • What steps do you take to identify a risk in a new development • Who is responsible for determining the steps to mitigate the risk • Do you consider urban interface fire a threat in Calgary • Do you consider any of these practices of any value to Planning? (Why or why not) • Have you considered partnering with other departments to conduct risk evaluation of established communities and/or parks • Are there ways of incorporating these practices that would be supported by Planners • Do you think that developers would support FireSmart requirements • Which departments do you consult when assessing a new project • Have you heard of FireSmart • What criteria do you use to evaluate risk
	Yellow	• Are there penalties for not reducing or alleviating risk • Where does Planning and Development fit within the City's hierarchy • Is there a lead department • Is there a department that might influence a new proposal (more review, hurried evaluation) • Do you ever encounter political pressure when evaluating new developments • What are some of the concerns that might be raised if you were to implement FireSmart practices • Which departments play a big role in helping you to make a decision in terms of risk (Parks, Business and Development, None)
	Red	• Have you analyzed what other communities or municipalities are doing in response to this problem
Alberta Sustainable Resource Development	Blue	• No questions
	Green	• How successful has FireSmart been • What was the scope of the Alberta FireSmart program, do you think that these practices are applicable to a City setting

		• Is the focus of FireSmart for new developments or does it apply equally to existing communities • Does a City setting set different priorities for safe communities (less crown fire) • How would you promote FireSmart to a City community • What is the priority when mitigating fire hazard, property or environment, when is one more important • Research has shown that most ignitions occur as a result of the home ignitability, rather than wildland fuels. How can this information be used to gather support from Planning and Development departments in urban settings
	Yellow	• Do you think that City residents would buy into FireSmart principles or just brush them off as not applicable • Do you think that there is a role for prescribed fire in an urban setting or are the risks too high in terms of immediate outcomes • Is the definition of the wildland urban interface zone over-generalized. Is there a more specific measure for homeowners • Research suggests that the primary and ultimate responsibility for home wildfire protection lies with private homeowners, not public land management agencies (or taxpayers). Why has the Province chosen to adopt voluntary measures of implementation in comparison to the United States where they have used legislation to address the urban fire risk
	Red	• If you have a development already in place, which principles should be a priority

Appendix E: City of Langford Development

Table 15: Development Permit Area Guideline Recommendations for New Developments: Part 1

WUI New Development Concern	Recommendation	Outcomes
One access route	Exterior sprinkler systems on dwellings encouraged	Protection against exposure (WUI) fires
High/Extreme WUI Area	May require a report by a Registered Professional Biologist and a Registered Engineer to assess interface fire hazard	Provide recommendations for minimizing interface fire hazard All buildings within 30 m of a high or extreme wildfire risk area must include fire resistant construction materials for exterior siding and roofing
High/Extreme WUI Area	Council and the approving officer may consider requiring the development of a trail system around the developments	Accommodate fire vehicle access for fighting wildfire in interface areas
High/Extreme WUI Area	Proponents shall consider the incorporation of fire breaks adjacent to residential areas	Incorporate the use of cleared parklands, roads or trails
High/Extreme WUI Area	City Planner may require that landscape plans be prepared in consultation with both a Registered Professional Biologist and a Registered Professional Forester	The plans should provide recommendations for ensuring minimal fuel loading within landscaped areas; ongoing protection from interface fire hazard; and the type and density of fire resistive plantings that may be incorporated within landscaped areas to help mitigate the interface fire hazard.
Hydro Service	Encouraged to be underground and is required for developments of four (4) or more lots	Prevent the disruption of residential sprinkler system service during WUI fires

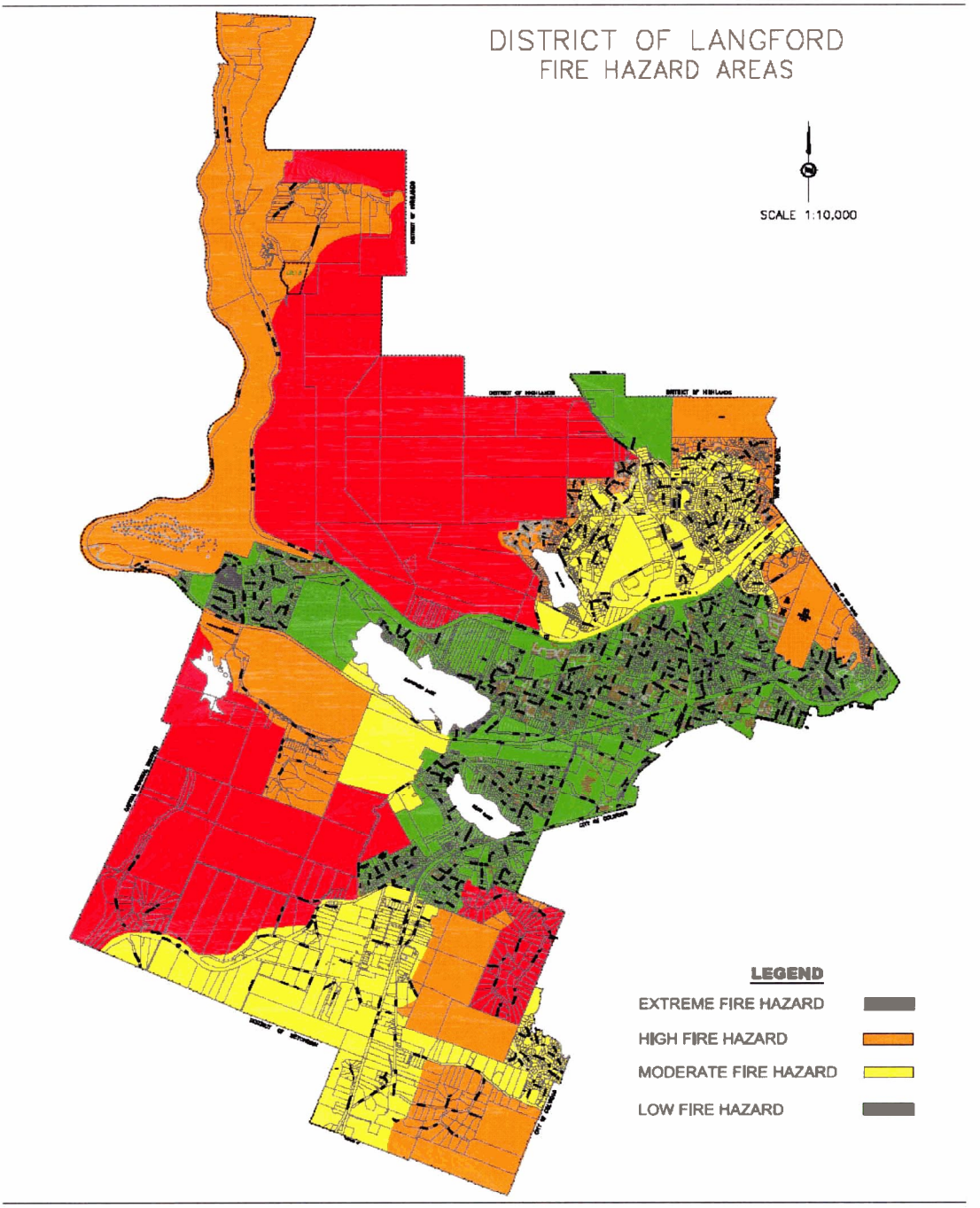
Data Source: City of Langford. (1996). Appendix N: Development permit area guidelines for interface fire hazards (Bylaw No. 635), Official community plan. Retrieved February 18, 2005, from, http://www.district.langford.bc.ca/documents/bylaws/OCP.pdf

Table 16: Development Permit Area Guideline Recommendations for New Developments: Part 2

WUI New Development Concern	Recommendation	Outcomes
Roofing Material	Meet Class "B" fire rating	Fire resistance
Buffer Zones	Fuel reduced buffers around individual homes from the house to the property boundary or 10 m in distance, whichever is lesser	The area may contain natural tree cover in locations approved by the City of Langford, but the owner must landscape and maintain the area with the intent of eliminating the accumulation of combustible debris
Eaves, Attics, Decks, and Openings Under Floors	Screened	Prevent accumulation of combustible material
Wood Burning Appliances	Installed with approved spark arresters	Reduce firebrand or spark dispersion
Building Design and Construction	Be consistent with the standards in the National Fire Protection Association Standard 299 (Standard for Protection of Life and Property from Wildfire)	National WUI standard
Wood Fuel Adjacent to Residence	May require a Section 219 covenant requiring property owners to ensure the 10 m fuel restriction zone around houses and buildings is maintained	If they are not maintained, they may be required to pay a rent charge of $1,000 per year

Data Source: City of Langford. (1996). Appendix N: Development permit area guidelines for interface fire hazards (Bylaw No. 635). Official community plan. Retrieved February 18, 2005, from, http://www.district.langford.bc.ca/documents/bylaws/OCP.pdf

Figure 13: City of Langford Hazard Assessment Map



Source: Buchan, R. (2004), p.3. Permission was obtained in advance for the use and publication of this map from Ron Buchan, Municipal Planner, City of Langford.

Appendix F: City of Calgary Summary of Circulation Replies

Table 17: Summary of Circulation Replies for Discovery Ridge Land Use Amendment LOC2001-0041

Circulated To:	No Reply Received By:	No Obj	Easement Required	Objections Outstanding Issues/ Special Requirements
CPAG		X		Servicing Requirements, Development Agreement
TransAlta		X	X	Require detailed Development Plans for review and approval prior to construction commencing
Telus Comm.		X	X	
Fire Dept		X		
Corp. Properties		X		
Calgary Regional Health Authority		X		
Calgary Board of Education		X		
Separate School Board		X		
Policy Planning & Planning Community Strategies		X		
MD of Rocky View		X		
East Springbank and Discovery Ridge Community Association	May 1, 2002			

Data Source: Report to Council from Calgary Planning Commission. Land Use Amendment. A-7, LOC2001-0041. 2002 May 08. Retrieved January 2, 2005, from http://www.calgary.ca/DocGallery/BU/planning/pdf/cpc_agendas/2002_may_08/loc2001_0041.pdf

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