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Assessing the 'Hazards of Place' Model of Vulnerability: A Case Study of Waterloo Region

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THESIS

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ABSTRACT

This research project examines the Hazards of Place model of vulnerability (as developed by Cutter, 1996) to determine whether it is applicable in a Canadian context. An in-depth case study of the Regional Municipality of Waterloo was used to determine whether the model accurately describes:

a) emergency and community practitioners understandings of vulnerability and vulnerable populations in Waterloo Region
b) emergency and community practitioners perceptions of the variables that influence vulnerabilities
c) mitigation and preparedness efforts that could be enhanced and/or implemented to reduce the vulnerability of individuals and groups in Waterloo Region

To complete this study, in-depth interviews and surveys were conducted with a variety of emergency management practitioners and community organizations at the regional, as well lower-tier municipal levels. The results of the research indicate that the Hazards of Place model of vulnerability provides a reasonably accurate portrayal of emergency practitioners understanding of vulnerability, although some additional variables that influence vulnerability were introduced. Throughout this research, emphasis on building community and individual resilience was also promoted as a key factor in reducing the human and economic losses associated with disaster events. This led to an enhanced version of the 'Hazards of Place' model which recognized the layered and dynamic processes of vulnerability and resilience. Through this, a new understanding of the overall place resiliency was presented which merges the vulnerability and resilience literature to create a new understanding of the relationship between these two concepts.

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CEMC	Community Emergency Management Coordinator
DFAA	Disaster Financial Assistance Agreement
EMO	Emergency Management Ontario
EPC	Emergency Planning Canada
HIRA	Hazards Identification and Risk Assessment
JEPP	Joint Emergency Preparedness Program
NEPE	National Emergency Planning Establishment
NGO	Non Government Organization
PAR	Pressure and Release
PSC	Public Safety Canada
SoVI	Social Vulnerability Index

1. INTRODUCTION

The purpose of this study is to examine vulnerability to disaster events in Waterloo Region, as understood by various emergency management practitioners and community representatives. This section begins with an overview of disasters in Canada to demonstrate the importance of this type of research. Following this, the research questions and key objectives, as well as justification for the research, will be provided. To conclude, an overview of the organization of this thesis is also provided.

Section 1.1 – Background

Due to its large size, as well as varied geographies and climates, Canada is exposed to a wide range of hazards, both natural and human-induced. When these hazardous events interact with vulnerabilities, the results can be extremely costly – both economically and socially (Henstra & McBean, 2005). These types of events are referred to as disasters (also commonly referred to as emergency events in Canada – throughout this paper, these two terms are used interchangeably). A *disaster* is defined as an event in which a community experiences "severe danger and incurs such losses to its members and physical appurtenances that the social structure is disrupted and the fulfillment of all or some of the essential functions of the society is prevented" (Fritz, 1961 quoted in Mileti, 1999).

In recent years, Canada has been fortunate to have suffered minimal human losses as a result of emergency events although the economic costs of recovery have dramatically increased. The Disaster Financial Assistance Arrangements (DFAA), the primary federal organization responsible for distributing funds to provinces and territories

after an emergency event, has experienced tremendous increases in disaster-assistance payouts since 1996. Over a three-year period the Canadian government spent over one billion to recuperate from only three extreme events (the Saguenay River flood (1996), the Red River flood (1997), and the eastern Canada ice storm (1998)) while previous to this time disaster payouts had not exceeded 30 million per event (Hwacha, 2005, p. 176).

The economic losses associated with disaster events are also staggering. Although it is difficult to calculate the true amount of economic loss and the figures can be somewhat unreliable (i.e. Hewitt (2000) lists the economic loss due to the 1998 ice storm at $1.5 billion, whereas Public Safety Canada list the cost of this same event at $5 billion (PSC, 2003)), some sense of the destruction of the disaster event is required (Hewitt, 2000). Table 1.1 below indicates the reported economic losses for the larger emergency events that have occurred in Canada since 1977.

Table 1.1: Economic Losses Due to Disaster Events

Location (Date)	Disaster Type	Cost (CDN$)
Atlantic Canada (1990's)	Collapse/moratoria GFF*	12 billion +
Prairies (1979 - 1980)	Drought	2.5 billion
BC, Prairies, ON, PQ (1988)	Drought + wildfires	1.8 billion
PQ, ON, NB (1998)	Ice storm	1.5 billion
Saguenay, PQ (1996)	Flood	1.0 billion
Manitoba (1993)	Rainstorms/floods	500 million
Calgary (1991)	Hailstorm	450 million
NS to BC (1989)	Forest fires	325 million
Edmonton (1987)	Tornado	250 million
Great Lakes region (1985 - 1987)	Floods	133 million
Southern Ontario (1985)	Tornadoes	120 million
Red River (1997)	Flood	110 million
Western Canada (1990)	Drought	96 million
Ontario (1979)	Rail accident/fire/chemical hazard	90 million
Nova Scotia (1986)	Windstorm/wreck, drilling platform	90 million
Calgary (1981)	Hailstorm	79 million
Ontario (1984)	Windstorm	65 million
Montreal (1986)	Hailstorm	65 million
Quebec (1983)	Coastal flooding	58 million
Western Canada (1985)	Drought + wildfires	50 million
St-B-le-Grande (1988)	Fire/chemical hazard (PCB's)	50 million

*GFF = Atlantic ground fish fishery

Source: Hewitt, 2000

These figures demonstrate the enormous losses experienced by individuals, businesses, communities and governments when a disaster event strikes. This table confirms research which has indicated that in developed nations such as Canada, although mortalities are usually quite low, the economic impacts and costs of recovery have been rapidly increasing (Hwacha, 2005; Newkirk, 2001). In Table 1.1, many of the most costly emergency events have occurred in the past ten to fifteen years. This demonstrates the importance of effective planning and preparedness that allows individuals, communities and households to increase their resiliency and their ability to recover quickly and efficiently after an emergency event.

While economic losses and recovery costs are important indicators of the impacts of extreme events, loss of human life, injuries and the psychological impacts of disasters on humans is also important to take into consideration. Table 1.2 below depicts historical human impacts for natural disaster events in Canada over the past century. The mortality, injury and evacuation rates indicate the tremendous impact of disaster events on humans.

Table 1.2: Historical Human Impacts of Natural Disaster in Canada: 1900 – 2005

Historical Impact of Natural Hazards in Canada					
Time Period	Disaster Type	Number of Events	Mortalities	Injuries	Evacuations
1900 - 2005	Heat Wave	5	1,900	---	---
1912 - 2005	Tornadoes	31	142	1,930	6,500
1950 - 2003	Violent Storms	18	137	---	---
1900 - 2005	Forest Fire	52	366	---	155,000
1950 - 2005	Drought	37	0	---	---

Source: Belanger et al., 2008

As the economic losses, recovery costs and human impacts of disasters in Canada are increasing, these trends may be exacerbated by anthropogenic forces. In a social and

political era where the environmental discourse is dominated by issues related to climate change, emergency management planning and preparedness is becoming increasingly relevant (Haque & Burton, 2005, p. 338). While general consensus on the impact of global warming has yet to occur, scientists and climatologists project that the increases in greenhouse gases in the atmosphere will result in shifts in the frequency, intensity and duration of extreme events (IPCC, 2001, p. 14; Haque & Burton, 2005, p. 338; Newkirk, 2001). Note that in Table 1.1 above, over eighty percent of the disaster events were caused by natural hazards, many of which were the result of extreme weather events (i.e. ice storms, droughts, storms, tornados etc.). Watson (2000) notes that the predicted increases in these extreme weather events will lead to "significant economic losses and loss of life" (p. 362). As discussed above, these extreme events require significant funds for recovery which are often diverted from other social investments (McBean, 2005, p. 363).

In light of these developments, disaster management policies in Canada have shifted towards a philosophy of mitigation and risk reduction (Henstra & McBean, 2005). While hazardous events will continue to occur, and perhaps even increase, the social, economic and human losses attributed to these events can be significantly reduced through a variety of mitigation and preparedness programs, as well as through a greater understanding of the social, economic and political processes that work to create vulnerability. This research builds on these recent trends with a focus on understanding vulnerability, specifically within a Canadian context, as well as examining methods for building resilience at a variety of scales.

Section 1.2 – Objectives

This thesis examines the perceptions and opinions of a variety of emergency management practitioners and community representatives in Waterloo Region related to vulnerability and resilience in a disaster management context. Specifically, this research examines an American model of vulnerability, the 'Hazards of Place Model of Vulnerability' (discussed in detail in section 3.2.1), as developed by Susan Cutter (see Cutter, 1996, 2003). The intention of this research is to examine whether the American model is applicable and adaptable to a Canadian context, based on a case study of Waterloo Region. This research also seeks to understand the underlying processes affecting vulnerability in the region, as well as how to build resilience on a variety of levels, including individual and community.

Based on the above objectives, this research will attempt to answer four distinct research questions:

1) Based on the perceptions of a variety of actors and decision-makers involved in the emergency management process in Waterloo Region, is the Hazards of Place model of vulnerability applicable to a mid-sized Canadian city?
2) Based on the opinions and perceptions of emergency management practitioners, what variables appear to influence vulnerability in Waterloo Region? Are these variables similar to those described by Cutter (1996; 2003) in the Hazards of Place model?
3) Does the Hazards of Place model of vulnerability provide an accurate depiction of the emergency management practitioners understanding of vulnerability?

4) What mitigation efforts could be focused on the 'Social Fabric' portion of the vulnerability model to decrease the overall social vulnerability of Waterloo Region and build resilience in the community?

Section 1.3 – Justification of Research

This research seeks to fill a gap in the literature through its examination of vulnerability in a developed country context. While academics and practitioners generally agree that social, economic and political processes are involved in the creation of disaster events, few studies have been undertaken in Canada to assess the role of vulnerability in emergency events. Although a broad base of vulnerability literature exists, general consensus on the meaning of vulnerability and the variables that influence vulnerability is lacking (Brooks, 2003; Henstra & McBean, 2005). This research attempts to strengthen the body of literature related to vulnerability through an analysis specific to Canada, as a developed country.

The argument has also been made that Canada is lacking in fully developing its emergency management program. Henstra & McBean (2005) argue that Canada has yet to fully implement mitigation into its emergency management philosophy, instead focusing mainly on response and recovery. More recently, the federal government of Canada has been pushing for mitigation approaches which recognize the need for enhancing community and individual resiliency to emergency events, yet a comprehensive understanding of appropriate mitigation and resilience enhancing methods is lacking (Murphy, 2008). This research offers a specific opportunity to examine a

proactive emergency management community and provide insight into vulnerability and resilience building for other Canadian cities.

Ferrier (2008) notes that emergency management has shifted over the past thirty years, from an all-hazards paradigm, whereby the approach to response and recovery was essentially similar to all disaster types, to a disaster risk approach wherein response and recovery are based upon the individual community's identified risks through the incorporation of mitigation and resilience. Yet he argues that the current philosophy does not adequately address the vulnerability that exists within the community. This research offers an important opportunity to critically examine vulnerability in Waterloo Region.

This research also aims to add to the current vulnerability and resiliency literature through its emphasis on the relationship between vulnerability and resilience. While recent literature has generally reached consensus on the inherent connection between vulnerability and resilience, the nature of this relationship has not been clearly established (Smit & Wandel, 2006; Gallopin, 2006; Handmer, 2003). Through an examination of vulnerability and resilience in Waterloo Region, this research will attempt to add to the discussion and clarify the exact nature of this relationship.

Section 1.4 – Thesis Organization

Beginning with the introductory chapter, this thesis includes six chapters. Following the introduction, the literature review explores the history of emergency management in Canada, as well as an in-depth overview of the relevant literature related to both the concepts of vulnerability and resilience. Chapter 3, the methodology section,

provides background information on Waterloo region, including historical disaster events and an overview of the emergency framework for the region. The conceptual framework includes a summary of the Hazard's of Place model of vulnerability and the methods used to analyze the model. The results, Chapters 4 through 7, include the relevant findings related to the research goals, whereas the discussion in Chapter 8 examines how the results inform and develop the relevant vulnerability literature. Chapter 9 concludes the findings of this research through a summary of the relevant points, as well as providing suggestions for future research.

2. LITERATURE REVIEW

The following section provides an overview of the relevant literature related to the field of emergency management. This begins with an outline of the key terms used throughout this thesis, followed by a brief history of the development of emergency management in Canada, as well as the relevant legislation. This section continues on to an introduction of the current philosophy of emergency management, followed by an in-depth discussion of the vulnerability and resilience literature.

Section 2.1 – Emergency Management Definitions

Although there is some discrepancy and divergence in the use of key terms in the emergency management literature, a definition for each term is provided here. These understandings of risk and hazard are the most common and provide an understanding that clearly separates the concepts of risk and vulnerability.

A ***hazard*** is defined as an event, either natural, technological, or human-induced (both accidental and intentional), that "has the potential to cause adverse effects within a community, organization, or some subset of the population" (Ferrier, 2008, p. 108; Blaikie *et al.*, 1994). The impact the hazard will have on a community is influenced by the level of risk. ***Risk*** is defined as the "likelihood that a particular hazard will cause adverse effects within a community, an organization, or some subset of the population" (Ferrier, 2008). The level of risk experienced is a function of both the social risk and the physical risk. When a hazard threatens a community, the physical risk is a product of the frequency or probability of the hazard occurring, as well as the magnitude of the hazard

itself (Cutter, 1996; Ferrier, 2008). For example, a flood could have a 1% chance of occurring and is often referred to as the 100-year flood. A basic representation of physical risk can be represented as:

Physical Risk = Frequency of Hazard x Magnitude of Hazard

The amount of social risk experienced by that community is a product of the interaction of the hazard and the vulnerability of the community. ***Vulnerability*** represents the susceptibility of a community to experience losses, including human, physical and economic, as a result of a hazard. This can be represented as:

Social Risk = Hazard x Vulnerability

This implies that the same level of hazard can result in low risk for a location with low vulnerability while a location with high vulnerability experiences high levels of risk (Alexander, 2002; Johnstone, 2007). Therefore, the risk level can be understood through the frequency of the hazard event, as well as through the susceptibility of the community to that hazardous event. This is a common approach to emergency management wherein disaster risk is understood to be a product of the interaction between the hazard frequency and magnitude, exposure to the hazard and vulnerability (Birkmann, 2007). ***Resilience***, on the other hand, is a measure of the ability of a social entity (i.e. individuals, households, groups, or communities) to cope, bounce back, or respond positively to adversity, external stresses and disturbances. Vulnerability and resilience are two key terms in the emergency management literature and as such, are discussed in detail in sections 2.3 and 2.4, respectively.

Another term that is used throughout this thesis is the concept of '*place*'. While the concept of place has been approached from a variety of paradigms, and has generated research and debate in the academic community, a very brief overview is provided here. ***Place*** refers not only to a particular location, but also to the values, identities and significances that are created and perpetuated within the place (Norton, 2002). Thus, places are viewed as socially-constructed geographic locations where the inhabitants and visitors have attributed a strong identity, character and meaning derived from the social, economic, political, as well as biophysical processes occurring in the area (Johnston, 1991; Tuan, 1979). In this sense, the meaning of place is derived socially, by the experiences and perceptions, not only of the inhabitants, but also by those individuals and groups outside of the place.

Section 2.2 – History of Emergency Management in Canada

Emergency management in Canada was developed within the context of civil defense beginning during World War II and continuing throughout the late 1940's and early 1950's (Ferrier, 2008). Throughout the late fifties, the cold war and the threat of nuclear warfare led the government to establish the Emergency Measures Organization in 1959. During this period, emergency management was heavily influenced and directed by military philosophy and the training exercises and planning undertaken reflected this influence (Ferrier, 2008). The focus remained on civil defense and wartime planning until the late 1960's when attention slowly turned to civil protection and the risk from natural and technological disasters throughout the 1970's (PSC, 2008, Ferrier, 2008). During this period, the Emergency Measures Organization was recreated as the National Emergency

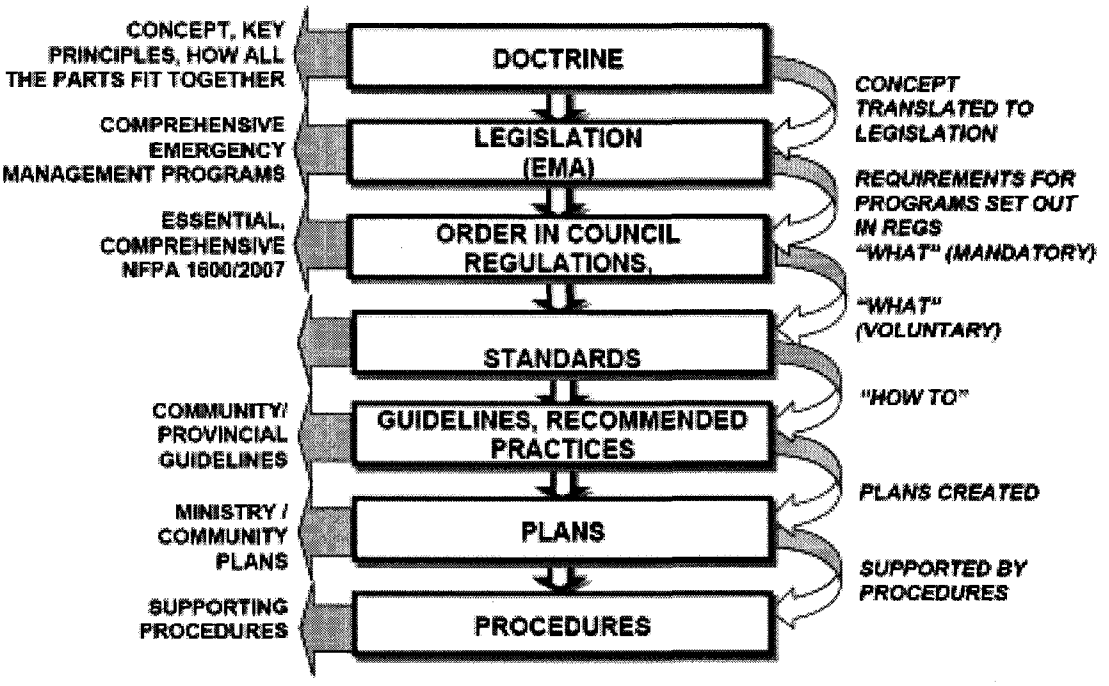
Planning Establishment (NEPE) and later renamed Emergency Planning Canada (EPC). Throughout the latter half of the twentieth century, both the federal and provincial governments of Canada encouraged and facilitated development in the emergency management field (Henstra & McBean, 2005). In 1970, the Disaster Financial Assistance Arrangements (DFAA) was established to provide a cost-sharing program between the federal and provincial/territorial governments for natural disaster events. The DFAA distributes federal funds to provinces or territories to compensate them when recovery costs exceed "what individual provinces or territories could reasonably be expected to bear on their own" (PSC, 2008). In 1980, the government developed the Joint Emergency Preparedness Program (JEPP) to contribute to emergency preparedness programs and initiatives across Canada. Although there are some criticisms of this program, JEPP has distributed over $184 million across Canada to develop emergency response programs and protect critical infrastructure (PSC, 2008).

Currently, responsibility for emergency management is shared between the three levels of Canadian government: federal, provincial and local (Henstra & McBean, 2005). At the federal level, Public Safety Canada (PSC) is responsible for facilitating research, national policy and corroborating with emergency management organizations across Canada, including provincial and local authorities (PSC, 2008). The *Emergency Management Act*, revised in 2007, sets out the roles and responsibilities of the government at the federal level, with emphasis on prevention and mitigation, preparedness, response and recovery, and critical infrastructure protection (PSC, 2008).

Most disaster events tend to fall under the jurisdiction of the provincial government, with each province employing a specific agency to handle emergency management (Emergency Management Ontario (EMO) is the Ontario organization responsible for emergency management) (Henstra & McBean, 2005). The *Emergency Management and Civil Protection Act* informs EMO by providing a legal basis and framework for responding to emergencies. After the September 11th, 2001 terrorist attacks in New York City, the Ontario government (along with the other provincial and federal governments) was moved to reform its emergency management and preparedness programs to a more comprehensive approach which incorporated the threat of intentional acts of harm (Ferrier, 2008). *Ontario Regulation 380/04* was amended in 2004 to establish the emergency management program's minimum requirements for each municipality in Ontario (EMO, 2008). The essential level regulations require each community to engage in the development of emergency response plans, hazard identification and risk assessment, designating a community emergency management coordinator, establishing an emergency operations centre and engaging in practice exercises and training. EMO released an Emergency Management Doctrine in 2005 that outlines the official hierarchy for emergency management in Ontario and is shown in Figure 2.1 below. The document states:

> "the new emergency management concept... embedded in the hierarchy of documents necessary to implement the concept, including legislation, regulations, guidelines, plans and procedures. Taken together, these documents provide a strategic, coherent and integrated approach to emergency management in Ontario and assist in developing federal, provincial and municipal strategies to reduce risk around a common concept and terminology"
>
> Source: EMO-EMD, 2005

Figure 2.1: Hierarchy of Emergency Management Documents in Ontario



Source: EMO-EMD, 2005

Although the original plan was established to provide a timeline for local municipalities to develop from the essential level to the comprehensive level, at this time, the importance allocated to emergency management after 9/11 has diminished and has yet to be pushed to the comprehensive level. A more in-depth discussion of local-level responsibilities, specifically related to Waterloo Region, is provided in section 3.1.

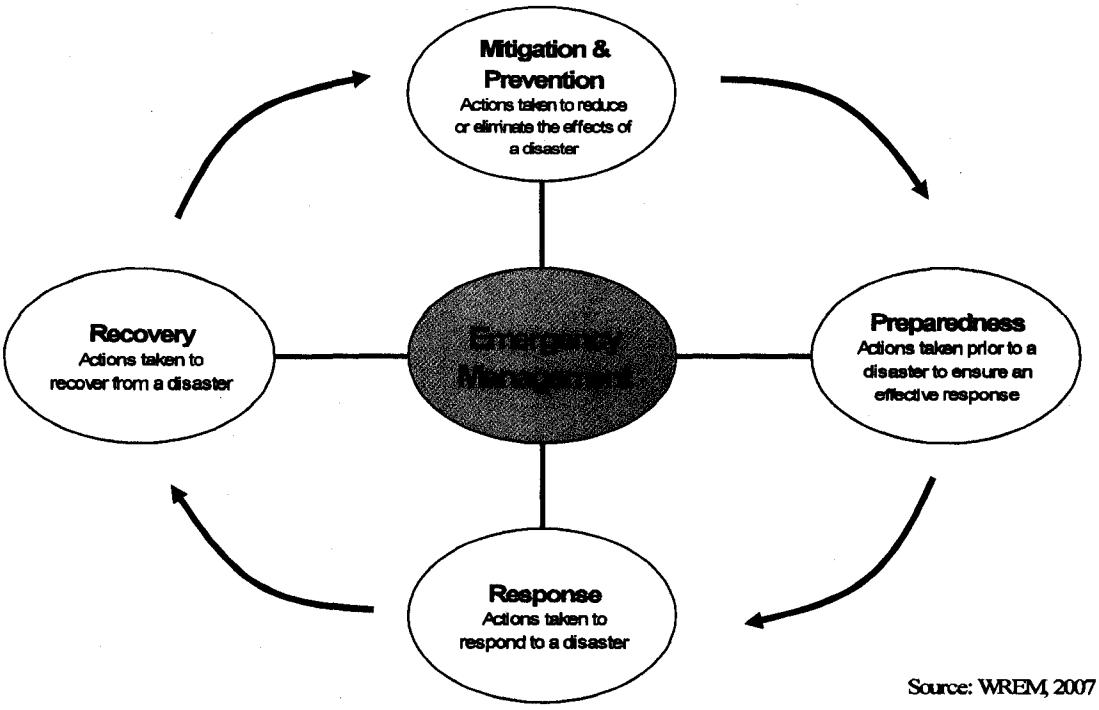
While the above sections focused on a brief history of emergency management in Canada, the following section provides an overview of the current philosophy of emergency management in Canada. ***Emergency management*** is the continuous process through which individuals, groups and communities attempt to avoid and/or minimize the risks and damages associated with hazards and emergency events. This process involves

all aspects of preparing for and recovering from emergency events, including preparedness, response and recovery and mitigation (EM, 2007; Henstra & McBean, 2005). Emergency management, also referred to as disaster management, requires the coordination of a variety of different social actors, including governmental, social and academic organizations as well as local business and community members.

The current philosophy of emergency management revolves around four key categories, including mitigation/prevention, preparedness, response and recovery (see Figure 2.2). These pillars of emergency management work together to reduce the human, physical and financial losses before, during and after a disaster event strikes.

Mitigation and prevention incorporate the actions and activities that work to minimize the probability of a hazard developing into an emergency event (WREM, 2007). Mitigation and prevention are long-term processes which attempt to decrease the risks and vulnerabilities of individuals and communities. Mitigation can occur through structural and non-structural approaches, or a combination of both. Structural mitigation involves the use of technological solutions to build physical structures that decrease the potential risk for disaster. Examples include the building of levees and the introduction of building codes. Non-structural mitigation incorporates social and economic legislation to decrease vulnerabilities and includes building zones, land-use planning and insurance policies (Haddow & Bullock, 2004).

Figure 2.2: The Four Pillars of Emergency Management



Source: WREM, 2007

The preparedness category includes the activities which improve the effectiveness of the community's response to a disaster event. These activities include the establishment of community response plans, emergency operation and communication centres, as well as public education, training and exercises (WREM, 2007). The response category involves those activities which take place during or immediately after the disaster event. This includes the mobilization of emergency response personnel (i.e. police and firefighters), human and supply resources and the declaration of an emergency (WREM, 2007). In this phase the focus is mainly on search and rescue missions, as well as fulfilling the basic needs of the affected community. The final category incorporates the long-term activities undertaken to recover from the disaster event in an attempt to

return to pre-disaster norms (WREM, 2007). Increasingly, the recovery period of disasters is viewed as an opportunity to reduce vulnerability in the community and build adaptive capacity for future events.

These recent and emerging shifts in emergency management philosophy have led researchers and practitioners alike to begin to examine concepts of vulnerability and vulnerable populations. As hazardous events in Canada are likely to increase (Buckle et al., 2000; Haque & Burton, 2005; IPCC, 2001; Newkirk, 2001), the importance of having a thorough understanding of vulnerability has never been more important. Through an in-depth understanding of the processes affecting vulnerability, initiatives, programs and actions taken throughout all pillars of emergency management could be enhanced to increase the overall resilience and coping capacity of the community.

Section 2.3 – Vulnerability

As a developing field in Canada, emergency management has focused on the identification of hazards and risks, the probability of these events occurring, and the consequences if the identified hazards and risks were to occur. After these processes have been completed, emergency managers examine prevention and mitigation policies as one element of the emergency management cycle (Dunning, 2007). Yet many researchers have argued for the need for a more holistic approach which examines disaster events in terms of the varying levels of vulnerabilities that exist within the community (Blaikie *et al.*, 1994; Hewitt, 1997; Henstra & McBean, 2005; Adger, 2006; Buckle *et al.*, 2000; Ferrier, 2008). Historically, disasters were viewed as purely physical events – acts of God - where the victims were passive actors in the disaster process. Increasingly, disaster

events are viewed as a complex interaction between the physical event and the social processes that exist within the community (Ronan & Johnston, 2005; Cutter, 2000; Ferrier, 2008).

Vulnerability is a relatively new concept in the disaster management literature, and as such, has a wide variety of meanings and understandings (Birkmann, 2006). Villagrán's (2006) review of vulnerability literature determined that the term has been perceived through a variety of different meanings, including:

> 1. *As a particular condition or state of a system before an event triggers a disaster, described in terms of criteria such as susceptibility, limitations, incapacities or deficiencies e.g. the incapacity to resist the impact of the event (resistance) and the incapacity to cope with an event (coping capacities);*
> 2. *As a direct consequence of the exposure to a given hazard; and*
> 3. *As the probability or possibility of an outcome of the system when exposed to an external event associated with a hazard, expressed in terms of potential losses such as fatalities or economic losses, or as the probability of the person or a community reaching or surpassing a certain benchmark.*
>
> (Villagrán, 2006, p. 11)

One of the earliest uses of the term vulnerability in a disaster management context dates back to the early 1970's, when a disaster preparedness report was presented to the United States Congress by the Office of Emergency Preparedness in 1972. This report recognized vulnerability as the predisposition of individuals, groups, communities, as well as other economic and infrastructure organizations, to be affected by a natural disaster event (OEP-EOP, 1972). While this report does not provide an explicit definition of vulnerability, it recognizes that both the hazardous event and social processes are key ingredients in the creation of disaster events (Villagrán, 2006).

The notion that disaster events are caused not only by exposure to hazardous events, but also by the interaction of social and economic processes was further developed by O'Keefe *et al.* wherein the authors argued the need for "taking the naturalness out of natural disasters" (O'Keefe *et al.*, 1976). They provided empirical evidence which suggested that disaster events and the associated losses were increasing and the causes of these observed increases could be attributed to "the growing vulnerability of the population to extreme weather events" (O'Keefe *et al.*, 1976). Interestingly, although O'Keefe *et al.* are generally credited as some of the earliest researchers to espouse this understanding of vulnerability, one of the earliest proponents of the socially constructed nature of disasters dates back to Lisbon in 1756. After an earthquake and tsunami struck Lisbon, Portugal on November 1, 1755, Rousseau (1756) wrote a letter to Voltaire noting, among other things, that the disaster was caused not by the earthquake and tsunami, but by the dense population structure and the actions of the population after the natural hazard struck:

> The majority of our physical misfortunes are also our work. Without leaving your Lisbon subject, concede, for example, that it was hardly nature that there brought together twenty-thousand houses of six or seven stories. If the residents of this large city had been more evenly dispersed and less densely housed, the losses would have been fewer or perhaps none at all. Everyone would have fled at the first shock. But many obstinately remained . . . to expose themselves to additional earth tremors because what they would have had to leave behind was worth more than what they could carry away. How many unfortunates perished in this disaster through the desire to fetch their clothing, papers, or money?
>
> (Rousseau, 1756; Kelman, 2007)

The following sections outline how the concept of vulnerability has developed since the mid-eighties and examines a number of models that explain how the various

social, economic, political and biophysical processes interact with each other to create vulnerable populations.

Section 2.3.1 – Internal and External Processes of Vulnerability

In the late 1980's, Chambers (1989) developed a more concrete definition of vulnerability wherein it was understood as the "exposure to contingencies and stresses and the difficulty which some communities experience while coping with such contingencies and stresses" (Chambers, 1989: 1). This understanding of vulnerability incorporated both internal and external processes:

> Internal Processes: associated with individual and community incapacity to cope without experiencing damaging losses (influenced by social and economic factors).
>
> External Processes: related to exposure to external shocks (sudden and unpredictable events, i.e. extreme weather events, epidemics) and stresses (longer-term, chronic or predictable events, i.e. malnutrition, declining resources) (influenced by natural and biophysical processes).

Through this conceptualization, vulnerability is viewed as the opposite of security, and livelihoods, income levels and management of assets are the key components which provide individuals and communities with the opportunity to absorb and cope with the stresses and shocks of disaster events (Chambers, 1989; Villagrán, 2006). Yet the Chambers model, while incorporating both the physical and social aspects of

vulnerability, has an inherently individual focus which fails to explicitly acknowledge wider scale social and political systems which distribute access to income and resources.

Liverman (1990) developed an approach to potential measures of vulnerability that incorporates a range of political, economic, environmental and social activities and processes at the individual, as well as larger scale levels. These processes are listed in Table 2.1 below.

Table 2.1: Potential Measures of Vulnerability

Environmental Conditions	Technological Conditions	Social Relations	Demographics and Health	Land Use and Ownership	Economy and Institutions
i.e. temperatures, rainfall, soil types, storms, genetic varieties and meteorological extremes	i.e. the use of irrigation, reservoirs, genetically modified seeds and fertilizers, indigenous agricultural techniques	i.e. social class, income, gender, race and ethnicity	i.e. health, age, population densities, populations growth rates	i.e. unstable land tenure, land productivity, levels of independence, landlessness	i.e. lack of access to markets, artificial or inflamed prices, lack of supports, debt

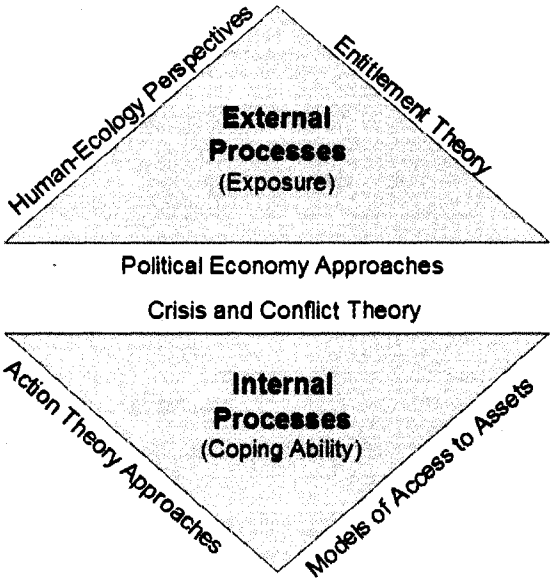
Source: Liverman, 1990

Liverman (1990) also emphasizes the importance of geography and the inherent uniqueness of each place as the internal (social) and external (hazard) processes interact and manifest themselves at the local scale. While Liverman (1990) enhances Chambers (1989) approach to vulnerability through the inclusion of a wider range of processes at higher scales, there is a lack of explicit recognition of the larger scale political and economic processes that impact the ability of individuals, groups and communities to mitigate, respond and cope with emergency events.

This led Watts and Bohle (1993) to expand the Chambers model of vulnerability through the incorporation of their view of vulnerability as a "multi-layered and multi-

dimensional social space defined by the political, economic, and institutional capabilities of people in specific places and times" (Villagrán, 2006, p. 12; Watts and Bohle, 1993). While the Watts and Bohle (1993) model is similar to the Chambers model of internal and external processes of vulnerability, the factors which influence these processes has been enhanced. Figure 2.3 depicts the Watts and Bohle model of vulnerability.

Figure 2.3: Watts and Bohle Model of Vulnerability:



In the Watts and Bohle model, the external processes are still related to the exposure to shocks and stressors, and these external factors are influenced by the following:

a) *Human-Ecological Perspectives*: these perspectives focus on population dynamics and the capacities of individuals, groups and communities to manage their surrounding environment

b) *Entitlement Theory*: argues that those individuals, groups and communities who are unable or incapable of obtaining and managing their assets through legitimate economic means have increased vulnerabilities

c) *Political Economy Approaches*: examines the social inequalities and injustices which lead to struggles and conflicts between classes of people. This approach relates vulnerability to exposure to social inequalities and lack of control of assets

The internal processes, or coping abilities, of individuals and groups is influenced by the following:

a) *Action Theory Approaches:* examines the means and ways incorporated by people which allows them to act, either by free will, or as a consequence of societal, governmental or economic constraints

b) *Models of Access to Assets:* these models relate vulnerability to control over their assets and provides techniques through which individuals can mitigate their vulnerability through access to resources and assets of a different nature

c) *Crisis and Conflict Theory:* examines how control over resources and assets, as well as capacities to manage resources and assets through crisis situations can influence vulnerabilities.

(Watts and Bohle, 1993)

Similar to the Chambers model, Watts and Bohle (1993) incorporate both internal and external processes of vulnerability, yet the Watts and Bohle model examines external processes not as geographical and physical characteristics, but as the wider scale political, economic and social processes which affect individual capacity to respond and cope with disaster events (Watts and Bohle, 1993; Villagrán, 2006). Through this approach, access

and control over assets, including economic, socio-political, infrastructural, ecological and personal, is recognized as a key process affecting vulnerability levels. In this sense, those individuals and groups who have control over key assets have increased their coping capacities to disaster events, thereby reducing their vulnerability. This model of vulnerability is effective because is provides not only an explanation of vulnerability, but also some of the key causes and origins (Villagrán, 2006). The Watts and Bohle (1993) model also incorporates the geographical importance of place through the interaction and manifestation of various processes at the local scale.

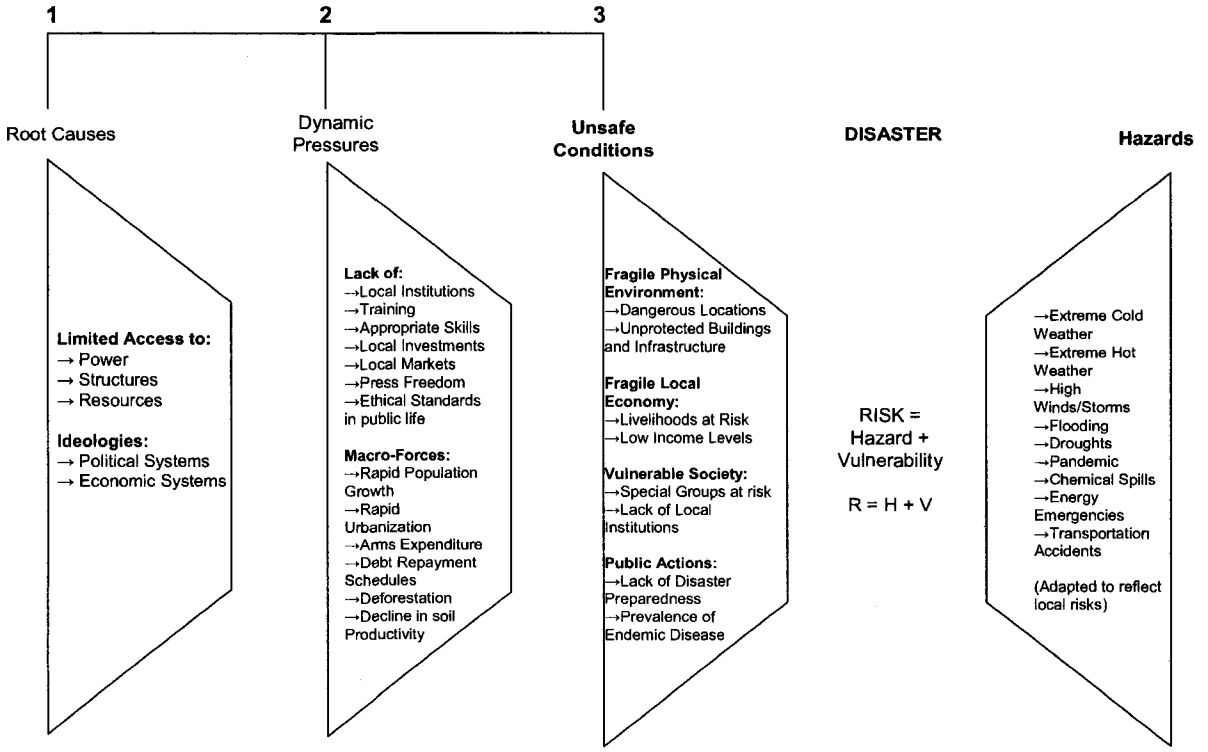
Section 2.3.2 – Pressure and Release Model of Vulnerability

Blaikie *et al.* (1994) also emphasized the examination of vulnerability through an exploration of its underlying causes and origins. The Pressure and Release Model of Vulnerability (PAR), developed by Blaikie *et al.* (1994), is a schematic expression of the complex interactions between the underlying social processes that create vulnerability and the hazard itself. The model is built upon the juxtaposition between these two opposing forces. In this model, the 'pressure' builds through increasing vulnerability and exposure to hazards, while the 'release' conceptualizes the actions taken to reduce the impact of the disaster – the reduction of vulnerability (Blaikie *et al.*, 1994). Figure 2.4 depicts the PAR model – specifically the progression of vulnerability from root causes through to their manifestations as unsafe conditions.

The pressure side of the model indicates a progression of vulnerability that starts with the *Root Causes*, including limited access to power, structures and resources, as well as vulnerabilities created through specific political and economic ideologies. These root

causes are widespread processes that impact the distribution of resources and are a reflection of the distribution of power in a society (Blaikie *et al.,* 1994). Individuals and groups who are marginalized and lacking in power, either economically, politically and/or socially, are exposed to a double source of vulnerability. These groups are less likely to have secure access to quality livelihoods and resources and they have a tendency towards lower priority for government action and intervention (Blaikie et al., 1994).

Figure 2.4: PAR Model – Progression of Vulnerability



Source: Blaikie *et al.*, 1994

The *Dynamic Pressures* "channel the root causes into particular forms of insecurity" and are visibly manifested as *unsafe conditions* (Blaikie et al., 1994, p. 24).

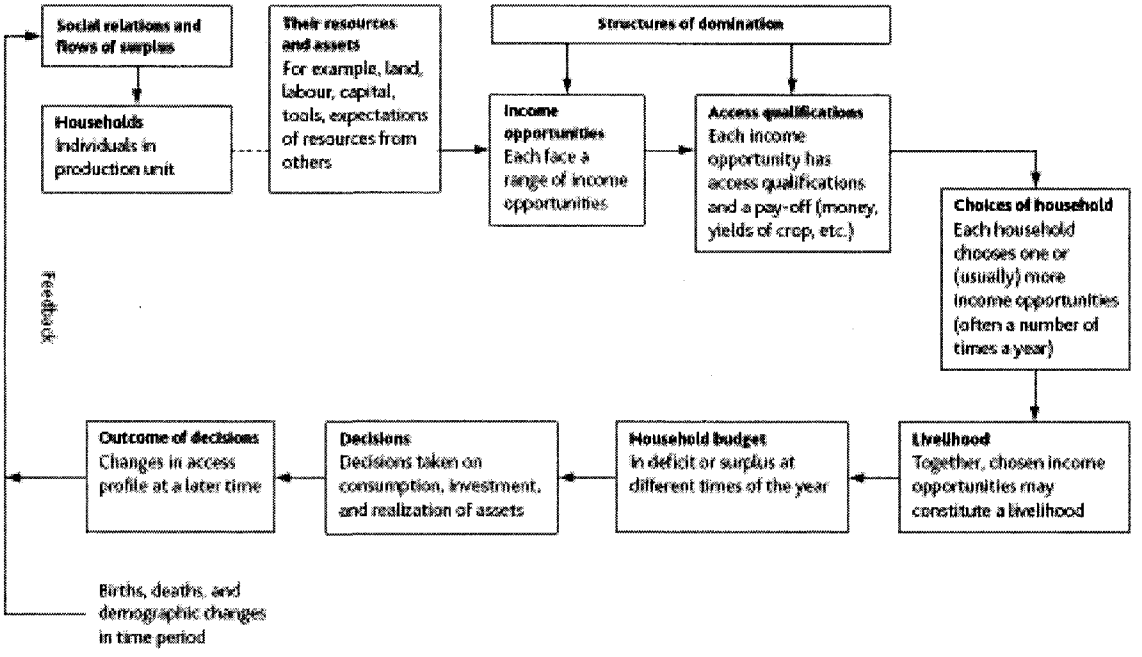
These processes range from economic investments in human capital to macro demographic trends and environmental sustainability. The unsafe conditions in the PAR model are the actual or visible populations that experience vulnerability during a disaster event. Unsafe conditions are the "specific forms in which the vulnerability of a population is expressed in time and space in conjunction with a hazard" (Blaikie *et al.*, 1994 p. 25). Therefore, each manifestation of vulnerability can be traced back to larger, widespread social, economic and political processes that work to generate vulnerable populations.

The Pressure and Release model has some limitations, including the explicit focus on the 'pressures', or vulnerabilities, with little emphasis on the 'releases' that could increase resiliencies and overall coping capacity. There is also an inherent oversimplification of the juxtaposition of two opposing forces. This suggests that the hazard is separate from social processes and "independent of the conditions that create vulnerability" (Blaikie et al., 1994, p.22). As well, the model presents a static depiction of vulnerability: in this model, "the generation of vulnerability is not adequately integrated with the way in which hazards themselves affect people...it exaggerates the separation of the hazard from social processes in order to emphasize the social causation of disasters" (Blaikie et al., 1994, p. 46).

For these reasons, Blaikie et al. also developed the 'Access' model of vulnerability which is essentially an expanded analysis of the core components of the PAR model. The Access model examines the specific political and economic processes that generate vulnerability, and focuses on incorporating the hazards themselves as a

process in creating vulnerability. The Access model, shown in Figure 2.5, is essentially cyclical and examines how individuals and households manage their access to assets and resources under the domination of social, political and economic systems (Blaikie *et al.*, 1994). In this sense, the socially constructed process of differential access to natural resources leads to differential exposure to hazards themselves (Blaikie *et al.*, 1994). The Access model is designed to draw "attention to the socio-economic relations which cause disasters or allow them to happen" (Blaikie *et al.*, 1994, p. 59). Thus, for Blaikie *et al.*, similar to Watts and Bohle (1993) there is an explicit focus on access to resources and assets as a critical component of vulnerability, yet they acknowledge that there are underlying processes which work to create these differences.

Figure 2.5: The Access Model to Resources



Source: Blaikie et al., 1994

Although the work of Blaikie *et al.* (1994) explores the underlying processes that affect levels of vulnerability, there are two main limitations to this approach. While Blaikie et al. (1994) emphasize the larger political, social and economic processes that manifest themselves as unsafe places, this approach lacks an explicit recognition of the importance of place and geography. Despite similar root causes and dynamic pressures, manifestations of vulnerability may be different depending on smaller-scale, more localized processes as well as individual experiences and perceptions. In general, this approach, similar to other vulnerability models, focuses exclusively on the interactions of negative processes during disaster events and is inherently disempowering through a lack of emphasis on capacity building.

Section 2.3.3 – Powerlessness and Vulnerability

Hewitt (1997) defines vulnerability as a "product of the circumstances that put people and property on a collision course with given dangers, or that make them less able to withstand or cope with disaster" (p. 167). For Hewitt, while the immediate cause of disaster events may be related to some type of hazardous event (i.e. natural or technological) the seriousness of the impact is inherently dependent on the pre-existing social, economic and political systems and characteristics of the community (1997). The main factors which influence vulnerability are shown in the table below:

Table 2.2: Influencing Factors on Vulnerability According to Hewitt (1997)

Vulnerability Influences:	
Exposure to Dangerous Agents	This is related to the environment of human settlements and the relative risk level of the area

Weaknesses	Linked to the predisposition of individuals, buildings, communities to experience greater harm
Lack of Protection	Linked to exposure to dangerous agents, as well as lack of protection against weaker individuals
Disadvantage	Linked to lack of access to resources and assets that would allow individuals and groups to reduce risks or increase their ability to respond to hazardous events
Lack of Resilience	Related to the capacity, or lack thereof, of individuals and groups to avoid, withstand or offset and recover from disaster event
Powerlessness	Linked to the ability, or lack thereof, of individuals and groups to influence the safety of their surrounding environment, or to acquire means of protection and relief

Similar to Watts and Bohle, as well as Chambers, Hewitt examines how lack of access to social and material assets impact levels of vulnerability, although he links the root causes of these issues to access to power. Through this understanding, Hewitt focuses on concepts of power and powerlessness and how these processes are generated and perpetuated through disaster events. Emergency events break down the organized economic, social and political networks of modern societies and present locations of *spatial disorganization* and loss of control (Hewitt, 1997). As disaster events disproportionately impact individuals and communities who lack political power, this suggests that this is an important variable that influences vulnerable populations. Thus, Hewitt's approach differs from the above social approaches in that it sees "risk and disaster as originating, via vulnerability, in a lack of ability to influence the decisions and direction of a society in those matters that determine one's security. Here, the key to vulnerability is found in *powerlessness*, and relative security in its opposite" (p. 151).

Therefore, powerlessness is not viewed as one aspect of or influence on vulnerability (as indicated in the Table 2.2) it is the underlying social condition which creates a variety of other circumstances that influence vulnerability (i.e. lack of resilience, disadvantage, lack of protection etc.).

Section 2.3.4 – Types of Vulnerability

Alexander (2000) developed another approach to vulnerability which examines how information and knowledge is used and disseminated by emergency management practitioners and community members during disaster events. Alexander defines vulnerability as the "potential for casualty, destruction, damage, disruption or other forms of loss with respect to a particular element" (2000, p. 12). This approach to vulnerability sees information and research results, and the response to this information, as an explicit component for either increasing or reducing vulnerabilities. This understanding of vulnerability is especially important for academics and decision-makers who are in positions of power and have an explicit responsibility for understanding and reducing vulnerability as well as increasing overall resiliencies. According to this approach, the processes and systems that create knowledge also impacts vulnerability. In order to conceptualize this understanding of vulnerability, Alexander developed several different, yet related types of vulnerability, as shown in the table below.

Therefore, for Alexander, the key component that influences levels of vulnerability is both a lack of knowledge and information, either through lack of experience, lack of wide dissemination of important information, or deliberate misuse of

knowledge, as well as the capacity of a variety of social and political organizations to respond and cope with the disaster event.

Table 2.3: Types of Vulnerability as Defined by Alexander (2000)

Types of Vulnerability		
Deprived Vulnerability	This vulnerability arises when research and information is known, but the results have not been disseminated or used appropriately	Related to use of research information and knowledge
Willful Vulnerability	This vulnerability arises when information and knowledge is known but deliberately ignored or not taken into consideration	
Pristine Vulnerability	This vulnerability arises when there is a lack of experience regarding hazards and dealing with disaster situations	
Primary Vulnerability	This vulnerability arises through high susceptibility to catastrophic damage, either through close physical proximity, or lack of preventative/mitigation measures	Related to capacities to respond and cope
Secondary Vulnerability	This type of vulnerability is related to the lack of ability to respond and cope with disaster events which can lead to poor and insufficient responses	

Similar to Alexander, Pelling (2003) has developed multiple definitions for vulnerability. He defines vulnerability as the "exposure to risk and an inability to avoid or absorb potential harm" (Pelling, 2003). Through this understanding, he identifies three separate types of vulnerability:

Physical Vulnerability: the vulnerability of the physical environment (i.e. the built environment)

Social Vulnerability: the influences of a variety of social, economic and political processes which creates the vulnerability of human populations

Human Vulnerability: the combination of both social and physical vulnerability.

In this approach, the notion that physical proximity to the disaster event is an important component of vulnerability is reintroduced after a period where social processes dominated the vulnerability literature.

Building upon the ideas of Alexander and Pelling, Cardona (2004) developed an approach to vulnerability which combines the issues of physical proximity, social and economic factors, as well as the response and coping capacity of the individuals and communities involved in the disaster event. Cardona returns to Chamber's concept of internal and external processes, whereby the varying levels of vulnerability experienced by individuals, groups and communities creates the internal risk factor, and the hazard itself generates the external risk factor (Cardona, 2004; Villagrán, 2006). According to Cardona, the internal risk factors are influenced by three main factors:

1) Physical Fragility/Exposure – linked to the geographic location of human settlements and their related susceptibility to various forms of environmental hazards;
2) Socio-Economic Fragility – related to a variety of social and economic processes which affect the predisposition of some individuals and groups to experience greater risk and a lowered ability to cope with hazardous events due to increased marginalization, poverty, social segregation etc. and;

3) Lack of Resilience – Linked with the community's ability to access and mobilize key resources and assets for use during the response and coping phases of a disaster event. Incapacities to respond can be related to issues of under-development and a lack of planning and emergency management plans and strategies.

(Cardona, 2004)

This approach, while beginning to incorporate concepts of place and geographic location through the physical fragility component, still fails to explicitly acknowledge how various processes manifests themselves differently in different places.

The concept of vulnerability being subdivided into different components has been explored by a variety of academics that have developed various types of vulnerability. Wilches-Chaux (1993) defined vulnerability as the inability to cope with changes, either rapid or chronic onset: "[vulnerability is] the incapacity of a community to absorb, via auto-adjustments, the impacts of a change in the environment" (p. 17). Through this understanding, he proposes a variety of different dimensions of vulnerability, including physical, environmental, economic, social, political, technical, ideological, ecological, institutional, education, health-related and cultural (Wilches-Chaux, 1993).

These various dimensions of vulnerability led to the introduction of distinctions between populations that experience a rapid-onset, or unpredictable occurrence, such as an extreme weather event, and those populations that experience chronic conditions which decrease their overall capacity to cope with a variety of experiences. Lavell (2004) developed a two-tiered understanding of vulnerability where *exceptional* vulnerability is

related to those populations that experience an uncommon occurrence and *everyday* vulnerability is linked to the permanent conditions experienced by populations with low income. A similar idea was also proposed by Watts and Bohle (1993) through their notion of base-level vulnerability and recurrent vulnerability. Through these approaches to vulnerability, a distinction can be made between rapid-onset disasters (i.e. extreme weather events) and chronic disasters (such as malnutrition, starvation, disease etc.).

Section 2.3.5 – Synthesizing Vulnerability Theories

As discussed above, historically, emergency management researchers and practitioners viewed humans and society as passive actors/victims who were afflicted by disaster events. This view has shifted to the current emergency management theory which understands humans and society as active participants in the risk process associated with hazardous events (Blaikie et al, 1994; Hewitt, 1997; Lewis, 1999; Hewitt, 2000; Lindsay, 2003).

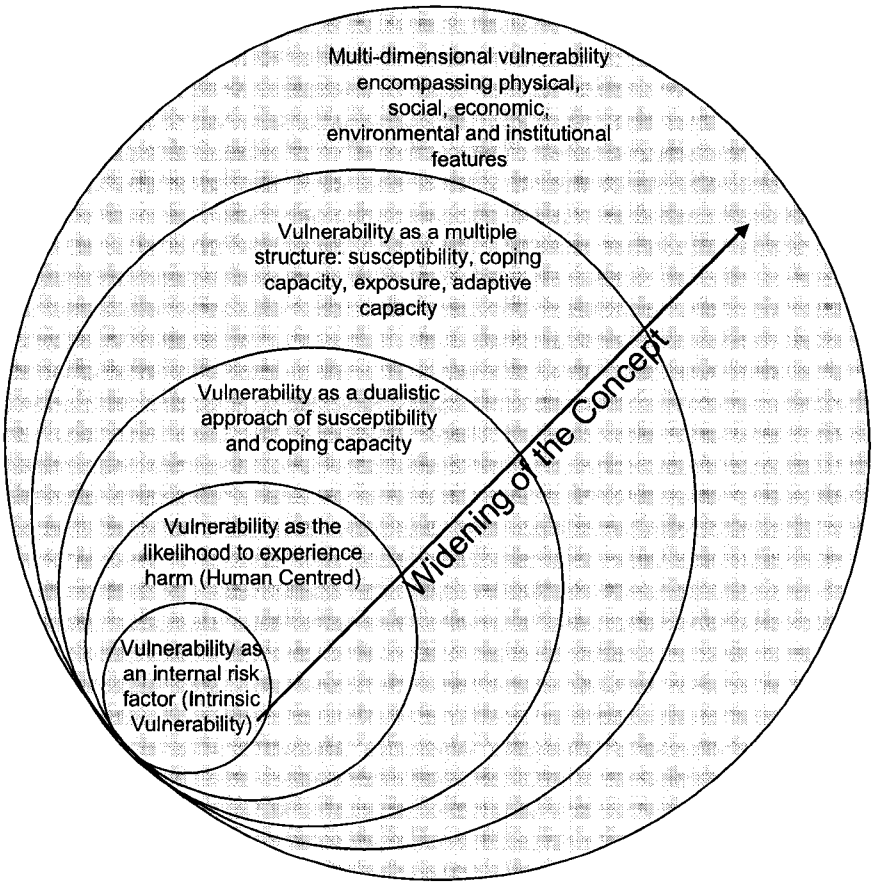
Initial approaches to vulnerability, while incorporating both social and physical features, presented them as separate, independent processes. As the literature moved towards detailed analysis of social vulnerability, the physical and environmental processes were somewhat ignored. This led to a search for an understanding of vulnerability that incorporated both social and environmental processes and acknowledged the complex interactions between them. Several academics have attempted to provide an overview of vulnerability that resolves these issues. Susan Cutter developed the 'Hazards of Place' model of vulnerability throughout the 1990's and 2000's as an attempt to provide an understanding of vulnerability that incorporated social and

biophysical aspects, but which was "also inherently more geographically centred" (Cutter, 1996). Using this approach to vulnerability, Cutter (1996) found that many existing vulnerability theories were either "too limiting or too diffuse to be of practical use" (p. 77). Through her research, Cutter attempted to incorporate many of the ideas from recent vulnerability literature, as well as merging work from the past (i.e. Hewitt & Burton, 1971), to create an understanding of vulnerability that was relevant for developed countries, with an explicit focus on 'place'. This model forms the conceptual framework for this research and is discussed in detail in Chapter 3.

Through this shift in thinking, vulnerability theories have broadened from human-centred approaches which focused on the intrinsic vulnerability of the individual to approaches that incorporate coping capacities and the building of resilience. Birkmann (2006; 2007) demonstrates how "the concept of vulnerability has been continuously widened and broadened towards a more comprehensive approach encompassing susceptibility, exposure, coping capacity and adaptive capacity, as well as different thematic areas, such as physical, social, economic, environmental and institutional vulnerability" (Birkmann, 2007, p. 21). These different spheres of vulnerability are shown in Figure 2.6.

The importance of vulnerability is summarized by Smith (2005): "It is generally accepted among environmental geographers that there is no such thing as a natural disaster. In every phase and aspect of a disaster—causes, vulnerability, preparedness, results and response, and reconstruction—the contours of disaster and the difference between who lives and who dies is to a greater or lesser extent a social calculus".

Figure 2.6: The Spheres of Vulnerability



Source: Birkmann, 2006; 2007

Section 2.4 – Resiliency

Although this research is focused on vulnerabilities, it is important to recognize that identifying and attempting to mitigate vulnerabilities is inherently related to increasing the resiliency of the community. The concept of resiliency originated in the ecological literature, particularly on the study of ecosystems, during the 1960's and early 1970's (Janssen *et al.*, 2006; Folke, 2006). This initial understanding saw resilience as the

"persistence of relationships within a system and is a measure of the ability of these systems to absorb change of state variable, driving variables, and parameters, and still persist" (Holling, 1973, p. 17). As the emergency management community began to recognize that disaster events were influenced not only by physical processes, but also social processes, concepts of resiliency and social coping capacity were increasingly incorporated into emergency management domains (Janssen *et* al., 2006; Ronan & Johnston, 2005). Foster (1995) notes that "escalating disaster losses indicate that what are needed are more inherently resilient social and technological systems, capable of absorbing shocks with grace and designed so that their failure does not lead to inevitable catastrophe" (p. 1-93). While identifying vulnerabilities is critical for determining the appropriate mitigation activities, identifying resiliencies can also be an effective tool to accomplish this task. Studying resiliency can help to determine the features and attributes of the community which will increase its coping capacity to disaster events and provide emergency managers with tools to aid in the process of decreasing vulnerabilities. This approach is inherently more empowering as it recognizes the positive characteristics and attributes of individuals, households, groups and communities to effectively prepare, respond and recover from disaster events through all the pillars of emergency management.

Similar to vulnerability, there are somewhat varied definitions for resilience. Resiliency is defined as the activities and capacities which allow communities and societies to withstand and rebound after disaster events (Ronan & Johnston, 2005; Foster, 1995). Ferrier (2008) defines resiliency as the "relative ability of a community to absorb the effects of a hazard event and quickly return to normal, or near-normal operations" (p.

109). Similar to the above definition, Buckle *et al.* (2000) define resiliency as "a measure of how quickly a system recovers from failures" as taken from Emergency Management Australia (p. 9). Yet Buckle *et al.* (2000) argue that these definitions appear somewhat static and fail to "identify that individuals, groups and communities may each possess degrees of resilience which will vary over time and within each of these categories" (p. 9).

Currently, there is a growing body of literature which focuses not only on resilience, or returning the community to its previous level of functionality, but also as a tool for promoting positive growth (Ronan & Johnston, 2005; Kumpfer, 1999). Kumpfer (1999) focuses on differing levels of resilience through a discussion of three separate outcomes after a hazardous event:

1) *resilient reintegration* – not only returning to previous levels of functioning, but also adapting in a positive direction through appropriate mitigation activities
2) *homeostatic reintegration* – returning to previous levels of functioning but not necessarily making any adaptations
3) *maladaptive/dysfunctional reintegration* – difficulty in returning to previous levels of functioning and perhaps even increasing social/economic problems

Through this approach, if resilient reintegration occurs, a hazardous event can be viewed as a catalyst for transformation and growth in the community.

While this literature focuses on how communities can draw strength from the adverse impacts of a disaster event, currently, the emergency management literature has focused almost exclusively on loss reduction and returning affected communities to

previous levels of functioning (Ronan & Johnston, 2005). Much of the resiliency literature has focused on practical and adaptable methods for increasing community resiliency, as compared to the vulnerability literature which has a tendency towards theoretical approaches. Through this resilience approach to disaster events, the mitigation pillar of emergency management can be seen one of the most essential components of emergency management programs.

Section 2.4.1 – Dimensions of Resilience

Research has indicated that increasing the resiliency of a community can be accomplished through a variety of methods. Overall, structural mitigation can greatly reduce physical and human losses as studies have indicated that most loss of life is due to inadequate and/or poorly constructed physical structures (Ronan & Johnston, 2005; Cuny, 1983). Public education also plays a key role in allowing communities and households to prepare themselves for hazardous events.

Sewell and Foster (1976) and Foster (1993) have designated a set of elements that appear to increase the resiliency of communities, although because antagonism occurs between some elements they cannot all be applied together. According to Foster (1995), these elements are merely a list of attributes that can work to increase the resiliency of a community or society. These elements are shown in Table 2.4 and a short discussion of each follows the table.

Table 2.4: Community Dimensions of Resilience

Dimensions of Resilience			
Social Characteristics:		**Time and Timing:**	
1	Compatibility with diverse value systems	1	Short lead time
2	Capacity to satisfy several goals and objectives	2	Responds rapidly
3	Equitable distribution of benefits and costs	3	Operation life span open ended
4	Generous compensation for those who lose	**Operational Characteristics:**	
5	Easily understood	1	Efficient, creates little waste
System Characteristics:		2	Reversibility of impacts
1	Internal variables paramount	3	Hierarchal embedding present
2	Capable of withstanding large external variable fluctuations	4	Incremental operation possible
3	Diversity of components	5	Early fault detection
4	Functional redundancy	6	Fail safe design
Economic Characteristics:		**Physical Characteristics:**	
1	Incremental funding possible	1	Not site specific (dispersion)
2	Wide range of potential financial support	2	Fine grained and modular
3	High benefit/cost ratio	3	Prefabricated and standardized
4	Early return on investment	4	Mobile
Environmental Characteristics:		5	Esoteric components unnecessary
1	Minimal adverse impacts	6	Unique skills not required
2	Replenishable or extensive resource base	7	Stable

Source: Foster, 1995

The social component seeks to analyze how stable social and political systems can increase the resiliency of communities. Groups and individuals who hold power who are able to harmonize diverse value systems and satisfy the needs of many different groups create societies which are more resilient in the face of disaster events (Foster, 1995; Buckle *et al.*, 2000). Societies and communities who have equitable distribution of resources promote resiliency through equal access to resources and technology. Communities who are capable of providing compensation and resources to those groups and individuals who suffer physical and economic losses during disaster events allow those individuals and groups to recover from the event in a more timely fashion. This

results in an increase in resiliency as the community as a whole is able to recuperate quicker from the disaster event. Finally, resiliency is also promoted by accessibility to knowledge and information. Widespread education programs and public understanding of hazardous events allows those communities to understand the actions required both before, during and after a disaster event (Foster, 1995). This accessibility increases the coping ability of individuals and groups in the community/society.

The characteristics of the society and community are also important to consider when examining resiliency. Communities that hold control over key variables and have the ability to withstand large external fluctuations are more resilient than those communities who lack control and capacity (Foster, 1995; Buckle *et al.*, 2000). Diversity is also a variable that can increase resiliency throughout numerous industries from large scale systems down to individual households. Functional redundancy refers to the ability of the system to cope with and take over the functions of one component should that particular component fail (Foster, 1995). Resilient societies should exhibit functional redundancy to protect the system from disaster should one of the components fail.

In order to increase resiliency, the economic system should have a wide range of resources available and projects funded by the government should maximize benefits. Those benefits should be available for public use in a short time frame (Foster, 1995). Partnerships and established networks between organizations, communities and political agencies also facilitate the exchange of information and ideas to promote resilient communities (Buckle *et al.*, 2000).

The environmental resiliency of a system should not be underestimated. An emergent literature has evolved which understands the increasing cost of disasters as a response to the human-induced transformations of natural ecosystems (i.e. deforestation), as well as increased pressures on vulnerable environments (i.e. development on hill slopes) (Abramovitz, 2001; Doberstein, 2006; Hewitt, 1997). Numerous studies have indicated that human processes, including land-use practices, settlement patterns, resource exploitation and human transformations on the environment, have lead to increased vulnerability to, and devastation after, a disaster event (Doberstein, 2006; Abramovitz, 2001). Through this understanding of the human-induced nature of disaster events, sustainable development has become a core issue in hazard mitigation. In order to increase the resiliency of the system, the environmental processes which work to increase the natural resiliency of the environment should be examined and preserved.

As technological innovations have worked to compress both time and space, numerous forms of hazards can disperse rapidly throughout the world. Resilient systems are those which have the capacity to respond with short lead times and are flexible to rapid changes in the system (Foster, 1995). This is similar to the flatness principle discussed below where rigid hierarchical systems that lack flexibility tend to decrease resilience levels (Ferrier, 2008).

The operational characteristics of the community and industries within the community also affect levels of resilience. Communities and systems with increased efficiency, reversibility and redundancy are deemed higher in resiliency. Operational resilience is essential in terms of critical infrastructure for key services such as

communications, power, transportation and water and gas pipelines. Critical infrastructure which has an increased ability to absorb shocks and hazardous events, as well as recuperate to functional levels after damages have been sustained, generally increases the resiliency of any community as loss of essential services is minimal.

The physical characteristics, as defined by Foster, is related to the engineering of physical structures, and is somewhat ambiguous, although the general principal is that resilient communities have dispersed systems, which minimizes the risk for losses and damages. Standardization, modular structures, mobility and stability also work to increase the resiliency of the entire community.

Similar to Foster's work, Buckle, Mars & Smale (2000) have developed a list of attributes that help build resilient communities (this list was not meant to be exhaustive) shown in Table 2.5. While many of these attributes are similar to those discussed by Foster, others offer other more insight into resiliency through a focus on social systems and networks. Similar to Birkmann's model of the widening of the concept of vulnerability, this list indicates the broad scope of resilience which incorporates aspects of social, economic and political spheres.

Through this list, Buckle, Mars & Smale (2000) have emphasized the importance of social networks and social capital in building resiliency. These social networks are important at a variety of scales, including the community as a whole, through acceptance of shared goals; social organizations, including religious, cultural, sporting and social clubs; as well as economic organizations, whereby knowledge, ideas and resources are shared and provides opportunities for innovation and expansion (Buckle *et al.*, 2000;

Murphy, 2007). At the individual level, social networks and participation in any of the above mentioned groups can help to build resiliency through increased participation, knowledge, and access to resources and information.

Table 2.5: Elements that Support Resilience

Shared community values, aspirations and goals	Including a shared and positive sense of the future, a commitment to the community as a whole and agreement of community goals as well as a shared culture
Established social infrastructure	Such as information channels, social networks and community organizations such as sporting and social clubs
Positive social and economic trends	Such as a stable or growing population, a healthy economic base
Sustainability of social and economic life	Which embraces a capacity for the community to weather disruption
Partnerships	Partnerships between agencies, between community groups and between commercial enterprises, or any combination of these, may bring innovation, sharing of experience, knowledge and resources and common goals. This applies particularly where the partners play a dominant role in the social and economic life of the town, such as towns dominated by a particular industry or economic activity
Communities of interest	Where a group may exist over a wide area and be otherwise socially diverse but they share a common area of interest, skill or expertise. This includes communities bound together by faith and religious commitment, cultural groups as well as less formal groups such as business or commercial associations or sporting or recreational clubs
Established networks	Clear and agreed and stable links between people and groups facilitate the exchange of information as well as the sharing of resources and the commitment of skills, time and effort to planning and preparedness
Resources and Skills	The resources and skills available locally may be directly relevant to emergency management planning, preparedness and for community support if an emergency does occur. These can be identified by the type of resource or skill, its amount, the cost to use it, its availability and by its location. Where useful resources or skills do not exist than they may be developed or promoted as part of preparedness activities.

Source: Buckle et al., 2000, p. 13

Many of the concepts described by Buckle, Mars & Smale (2000) form the basis of the social capital literature which is broadly defined as the "set of norms, networks, and organizations through which people gain access to power and resources, and through which decision making and policy formation occur" (Grootaert, 1998, p. 2 as quoted in Murphy, 2007). These social networks are generally seen at the informal scale, although formalized structures and networks can also be tapped into during emergency situations. The social capital literature suggests that individuals and groups with strong social networks appear more resilient through all phases of emergency management, including preparedness, response, recovery and mitigation (Murphy, 2007; Shaw & Goda, 2004; Bolin & Stanford, 1998). While social capital and relationship networks may provide a basis for coping with emergency events, researchers have noted limitations to this approach. Differential access and hierarchal-style networks may produce uneven distribution resources which can affect overall resilience levels. Murphy (2007) also mentions that tight-knit social networks may not necessarily result in productive and resilient behaviors, as noted in her example of inner-city gang communities.

Although there are some limitations, overall, social capital provides a positive, community-based approach for increasing resilience to disaster events. While this idea is not addressed explicitly in the vulnerability literature where the focus has remained on access to assets, power and information, networks can be seen as a tool to increase access to these types of assets. The importance of social networks during emergency events will be further addressed in the results and discussion section of this thesis.

Section 2.4.2 – Wildavsky's Six Principles for Enhancing Resilience

The use of political principals in developing resiliency is explored by Ferrier (2008) as well as Pelling (2003), where they examine how Wildavsky's six fundamental principles for fostering resiliency in communities and organizations applies to emergency management. Wildavsky's principles are shown in Table 2.6 below, followed by a brief discussion of the applicability of each and how they relate to the pillars of emergency management.

Table 2.6 – Wildavsky's Principles of Resilient Systems

Homeostasis Principle	Systems are maintained by feedbacks between component parts which signal changes and can enable learning. Resilience is enhanced when feedbacks are transmitted effectively.
Omnivory Principle	External shocks are mitigated by diversifying resource requirements and their means of delivery. Failures to source or distribute a resource can then be compensated for by alternatives.
High Flux Principle	The faster the movement of resources through a system, the more resources will be available at any given time to cope with perturbation.
Flatness Principle	Overly hierarchical systems are less flexible and hence less able to cope with surprise and adjust behaviour. Top-heavy systems will be less resilient.
Buffering Principle	A system which has capacity in excess of its needs can draw on this capacity in times of need, and so is more resilient.
Redundancy Principle	A degree of overlapping function in a system permits the system to change by allowing vital functions to continue while formerly redundant elements take on new functions.

Source: Ferrier, 2008, p. 123

The Homeostasis principle suggests that resiliency is increased as systems are progressively able to learn and adapt, similar to the 'Time and Timing' category of Foster's work. Ferrier (2008) argues that a key vulnerability in current emergency management systems is the ineffectiveness of feedbacks. He argues that while emergency

managers tend to use a 'lessons learned' approach by studying previous hazard events, generally the recommendations are not acted upon, either through politics, budgetary constraints, resistance to change and general apathy (Foster, 2008). This concept fits into both the preparedness and response aspects of emergency management. As emergency practitioners prepare and practice for specific events, the ability to adapt potentially increases. In a well-designed and proactive emergency management community, this will also translate into the response to real-time disaster events.

The protection of critical infrastructure and resource chains has been identified as a key responsibility of emergency management in Canada (see PSC, EMO). The Omnivory principle builds upon ideas of redundancy through the development of multiple sources for purchasing resources and supplies (Ferrier, 2008). The is similar to the 'Systems Characteristics' and 'Established Networks' component of resiliency developed by Foster and Buckle *et al.*, respectively, as well as the mitigation component of emergency management principles.

The High Flux principle emphasizes the importance of resources available in the community. While this principle suggests that those communities with greater access to assets and resources will have increased resiliencies, it is important to note that access to resources is rarely distributed evenly across communities, and some sections will fair better than others. Ferrier (2008) also argues that occasionally the resources in the community actually has the effect of increasing vulnerabilities. An example is provided of the presence of a petroleum tank farm in the community which may increase resiliency through the economic and resource benefits, but also increases the risk for fires,

explosions and hazardous materials events (Ferrier, 2008). The importance of assets and resources is also diminished where the dimensions of the disaster overwhelms the capacity of the resources available to the community (Murphy, 2008).

The Flatness principle highlights the importance of flexibility and dynamism of the operational and command systems. Although Ferrier (2008) has used this principle to focus on the command and control structure of responding to emergencies, this principle implicitly implies the need for social justice and equality. Political, social and economic systems that generate inequalities and uneven distribution of assets, power and information generate increased vulnerabilities (as discussed in the Pressure and Release model in section 2.3), whereas adaptability and equality can enhance the resiliencies in the community.

The Buffering principle suggests the prudence of stockpiling supplies and resources in the event of an emergency situation. This process is also suggested in the Access model (discussed in section 2.3) whereby excess assets are stored, or exchanged for other assets, which can then be used during a disaster event (Blaikie *et al.*, 1994). In this sense, reserve assets at both the individual, household and community level are seen as increasing resilience levels. These processes are emphasized throughout the preparedness pillar of effective emergency management programs and activities.

The Redundancy principle builds on the Omnivory principle, although whereas the omnivory principle stressed redundancy in access to resources and critical infrastructure, the redundancy principle stresses redundancy in terms of human and social capital. Access to training, education and the presence of multiple community and service

organizations work together to enhance the overall resiliency of the community. Similar to Buckle, Mars & Smale's 'Resources and Skills' and "Communities of Interest' components and the social capital literature, this principle, in part, emphasizes the importance of social networks that are well-established and developed within the community.

Using these principles, Ferrier (2008) concludes that "the acquisition of assets is a path to increased resiliency to the effects of virtually any given hazard event" (p. 181). This is similar to the work of Blaikie *et al.* (1994) through their use of the Access model of vulnerability. Through this exploration of how assets and resources increase resiliencies, the discussion on the impact of attaining these assets and resources is limited. Buckle *et al.*, in their 'Sustainability of Social and Economic Life' address the impact that resource extraction and economic systems which lead to environmental degradation can have on vulnerability and resilience. This demonstrates the interaction between the various components of resiliency and vulnerability, whereby an increase in resiliency at one level, can actually increase vulnerabilities at another.

Overall, the resilience literature suggests the inherent relationship between vulnerability and resilience. Those individuals, groups and communities that lack access to assets, resources, power and information have increased levels of vulnerability, whereas improved access increases levels of resilience. The resilience literature also addresses the importance of networks at a variety of scales, which suggests there is more to vulnerability than has been recognized in this literature review. Following this view, an

in-depth understanding of resilience can provide, not only an increased capacity to respond to emergency events, but also an increased understanding of vulnerability.

Section 2.5 – Conclusion

This literature review has examined the different theories and models surrounding the concepts of vulnerability and resilience. The key findings indicate that although much research has been conducted on vulnerability, the concept is still lacking in consensus among researchers. The models tend to lack the dynamism that is inherent in the economic, social and political systems that influence vulnerability and resilience. The vulnerability models presented also lack a focus on the importance of place and the unique characteristics of each community that interact with larger scale political, economic and social processes. This led Susan Cutter to develop the 'Hazards of Place' model, with its explicit focus on place and geography, presented in the following chapter, which provides the conceptual framework for this research. There is also a deficiency in research that examines the relationship between vulnerability and resilience. This research seeks to add to this small, but growing, literature through an examination of the processes affecting vulnerability and resilience using a case study approach.

3. RESEARCH METHODOLOGY

The purpose of this study is to examine the emergency practitioner and community workers' understanding of vulnerability in Waterloo Region. This will provide insight into issues of vulnerability and resilience in a specifically Canadian context, as well as offering important information on the nature of the relationship between vulnerability and resilience. In order to do this, a case study method was chosen as the most consistent method for allowing respondents to share their unique knowledge and perceptions. This chapter begins with an overview of Waterloo Region and the history of its emergency management program, followed by the methods used to undertake the study.

Section 3.1 – Background of Waterloo Region

The Regional Municipality of Waterloo is located in the South Eastern part of the Canadian province of Ontario and includes three cities (Kitchener, Waterloo and Cambridge), as well as four townships (North Dumfries, Wellesley, Wilmot and Woolwich). With a population of over 470,000 (as of 2003) the Region is the fourth largest urban area in Ontario (RGMS, 2003).

Although the Region has experienced few recent emergency events, historical emergency events have led to the development of a comprehensive emergency management and response system. Table 3.1 depicts emergency events that have occurred in Waterloo Region over approximately the past two hundred years. In this table, health emergencies are listed in yellow, natural emergencies are pink and human or technologically induced emergencies are listed in blue. Interestingly, it appears from this

chart that the occurrence of health emergencies has decreased over this period, whereas human and/or technologically induced emergency events have greatly increased. While this may be the case, historical events do not necessarily provide an indication of the risks and hazards a community is exposed to, and the chart merely provides an indication of the variety of natural, health and human-induced risks in Waterloo Region.

Table 3.1: Historical Emergency Events in Waterloo Region 1934 – 2006

Date:	Disaster Type	Effects:
1834	Cholera Pandemic	Heavy loss of life, including Galt where 20% of the population perished
1885	Great Flood of New Hamburg	No lost lives, but great damage to buildings and infrastructure
1886	Dipthera Outbreak	Affecting many young children in Wilmot and Wellesley - approx. 20% of those afflicted perished
1918 - 1919	Influenza Pandemic	Affecting almost 60% of population, resulting in many deaths - many social and public gatherings were closed
1929	Flood (Galt area of Cambridge)	Flooding and damage to infrastructure
1947	Blizzard	Heavy snowfall resulted in closed communication lines and heavy flooding in spring
1954	Hurricane Hazel	Results in significant flooding
1956	[illegible]	Two railway workers killed
1959	[illegible]	Kills eight, injures 14 - workers claw through depris searching for trapped boys
1959	[illegible]	Large fire in downtown Kitchener destroys Loblaws, Zellers and other Metropolitan stores
1974	Cambridge Flood	Large flood causes millions in damage
1989	[illegible]	Uniroyal chemical spill contaminates Elmira drinking water
1997 - 1998	Meningitis Outbreak	Outbreak results in deaths and widespread immunizations
2003	[illegible]	Large scale energy blackout causes minor disruptions
2004	[illegible]	Explosion and fire prompts emergency alert - air pollution

Source: WREM, 2007

The image below depicts the New Hamburg flood of 1885, whereby several building were destroyed and sidewalks and bridges were swept away. Fortunately no lives were lost during this emergency event. The New Hamburg flood, as well as other

emergency events, have led to an established and well-developed mitigation and response system in the Region. Emergency management practitioners, first responders and social service organizations have worked together to develop integrated and consolidated response plans based on a variety of hazards and risks.

Figure 3.1: Flooding in New Hamburg, 1885

Source: WREM, 2007

The Regional Municipality of Waterloo has established an Emergency Response Plan which is governed by the four pillars of emergency management (as described in Section 2.2). In accordance with the federal *Emergency Management Act*, this plan defines emergency as a "situation or an impending situation caused by the forces of nature, an accident, an intentional act or otherwise that constitutes a danger of major proportions to life or property...and require[s] a coordinated response by a number of

organizations, both governmental and private...as distinct from routine operations carried out by organizations as normal day to day procedures" (ERP, 2004, p. 1).

The plan incorporates the directions for declaring an emergency and the expected initial response, as well as outlining the roles and responsibilities of various actors in the response to the disaster event (ERP, 2004). The four specific aims of the plan are listed below, where emphasis is placed on the response and recovery aspects of the pillars of emergency management:

1) protect and preserve life and property;
2) assist the Lower-tier Municipalities as requested;
3) minimize the effects of the emergency on the Regional Municipality of Waterloo; and
4) restore essential services (ERP, 2004, p. 1).

The plan goes on to state the most likely types of emergency situations to occur in Waterloo Region in a peacetime situation and include the events shown in Table 3.2. In 2003, a Hazards Identification and Risk Assessment (HIRA) was completed to provide an overall understanding of the specific risks for the Region. This assessment analyzed the probability of the hazard occurring compared to the severity of expected damage (WREM, 2007). Through this assessment, the top ten most likely emergency events for the area, shown in Table 3.3, was determined. Compared to historical trends, the risks outlined in Table 3.2 and 3.3 indicate the changing nature of risks and hazards over time, as the prevalence and importance of certain hazards is decreased or increased over time (i.e. increasing technological risks such as air transportation accidents, pollution, energy crisis). These tables indicate that Waterloo Region is exposed to a variety of natural and technological hazards.

Table 3.2: Types of Emergency Events in Waterloo Region

Natural		Human	
Drought	Blizzards	Blackout	Air Pollution
Epidemics	Extreme Cold	Gas Leak	Air/rail crash
Floods	Fog	Infrastructure Failure	Building collapse
Hailstorm	Lightening Storm	Breakdown in flow of essential services (due to strikes or combination of other events	
Ice Storm	Tornado		
Windstorms	Extreme Heat	Transportation accident involving hazardous materals	
Snowstorms			

Source: ERP, 2004

Table 3.3: Top Ten Emergency Events for Waterloo Region

Natural	Human
Drought	Chemical Spills - Industrial Accidents
Health Emergency (Pandemic)	Chemical Spills - Road or Rail
Cold Weather (blizzards, extreme cold, ice storms, winter storms)	Energy Emergency (Blackout)
Warm Weather (Severe storms, tornado, extreme heat)	Extreme Air Pollution
Floods	Air Transportation Accident

Source: WREM, 2007

Each lower tier city and township has also developed their own emergency response plans. The purpose of these plans is to ensure an effective response within each jurisdiction, as well as to coordinate services with the regional response plans and services. Each local jurisdiction is responsible for the initial response to an emergency situation. The response would be elevated to the Regional response plan based on one of the following scenarios:

1. *the Mayor or Acting Mayor of an affected Municipality requests that the Regional Emergency Response Plan be implemented; or*
2. *the emergency affects a large portion of inhabitants of more than one local municipality; or*

3. *the emergency requires extraordinary actions or expenditure of monies by one or more regional services for the protection of property, health, safety and welfare of the inhabitants of the community.*

Source: WREM, 2007

While the main focus throughout the emergency plans remains on response, the established network of plans and training in Waterloo Region has led to a well-developed and active emergency management program. The formation of partnerships within the community with various social, economic and political organizations (i.e. school boards, humane society, conservation authorities, essential services companies, social agencies such as the Red Cross, Salvation Army, Community Care Access Centre, and amateur radio clubs) has ensured that the Region is one of the leading emergency management communities in the province, and as such, is an ideal candidate for study.

Section 3.2 – Research Framework

This research project will examine the applicability of the 'Hazards of Place' model of vulnerability in a Canadian context using a case study of the Waterloo Region. The focus will be placed on the perceptions and opinions of various actors and decision-makers in the emergency management process, as well as representatives from community organizations. This will help to determine the validity of the model outside of the United States and whether it effectively portrays vulnerability in the Region of Waterloo.

Section 3.2.1 – Conceptual Framework

For the purposes of this research, the understanding of vulnerability and how these vulnerabilities are created stems from the Hazards of Place theory as introduced by

Cutter (1996). This theory is a combination of biophysical vulnerability and social vulnerability theory. Biophysical vulnerability theory focuses on the environmental processes which create hazardous conditions and understands vulnerability as a pre-existing condition (Cutter, 1996). The primary method for measuring biophysical vulnerability is through proximity to the hazard itself. Social vulnerability theory argues that patterns of vulnerability are influenced by factors such as development, social relations and political power, indicators of which may include gender, race, age and income variables (Cutter, 1996; Wu et al., 2002; Rygel et al., 2005; see Hewitt, 1997; Blaikie *et al.*, 1994). The merging of these two theories creates an understanding of vulnerability that is both dependent upon the physical features that are specific to the area, as well as the social, political and economic processes occurring at the local scale (although it is understood that these local processes can be influenced by processes occurring at national, as well as global scales). Cutter *et al.* (2000) note that this explicit focus on place allows the researcher to "examine some of the underlying social and biophysical elements that contribute to vulnerability, as well as to assess their interaction and intersection" (p. 716). This explicit focus on place indicates the importance of examining the applicability of this model in a Canadian context, as large and small scale political, economic and social processes might manifest themselves differently in different places.

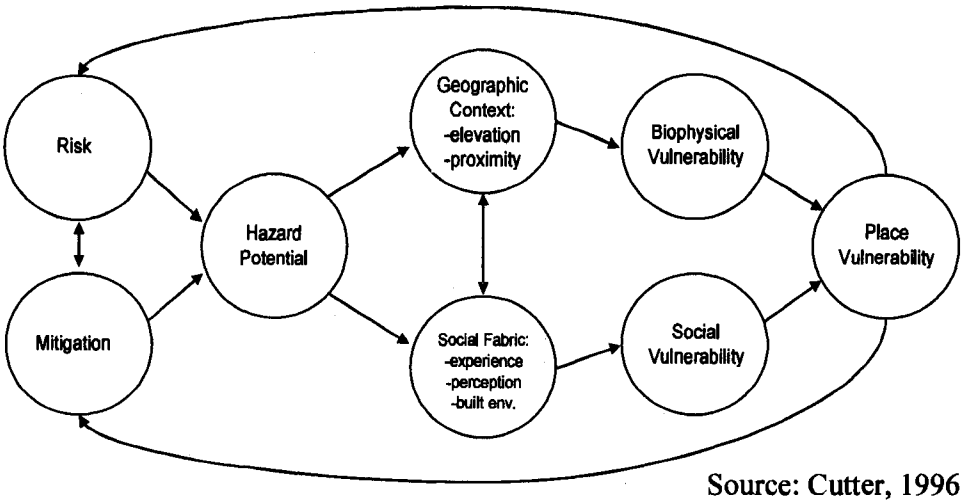
This model was selected for four main reasons. First, as the model incorporates both physical and social factors, it is a compromise between other models and theories. This allows a more holistic approach to understanding vulnerability which examines not only the risk produced through social processes, but also the risk produced by physical

processes. Second, the approach is inherently more geographical and the vulnerability level is understood within a specific region or geographical domain (Cutter, 1996). This allows the uniqueness of each place to be examined under the framework of an overarching model. Third, as this model acknowledges the links between all aspects of hazard and risk creation, as well as mitigation efforts, the model is inherently dynamic. The recognition that small changes in the social fabric or mitigation efforts can produce changes in the overall place vulnerability enhances the validity of this model. The acknowledgement of the importance of mitigation also recognizes that people (individuals and groups) are active participants in the vulnerability process. And finally, the Hazards of Place model considers a wide range of issues and factors in the social fabric portion to explain the overall social vulnerability. The model includes not only measurable variables such as ethnicity, age, education level and gender, but also processes that are difficult to measure and analyze using quantitative methods (including the perceptions and experiences of the community towards risks and hazards, coping ability etc.). This supports the use of qualitative and quantitative research methods that attempt to understand the perceptions and opinions of a variety of actors in the emergency management field.

Figure 3.2 below depicts the hazards of place model of vulnerability. In the Hazards of Place model, the risk level is characterized by the physical risk and has three components: the potential sources of the risk (i.e. physical, technological, social); the impact level of the risk (i.e. high or low impact); as well as the frequency of occurrence (i.e. one hundred year flood, 2% chance of structural failure) (Cutter et al., 2000). These three elements interact with the actions taken to mitigate the effects of the risk to create

the hazard potential. In this model, the hazard potential can be decreased through effective mitigation efforts, yet poor or ineffective measures can work to intensify the hazard potential (Cutter et al., 2000).

Figure 3.2: Hazards of Place Model of Vulnerability



Source: Cutter, 1996

The hazard potential interacts with both the geographic context as well as the social fabric. The geographic context includes the landscape features of the area under study, as well as the proximity to the hazardous sources and events. The social fabric incorporates a variety of socio-economic and demographic characteristics of the region, as well as the perceptions and experiences the community members have towards risks and hazards (Cutter et al., 2000). This indicates that while certain areas may have similar exposure to hazards, the willingness and ability of individuals or groups to mitigate, as well as manage after a hazardous event may be different. In this sense, coping ability is defined as the interaction between resistance and resilience (Cutter, 1996; Wu et al., 2002; Rygel, 2005).

The interaction between geographic context and the hazard potential creates the biophysical vulnerability, while the interaction between the social fabric and the hazard potential creates the social vulnerability. Notice that in this model, the geographic context and the social fabric are linked together, indicating that the geographic context influences the social fabric and vice versa. The interaction between the social vulnerability and the biophysical vulnerability creates the place vulnerability, also referred to as the hazardscape or the riskscape (Cutter et al., 2000; Cutter et al., 2003). In this model the place vulnerability is linked to the risk and mitigation elements, creating a feedback loop. This implies that changes or alterations in any of the elements in the model would result in changes to the vulnerability of the place. In this sense, the model is inherently dynamic, recognizing the complex and constantly changing nature of vulnerability.

In order to operationalize this model, Cutter *et al.* (2003) created the Social Vulnerability Index to provide some measurement of the 'Social Vulnerability' portion of the model. The Social Vulnerability Index (SoVI) considers previous social science research to determine which factors to incorporate into the index, including measures of income, political power and prestige in the community, gender, race and ethnicity, age, commercial and industrial development, employment loss, rural/urban development, types of residential developments, features of infrastructure and lifelines, family structure, education levels, population growth levels, access to medical services, social dependence, and special needs populations (Cutter et al., 2003). Based on their analysis of over 250 variables, Cutter *et al.* (2003) identified eleven composite factors which described over 75% of the variation experienced by counties in the Untied States. The factors are listed

in Table 3.4 below and include the amount of variation explained by the factor as well as the dominant variable used to determine the value for that factor. When combining the variables, an additive model was selected due to the absence of research and data which would support the use of weighting techniques and Cutter *et al.* (2003) noted that this allowed the researchers to make no "*a priori* assumption[s] about the importance of each factor in the overall sum" (p. 254).

Table 3.4: Composite Factors in the Social Vulnerability Index

Factor	Explained Variance	Dominant Variable
Personal Wealth	12.4%	Per Capita Income
Age	11.9%	Median Age
Density of the Built Environment	11.2%	# of Commercial Establishments/mi^2
Single-Sector Economy Dependence	8.6%	% Employed in Extractive Industries
Housing Stock & Tenancy	7.0%	% Mobile Homes
Race - African American	6.9%	% African American
Ethnicity - Hispanic	4.2%	% Hispanic
Ethnicity - Native American	4.1%	% Native American
Race - Asian	3.9%	% Asian
Occupation	3.2%	% Employed in Service Occupations
Infrastructure Development	2.9%	% Employed in Transportation, Communications and Public Utitilies

Source: Cutter *et al.*, 2003

While Cutter *et al.* (2003) found these variables were useful in the American context, little research has been carried out in regions outside of the US. As the Hazards of Place model would suggest, each region has its own unique blending of a variety of characteristics which creates its level of vulnerability at a localized scale. The SoVI, on the other hand, approaches social vulnerability from a larger scale, attempting to compare localized social vulnerability from region to region using the same set of social indicators. Therefore, while this research does not attempt to examine the validity of the SoVI, it is

important to understand whether the variables used in the United States are considered important in other developed regions of the world. The variables developed by Cutter form the basis for the survey, discussed in more detail in section 3.2.3.

Section 3.2.2 – Research Strategy

To conduct this research, a case study approach using both qualitative and quantitative research methods was used. The case study approach "contributes uniquely to our knowledge of individual, organizational, social, and political phenomena" (Yin, 2003, p. 2). As discussed in the literature review, vulnerability and resilience are processes affected by individual, organization, social, economic and political processes, and the case study allows an in-depth analysis of these processes. The case study method also allows the exploration of vulnerability and resilience within a "real-life context" (Yin, 2003, p. 1). Within the case study, both qualitative and quantitative research methods were used to collect data to allow for empirical and anecdotal evidence.

A variety of articles have provided definitions of quantitative and qualitative research methods, although a very concise and clear outline is provided below:

> Quantitative research is an inquiry into an identified problem, based on testing a theory, measured with numbers, and analyzed using statistical techniques. The goal of quantitative methods is to determine whether the predictive generalizations of a theory hold true. By contrast, a study based upon a qualitative process of inquiry has the goal of understanding a social or human problem from multiple perspectives. Qualitative research is conducted in a natural setting and involves a process of building a complex and holistic picture of the phenomenon of interest (SJI, 1999)

Various researchers have examined the importance of combining both quantitative and qualitative approaches to study complex phenomena such as vulnerability (Casebeer & Verhoef, 1997; Birkmann, 2007). Birkmann (2007) notes that vulnerability studies require the use of both qualitative and quantitative methods in order to "describe and operationalise vulnerability" (p. 20). The combination of both methods was particularly useful for this research as the aims of the research were both to explore perspectives and to test a previously developed model.

As one of the main purposes of the research was to explore the opinions and perceptions of emergency management practitioners and community workers who attend to the needs of identified vulnerable populations, qualitative research methods, in the form of interviews, were identified as the principal research tool. Auerbach & Silverstein (2003) note that quantitative research methods typically reduce human phenomena into "numerically measurable independent and dependent variables [and that] restricting data to measurable variables is unnecessarily limiting" (p. 23). Quantitative data makes the assumption that all respondents and participants would share similar experiences, whereas the qualitative approach allowed each interviewee the opportunity to share their own experiences and perceptions (Auerbach & Silverstein, 2003). Auerbach & Silverstein also note that qualitative methods allow the researcher to explore multiple perspectives and interpretations on any one issue and do not assume universality of experience. This is particularly well suited to the examination of vulnerability as vulnerable populations are dynamic populations that are affected and influenced by various social, political and economic processes.

While the use of qualitative methods was important in this research, the inclusion of quantitative methods also allowed the researcher to statistically test the validity of the 'Hazards of Place' model of vulnerability. A survey was designed to compare the variables developed by Cutter's Social Vulnerability Index to the variables that emergency managers found important for the Region. These follow-up surveys provided in-depth information on the disaster management practitioners' understanding of how vulnerabilities are created, what variables they feel are important influences on vulnerability and what mitigation techniques could be introduced (or enhanced) to reduce vulnerable populations in this Region. The survey approach incorporated questions in both a structured and semi-structured form. The subsequent section discusses the data collection methods in detail.

Section 3.2.3 – Data Collection

To conduct this research project, in-depth interviews and surveys were carried out with 25 emergency management practitioners and community organizations dealing with identified vulnerable populations in Waterloo Region. Originally the research proposal identified a smaller targeted group for potential interviews, consisting mainly of emergency management coordinators and essential response services (i.e. fire, police, ambulance and social services). After conducting the first few interviews, it became apparent that emergency management in Waterloo Region consisted of a larger group of individuals and organizations and the interview base was expanded to respond to this. As well, as the interviews were carried out, the researcher felt the need to include community organizations that worked closely with identified vulnerable populations to obtain the

perspective from those particular populations. This improved the confidence in the results and gave a variety of groups the opportunity to express their particular and unique needs and knowledge. The incorporation of different emergency response, social and community organizations is also supported by research in relevant literature including Buckle *et al.*, 2000; Ferrier, 2008; Cutter, 1996; Cutter *et al.* 2003.

Section 3.2.3a – Research Participants:

As discussed above, the research participants include emergency management practitioners, emergency responders, social services organizations, health and education institutions, infrastructure companies, community and faith organizations. Table 3.5 depicts an interviewee matrix broken down into the organizations and perspectives provided. Due to the confidential nature of the interviews, further subdivision or discussion of specific organizations targeted is not included.

Table 3.5: Interviewee Matrix

Organization	Number of Participants
CEMC's/Political Leaders	4
Responder Services	4
Responder Social Services	6
Infrastructure	2
Health Services	3
Education Services	3
Community Organizations	3
Total:	**25**

The placement, at times arbitrarily, of a person's knowledge and background resulted in a problem for the researcher. Many of the individuals interviewed provided insights from various perspectives and backgrounds, making it difficult to place them in definitive groups. This is particularly evident in the CEMC and responder services group whereby many of the CEMC's for each level of government are fire chiefs and therefore, they would bring in knowledge both as emergency coordinators as well as many years experience as emergency responders

Representatives from community, health and education organizations were the last group of individuals to be interviewed, due to the fact the organizations were targeted based on comments made from the emergency management population, as well as responder and social service organizations. Specific organizations were targeted through their work with identified vulnerable populations (i.e. health, children, elderly, disabled populations, low income, language/recent immigrants and geographical). Participants were selected based on their experience working with identified vulnerable populations (i.e. through advocacy, close personal relationships, mentorship etc.). Through the inclusion of these participants, an attempt was made to incorporate the perspectives, experiences and knowledge of identified vulnerable groups.

The first step in researching potential interviewee's began with an internet search on the Waterloo Region's Emergency Management website (www.wrem.ca). This website listed the names and email information for the regional, city and township community emergency management coordinators (CEMC's). Other participants were generated using the snowballing technique. At the end of each interview, participants

were asked to refer names of other individuals they felt would be able to provide further information for the study. Through this process, a total of 57 potential participants were contacted. Of these 57 individuals, 23 participated in face-to-face interviews, 1 participated in a phone interview and 1 submitted responses via email. A total of 7 individuals agreed to participate, either through face-to-face interviews or email submission of responses, but did not respond to further emails, whereas 7 individuals declined to participate due to time constraints. One other individual also declined to participate due to no longer being involved in emergency management in the Region. The remaining 17 individuals failed to respond to any email or telephone inquiries and no further contact was made.

Potential interviewees that did not participate included some from the rural areas of Waterloo Region. The lack of these participants is a limitation to this research. The inclusion of these participants would have provided a representation for the rural residents of the area. One potential reason for this lack of participation is that all the rural participants who declined to participate have other responsibilities besides emergency management. In many smaller townships, the CEMC also has the responsibility of the chief administrative officer, the town administrator, or the fire chief, etc. As noted by other interviewees, the priority of emergency management may be low for some of these individuals, hence their lack of participation.

All potential participants were contacted via email with a standardized invitation outlining the research project and requesting their participation. Those who responded were contacted either by phone or email to arrange an interview time. The interviews took place between October 2007 and June 2008. Participants were invited to choose

their interview location, either at their place of work, the university, or any other location of their choosing. Sixteen of the interviews took place at the interviewee's place of work, during work hours, whereas the remaining face-to-face interviews took place at Wilfrid Laurier University, both at the Waterloo and downtown Kitchener social work campuses. All the interviews were conducted with only the researcher and participant in the room, except for one interview where two participants were interviewed together.

Section 3.2.3b – Interviews and Surveys

The interviewee's were asked a variety of open-ended questions during the interview. The questions were designed to provide information specific to the participant's understanding of vulnerability and resilience, individuals and groups in the region who may have higher levels of vulnerability or resilience, as well as actions that could be taken to decrease vulnerabilities and increase resiliencies. The interview was designed specifically for emergency management practitioners. Interview questions are provided in Appendix A. The interview, along with the survey – discussed in further detail below – was piloted among emergency management practitioners in other regions in southern Ontario. A few minor changes were made to the structure of the questions based on these responses.

As the interviews continued, and the group of participants was expanded, changes were made to the questions to reflect the positions and responsibilities of those being interviewed. Through this process, the most important questions regarding vulnerability and resilience were kept, whereas the information specific to emergency management in the region was excluded (i.e. questions related specifically to disaster events, emergency

management procedures and documents). These changes did not affect the results as the most important questions under analysis remained the same. These revised interview questions are shown in Appendix B.

The interviews were approximately 45 minutes in length, although this ranged from 20 minutes to over 2 hours, depending on the interviewee. All the interviews were recorded using a voice recorder, with the exception of the interview where responses were submitted electronically and the phone interview, which was manually transcribed. All interviews were transcribed verbatim for the purposes of coding and analysis.

At the end of each interview, participants were asked to fill out a survey, which took approximately 10 minutes to complete. While some respondents completed the survey immediately, others asked to take the survey with them and complete it at their leisure. This resulted in some surveys not being returned to the researcher, although a total of 18 completed surveys were obtained. Research participants from community organizations were asked to complete the survey, but were warned that the survey was designed for emergency management practitioners. Respondents were directed to leave any questions blank they did not feel comfortable answering.

The survey, similar to the original interview questions, was designed and piloted for emergency management practitioners. The survey included lists of variables where the respondents were asked to rank both each individual variable and the absolute importance of each variable, as well as a variety of less structured questions pertaining to their vulnerability and resilience knowledge. The survey is shown in Appendix C. The variables selected for analysis are based on a wide range of vulnerability literature, but

also specifically on those variables that Cutter *et al.* (2003) found important through their social vulnerability index.

Section 3.2.3c – Data Triangulation

At the beginning of this research project, the intention was to use multiple sources of data to examine vulnerable groups in the Region. Yin (2003) notes the "case study's unique strength is in its ability to deal with a full variety of evidence – documents, artifacts, interviews and observations" (p. 8). At the end of each interview, participants were asked if they were aware of any documents, proceedings or internal reports relating to emergency events in the Region that the researcher would be able to examine. The researcher had expected the 1998 ice storm and 2003 blackout events to have generated this type of information. While this did not appear to be the case, several documents from the Region were incorporated into this study. These included a variety of emergency plans (local, regional and organization), pandemic reports and internal power-point presentations. Through these additional sources of data, the researcher was able to corroborate data obtained through the interviews and surveys (Woodside, 2007).

Section 3.2.4 – Data Analysis

Although case study research suggests that results are based on the "investigator's own style of rigorous thinking, along with the sufficient presentation of evidence and careful consideration of alternative interpretations" (Yin, 2003, p. 110), an approach to manage, organize and critically analyze the data is still required. For these purposes, the analysis and coding process was based, in part, on the grounded theory approach. The

grounded theory approach assumes that "through detailed exploration, with theoretical sensitivity, the researcher can construct theory *grounded* in data" (Morse & Richards, 2002, p. 54). The central purpose of grounded theory is to develop a core concept and examine how other categories and variables connect to the core concept (Morse & Richards, 2002; Strauss, 1987). While this approach attempts to hold no prior assumptions about the results, and assumes the resultant theories emerge from the data themselves, this was not necessarily the case in this research project (Strauss & Corbin, 1998). The specific aim of this research is to examine the 'Hazards of Place' model of vulnerability, and as such, there are various assumptions and prepositions made about vulnerability beforehand. While this may be the case, the research also seeks to develop a theoretical understanding of vulnerability and resilience and this supports the use of grounded theory methods.

Through the data analysis process, the data was manually coded using open coding. This inductive process involved the reading of the transcribed interview data and the linking and labeling of concepts, based both on the previously established research questions, as well as patterns that emerge from the data (Morse & Richards, 2002; Strauss & Corbin, 1998). The coding process involved the simultaneous use of topic and analytic coding. Topic coding separated "all material on a topic for later retrieval and description, categorization, or reflection" (Morse & Richards, 2002, p. 117). Analytic coding suggests that new ideas and themes are developed and evolved throughout the coding process as ideas and concepts are discovered, linked and expanded upon (Morse & Richards, 2002). Through the discovery of new concepts and categories, axial coding was used to further define core concepts. Axial coding is the process of defining categories and then referring

and relating them to their "subcategories to form more precise and complete explanations about phenomena" (Strauss & Corbin, 1998, p. 124; Morse & Richard, 2002). Once the topic and analytic coding was completed, the researcher used the ideas and themes that were generated to develop results, not only to support the research questions (see Chapter 4), but also to promote discussion on the theoretical concepts discovered in the data (see Chapter 8).

Due to the limited number of completed surveys, quantitative analysis was restricted to simpler forms of descriptive statistics. The nature of the data itself – the use of ordinal ranking – also restricted the forms of analysis. In this case, the median, mode and various percentages of each ranked variables was determined to compare these results to Cutter's (1996, 2003) research. Due to the small number of surveys completed, further subdivision of the data was not completed as this would have resulted in sample sizes that were too small to provide any meaningful results.

While comparison between Cutter's variables and the results of this research provide an indication of the applicability of the 'Hazards of Place' model, it should be noted that the methods for determining the relative importance of certain variables was different. While Cutter et al. (2003) used empirical data and statistical analysis to determine their vulnerability variables, the results of this research provide information based on perceptions of vulnerability. Cutter et al.'s (2003) analysis was also determined through analysis at the county scale, whereas the perceptions of vulnerability were based on a variety of scales. Although these differences in methods exist, the survey results

provided a relative indication of the importance of Cutter et al.'s (2003) variables in a Canadian context.

Section 3.3 – Challenges and Limitations of Data Collection

Challenges and limitations were encountered during this research project. The first challenge was attaining research participants. As noted in the above section, 57 candidates were contacted to participate, while only 25 were able to partake in the study. While this is a fairly high respondent rate, unfortunately there was a low participation rate from the rural areas in Waterloo Region. The inclusion of these persons would have incorporated a more 'rural' perspective into the research, and this lack of participation certainly limits the data to some degree.

One particular limitation of this research is that no member of groups who were identified as vulnerable participated in this study. At the beginning phase of this study, the researcher was only planning on interviewing emergency management practitioners. As the interviews took place, the decision was made to include representatives from community organizations that work closely with identified vulnerable groups in the region. Although this attempt was made to include the perspective of identified vulnerable populations, the persons chosen (or who were able) to participate were not actual members of the identified groups, and as such, their perspective and knowledge is limited to that of an 'outsider'. While this may be the case, the researcher found there was much valuable information gained from these particular individuals that directly related to resilience levels of identified vulnerable groups that was not obtained through other interviews.

The inclusion of a limited number of participants from each identified vulnerable group and emergency management organizations also limits the results to a certain degree. The comments and perceptions of certain individuals may not necessarily be representative of that particular organization or group. Although this may be the case, at this point, the emergency management community in Waterloo Region is relatively small and only one or two individuals were actively engaged in emergency response and planning for each organization. Wherever possible, more than one participant from each organization was interviewed.

One other limitation of this research relates specifically to how the data was collected. Obtaining information based on the perceptions of individuals, even those who have generous experience in the field of emergency management, can sometimes be misleading. Any type of bias or stereotypes, on the part of the interviewee, could change the results of the data set. Research has indicated that in some cases, groups identified as vulnerable by emergency planners were actually found to be more resilient during actual disaster events (Handmer, 2003; Buckle *et al.*, 2000; Ferrier, 2008). Although this may be the case, throughout the interviews, many of the participants noted the difficulty in defining vulnerable populations and discussed the resiliencies that some regularly identified vulnerable groups may have. The inclusion of community organizations as a perspective for identified vulnerable populations was a method for alleviating some of the possibility of bias and stereotypes.

Section 3.4 – Conclusion

The above section has provided an overview of the Waterloo Region, and an in-depth discussion of the methods chosen to examine the 'Hazards of Place' model of vulnerability. While both quantitative and qualitative methods were used, the emphasis was placed on qualitative approaches, specifically through the use of semi-structured interviews. The subsequent chapters provide a summary of the results, followed by a discussion of how the findings integrate with the literature in Chapter 8.

4. RESULTS – PART 1

The following chapters present the findings of the perceptions and opinions of emergency management practitioners and community representatives in relation to vulnerability in Waterloo Region. The results are presented in four chapters as they relate to the research questions first presented in Chapter 1. The focus is on the arguments between social and physical vulnerability, a comparison between the Cutter *et al.*'s (2003) variables and those discussed during the research, the depiction of vulnerability, as well as mitigation of vulnerability. Throughout these chapters, the findings are discussed through the participant's observations during the interviews and survey results and complemented by various findings in the vulnerability literature. Chapter 8 takes a theoretical approach where the theory is grounded in the data and discussed in terms of one main theme: vulnerability as the absence of resilience. In order to organize the results and discussion, a summary of the abbreviations used for each participant is presented in Table 4.1.

Table 4.1: Participant Abbreviation Breakdown

Participant Group	Number of Participants	Participant Abbreviation
Community Emergency Management Coordinator's (CEMC's) and Political Leaders	4	CEMC1 - CEMC4
Responder Services	4	RS1 - RS4
Responder Social Services	6	RSS1 - RSS6
Infrastructure	2	I1 - I2
Health Services	3	HS1 - HS3
Education	3	E1 - E3
Community Organizations	3	CO1 - CO3

Section 4.1 – Vulnerability: Social versus Physical

The first research question seeks to determine whether the 'Hazards of Place' model of vulnerability is applicable in a Canadian context. While previous vulnerability models focused almost exclusively on the social aspects of vulnerability, the 'Hazards of Place' model recognizes the importance of both social and physical vulnerability. The model argues that the overall place vulnerability is unique to each region as it is created through the interactions between the hazard potential, the geographic context and the social fabric of each region. Participants in this research communicated the importance of considering both the social and physical aspects of vulnerability. Two participant quotes are noted:

> It is a geographical area vulnerable to fires, floods, heat, those types of things. There is a pile of disasters – human and natural – depending where you live...so it's a vulnerability personally and a vulnerability geographically. RSS4

> Well if you think about [vulnerability] in terms of geographic and personal, so the larger geographic issue, for example are we in a floodplain? HS2

The importance of geographic location was reiterated throughout many of the interviews. When questioned about variables that affect vulnerability (discussed in further detail in Chapter 5) respondents identified location in 20 out of 25 interviews, and geographic location was mentioned a total of 50 times throughout all the interviews (see table 5.3). This placed geographic location in the top five variables identified as influencing levels of vulnerability. In this sense, respondents were clearly in agreement that geographic location affects the types of hazards that individuals and groups are exposed to, as well as the level of overall vulnerability experienced. This was reiterated

through the survey as well. Table 4.2 shows the results of the survey where participants were asked to rank the importance of variables from 1 (very important) to 5 (very unimportant). The mode and median value for each variable is provided, along with the percentage of respondents who ranked the variable for each value (for example, 82.4% of respondents' ranked physical proximity in the 1 (most important) ranking). Table 4.3 shows the results of the overall ranking of each variable from 1 (most important) to 13 (least important) using the same descriptive statistics.

Table 4.2: Survey Results: Ranking Importance for Each Variable

Variable	% Rank 1	% Rank 2	% Rank 3	% Rank 4	% Rank 5	Mode	Median	Total Responses
Physical Proximity	82.4	11.8	0.0	5.9	0.0	1	1	17
Mobility	47.1	29.4	17.6	5.9	0.0	1	2	17
Language	47.1	23.5	11.8	5.9	11.8	1	2	17
Infrastructure Development	40.0	33.3	20.0	6.7	0.0	1	2	15
Disability	35.3	52.9	11.8	0.0	0.0	2	2	17
Age	29.4	47.1	17.6	0.0	5.9	2	2	17
Income Levels	29.4	35.3	11.8	5.9	17.6	2	2	17
Density of the Built Env.	23.5	23.5	41.2	11.8	0.0	3	3	17
Social Status	17.6	41.2	11.8	0.0	29.4	2	2	17
Housing Quality	11.8	29.4	29.4	17.6	11.8	2, 3	3	17
Gender	6.3	18.8	25.0	6.3	43.8	5	3.5	16
Race/Ethnicity	5.9	17.6	35.3	17.6	23.5	3	3	17
Occupation	5.9	5.9	52.9	23.5	11.8	3	3	17

Table 4.3: Survey Results: Overall Ranking

Variable	% Rank 1 - 2	% Rank 3 - 5	% Rank 6 - 8	% Rank 9 - 11	% Rank 12 - 13	Mode	Median	Total Responses
Physical Proximity	76.5	11.8	5.9	0.0	5.9	1	1	17
Mobility	23.5	52.9	23.5	0.0	0.0	4	4	17
Age	23.5	52.9	11.8	5.9	5.9	4	4	17
Disability	23.5	47.1	17.6	5.9	5.9	5	3	17
Language	17.6	41.2	23.5	11.8	5.9	5	5	17
Infrastructure Development	17.6	5.9	41.2	29.4	5.9	6	7	17
Income Levels	11.8	29.4	29.4	17.6	11.8	3	6	17
Social Status	11.8	11.8	17.6	29.4	29.4	9	9	17
Gender	0.0	17.6	29.4	0.0	52.9	13	12	17
Density of the Built Env.	0.0	17.6	23.5	41.2	17.6	11	10	17
Occupation	0.0	5.9	35.3	29.4	29.4	8	10	17
Race/Ethnicity	0.0	5.9	5.9	64.7	23.5	9	10	17
Housing Quality	0.0	0.0	29.4	52.9	17.6	11	10	17

Through these results, it is clear that respondents recognized geographic processes as one of the primary factors affecting levels of vulnerability in Waterloo Region. Physical proximity to the disaster event was ranked as the most important variable affecting levels of vulnerability in both survey questions. This is summarized by two participants:

> I don't think that it would be a fair measure to say that for each disaster that we have the same group of vulnerable populations because we don't. It depends if you're on the inner circle and you've been immediately impacted. CEMC1

> Vulnerability, by my definition, is the proximity or exposure to adverse external events. E1.

While physical proximity to the disaster event was ranked as a highly important variable, living and working in locations with higher hazard risks was also discussed by participants. Respondents noted:

> The fact that we have certain factories locally that will increase the range of chemical hazards – the fact that we live in a particular zone or geographic location that we are more susceptible to tornados or ice storms. RSS1

> Certainly we have people in the community that are, because of where they are, they may be more vulnerable…so there may be some people who are more vulnerable to that kind of thing just by virtue of where they live in the community. CEMC3

> You make yourself more vulnerable if the community has identified through its emergency management program that here are vulnerable areas in the community to live…but they have decided to live or work in a floodplain…we work and we play and we live in hazardous areas. CEMC1

While many participants noted the importance of location and geographic risks in assessing overall vulnerability levels, they also emphasized the importance of

incorporating social, economic and political processes into the vulnerability discussion. One participant noted that:

> Vulnerability...it's really connected to the social, the economic, and the political processes that are going on in our community. CEMC1

A number of variables, including socio-economic status, education, health, social networks, language and cultural barriers, were repeatedly recognized throughout the interviews as affecting vulnerability levels. The survey results also indicate the importance of social variables, as issues of mobility, disability, age, language and income levels were given value of high importance, as well as overall ranking. These variables are discussed in more detail in Chapter 5.

Section 4.2 – Uniqueness of Place

The 'Hazards of Place' model, while taking both social and physical vulnerabilities into consideration, also emphasizes the uniqueness of each region or area. Cutter (1996) notes that through this model "there is an explicit focus on locality...for it is the place that forms the fundamental unit of analysis" (p. 78). This is similar to the observation of one participant who stated:

> So each community is different and it depends on your Hazard Identification and Risk Assessment (HIRA). It all depends on what it is that is identified in your region or your area as being problematic in terms of probability and consequence. RS1.

Many respondents implicitly noted the uniqueness of place through a discussion of the unique characteristics of Waterloo Region, including the Mennonite population,

recent immigrant populations, the two universities and a college located within, and the high prosperity levels in the region. A recent study of the Old-Order Mennonite population in Waterloo Region explicitly acknowledged the importance of place and suggested that the Mennonite community was "empowered in their unique identity in place" (Dabrowska-Miciula, 2007, p. 238), Thus the participants recognized the unique characteristics of the region compared to other areas and noted that this had the potential to impact vulnerabilities during particular types of disaster events. This is consistent with the growing research consensus that the impacts of large-scale social, political and economic processes will manifest themselves in diverse ways at the community level (Smit & Wandel, 2006; Murphy, 2007; Dabrowska-Miciula, 2007).

Section 4.3 – Vulnerability Literature

The 'Hazards of Place' model is also fairly consistent with more recent findings in the vulnerability literature. Various researchers have noted the importance of incorporating both physical and geographical elements of exposure and risk with the social conditions of the community (Smit & Wandel, 2006; Gallopin, 2006). This approach to vulnerability, whereby both social and ecological systems are seen as influential in the vulnerability process, incorporates an essential and holistic approach to vulnerability and resilience research. Adger (2006) notes that "the concept of a social-ecological system reflects the idea that human action and social structures are integral to nature and hence any distinction between social and natural systems is arbitrary" (p. 268). Similarly referring to social-ecological systems (SES), Gallopin (2006) also recognizes the:

> dynamic interplay between the social and ecological components...the need to investigate the whole SES arises from the increasingly recognized evidence that understanding and anticipating the behavior of the social and ecological components of the SES in many cases requires simultaneously taking into account both components; in other words, SES's are non-decomposable systems" (p. 294).

Section 4.4 – Conclusion

Through these observations, it is clear that the 'Hazards of Place' model of vulnerability is generally applicable in a Canadian context. Both the model and the research participants emphasized the importance of incorporating biophysical risk and social processes into the calculation of vulnerability levels, as well as emphasizing the uniqueness of these interactions specific to each place. While the model appears to be applicable in a Canadian context, the following section examines whether the variables identified by Cutter throughout her research are appropriate for a mid-sized Canadian city.

5. RESULTS – PART II

The second research question examines vulnerability variables identified during interviews and surveys and compares them to the variables identified during Cutter *et al.*'s (2003) research. Participants were asked a variety of questions (see Appendix 1) regarding the circumstances and variables that affect levels of vulnerability, either in groups or individually. In this section, a brief review of the variables affecting vulnerability levels identified through Cutter *et al*'s (2003) research is provided, followed by a discussion of the variables identified during this research. Subsequent to this is a discussion of the complexity of vulnerability, and how levels of vulnerability are affected by a variety of situational circumstances and events.

Section 5.1 – Cutter's Variables

Through her research and reading, Cutter has identified the importance of several key variables that affect levels of vulnerability. Table 5.1 provides an overview of variables that affect vulnerability as identified through an extensive literature review conducted by Cutter *et al.* (2003). These variables are generally agreed upon in the vulnerability literature, although Cutter notes that "disagreements arise in the selection of specific variables to represent these broader concepts" (Cutter *et al.*, 2003, p. 244). Table 5.2 offers a list of composite variables that Cutter *et al.* (2003) found that differentiated levels of vulnerability in the United States at the county level. The variables identified in Table 5.2 were used during the survey to determine whether the research participants felt they were significant in affecting vulnerability in Waterloo Region. The comparison is discussed below in section 5.1.2.

Table 5.1: Social Vulnerability Variables and Concepts

Concept	Description	Sources
Socio-Economic Status	The ability to absorb losses and enhance resilience to hazard impacts. Wealth enables communities to absorb and recover from losses more quickly due to insurance, social safety nets and entitlement programs	Burton et al (1993); Blaikie et al (1994); Peacock et al (1997); Hewitt (1997); Puente (1999); Platt (1999)
Gender	Women can have a more difficult time during recovery than men, often due to sector-specific employment, lower wages and family care responsibilities	Blaikie et al (1994); Enarson & Morrow (1998); Enarson & Scanlon (1999); Morrow & Phillips (1999); Fothergill (1996); Peacock et al (1997); Hewitt (1997)
Race and Ethnicity	Imposes language and cultural barriers that affect access to post-disaster funding and residential location in high hazard areas	Pulido (2000); Peacock et al (1997); Bolin & Stanford (1998); Bolin (1993)
Age	Extremes of the age spectrum affect the movement out of harm's way. Parents lose time and money caring for children when daycare facilities are affected; elderly may have mobility constraints or mobility concerns increasing the burden of care and lack of resilience	O'Brien & Mileti (1992); Hewitt (1997); Ngo (2001)
Commercial and Industrial Development	The value, quality and density of commercial and industrial buildings provides an indicator of the state of economic health of a community, potential losses in the business community and longer-term issues with recovery after an event	Webb et al (2000); Heinz Centre for Science, Economics and the Environment (2000)
Employment Loss	The potential loss of employment following a disaster exacerbates the number of unemployed workers in a community, contributing to a slower recovery from the disaster	Mileti (1999)
Rural/Urban	Rural residents may be more vulnerable due to lower incomes and more dependent on locally based resource extraction economies (e.g. farming, fishing). High-density areas (urban) complicate evacuation out of harm's way	Cova & Church (1997); Mitchell (1999)
Residential Property	The value, quality and density of residential construction affects potential losses and recovery. Expensive homes on the coast are costly to replace; mobile homes are easily destroyed and less resilient to hazards	Bolin & Stanford (1991); Heinz Centre for Science, Economics and the Environment (2000)
Infrastructure and Lifelines	Loss of sewers, bridges, water, communications and transportation infrastructure compounds potential disaster losses. The loss of infrastructure may place an insurmountable financial burden on smaller communities that lack the financial resources to rebuild	Platt (1995); Heinz Centre for Science, Economics and the Environment (2000)
Renters	People that rent do so because they are either transient or do not have the financial resources for home ownership. They often lack access to information about financial aid during recovery. In the most extreme cases, renters lack sufficient shelter options when lodging becomes uninhabitable or too costly to afford	Morrow (1999); Heinz Centre for Science, Economics and the Environment (2000)
Family Structure	Families with large numbers of dependents or single-parent households often have limited finances to outsource care for dependents, and thus must juggle work responsibilities and care for family members. All affect the resilience to and recovery from hazards	Blaikie et al (1994); Morrow (1999); Heinz Centre for Science, Economics and the Environment (2000); Puente (1999)

Occupation	Some occupations, especially those involving resource extraction, may be severely impacted by a hazard event. Self-employed fisherman suffer when their means of production is lost and may not have the requisite capital to resume work in a timely fashion and thus will seek alternative employment. Those migrant workers engaged in agriculture and low-skilled service jobs may similarly suffer as disposable income fades and the need for services declines. Immigration status also affects occupational recovery	Hewitt (1997); Heinz Centre for Science, Economics and the Environment (2000); Puente (1999)
Education	Education is linked to socio-economic status, with high education attainment resulting in greater lifetime earnings. Lower education constrains the ability to understand warning information and access to recovery information	Heinz Centre for Science, Economics and the Environment (2000)
Population Growth	Counties experiencing rapid growth lack available quality housing, and the social services network may not have had time to adjust to increased populations. New migrants may not speak the language and not be familiar with bureaucracies for obtaining relief or recovery information, all of which increases vulnerability	Morrow (1999); Heinz Centre for Science, Economics and the Environment (2000); Puente (1999)
Medical Services	Health care providers, including physicians, nursing homes, hospitals, are important post-event sources of relief. The lack of proximate medical services will lengthen immediate relief and longer-term recovery from disasters	Morrow (1999); Heinz Centre for Science, Economics and the Environment (2000); Hewitt (1997)
Social Dependence	Those people who are totally dependent on social services for survival are already economically and socially marginalized and require additional support in the post-disaster period	Morrow (1999); Heinz Centre for Science, Economics and the Environment (2000); Drabek (1996); Hewitt (2000)
Special Needs Population	Special needs populations (infirm, institutionalized, transient, homeless), while difficult to identify and measure, are disproportionately affected during disasters and, because of their invisibility in communities, mostly ignored during recovery	Morrow (1999); Tobin & Ollenburger (1993)

Source: Cutter *et al* (2003)

Table 5.2: Composite Variables for the United Sates at the County Level

Factor	Explained Variance	Dominant Variable
Personal Wealth	12.4%	Per Capita Income
Age	11.9%	Median Age
Density of the Built Environment	11.2%	# of Commercial Establishments/mi^2
Single-Sector Economy Dependence	8.6%	% Employed in Extractive Industries
Housing Stock & Tenancy	7.0%	% Mobile Homes
Race - African American	6.9%	% African American
Ethnicity - Hispanic	4.2%	% Hispanic
Ethnicity - Native American	4.1%	% Native American
Race - Asian	3.9%	% Asian
Occupation	3.2%	% Employed in Service Occupations
Infrastructure Development	2.9%	% Employed in Transportation, Communications and Public Utitilies

Source: Cutter *et al*., 2003

Section 5.2 – Waterloo Region Variables

Throughout the interviews and surveys, respondents discussed a variety of variables that affected levels of vulnerability in Waterloo Region. The interview variables were coded from the transcribed interviews using two methods. Both the number of times each variable was brought up during the interview (SUM Total) as well as the total number of interviews the variable was mentioned in (SUM Once) was calculated. Table 5.3 below shows the results from this coding. Variables that are similar to those discussed throughout the vulnerability literature, emphasized in Cutter *et al.* (2003) are highlighted in blue, whereas the variables similar to Cutter *et al.*'s (2003) composite variables at the county level for the United States are highlighted in yellow. Variables not mentioned in Cutter *et al.*'s (2003) literature review and research findings are highlighted in red.

From this table, it appears that several of the variables discussed by Cutter *et al.* (2003) were documented during the interviews, including race and ethnicity (this was understood as similar to language, culture and race), personal wealth, age, and building density. The composite variables determined by Cutter *et al.* (2003) that were not mentioned during any interviews include single-sector economy dependence, occupation type and infrastructure development. Postulations for why these variables were excluded include the fact that Waterloo Region includes a wide-range of economic industries, including service, tertiary, manufacturing and technology. Occupation was only mentioned in terms of geographic location, meaning that employers located in hazardous locations were exposed to increased vulnerability due to likelihood for damage as well as the economic ramifications on employees, especially those paid hourly. Infrastructure

development was acknowledged as a vulnerability in terms of providing and maintaining essential services to the community during a disaster event, but the presence or absence of infrastructure in the community was not seen as a vulnerability as described in Cutter *et al.*'s (2003) research.

Table 5.3: Variables that Affect Vulnerability

Variable	SUM Total	Variable	SUM Once
	76		22
	76		21
	56		20
Low income	53		20
	50		20
Language	48		19
	45	Elderly	18
	41	Age	17
Elderly	33	Low income	17
	30	Language	16
Age	28		16
Culture	24		14
Mobillity	22	Mobillity	14
Children	21	Children	12
	20		11
	20	Culture	10
	19		10
	17		9
	15		9
	13		9
	12		7
	12		7
	10		6
	6		5
	4		3
Population density	4		3
	3		3
	3	Population density	3
Race	1	Race	1
	1		1

Variables that affect vulnerability levels were also calculated through the survey results. The survey results can be seen in detail in tables 4.2 and 4.3 in the previous chapter, while table 5.4 below depicts the results of the survey compared to Cutter *et al.*'s composite variables. In each column, variables are ranked in order of importance with the most important variables listed at the top, and the least important listed at the bottom. In the survey results, only one variable was listed for both race and ethnicity (compared to four for Cutter's variables) and single-sector economy dependence was not included.

Table 5.4: Survey Results Compared to Composite Variables

Cutter's Composite Variable	Explained Variance	Survey Results Importance Variables	% Rank 1	Survey Results Ranked Variables	% Rank 1 - 5
Personal Wealth	12.4%	Infrastructure Development	40.0	Age	76.4
Age	11.9%	Income Levels	29.4	Income Levels	41.2
Density of the Built Environment	11.2%	Age	29.4	Infrastructure Development	23.5
Single-Sector Economy Dependence	8.6%	Density of the Built Env.	23.5	Density of the Built Env.	17.6
Housing Stock & Tenancy	7.0%	Housing Quality	11.8	Occupation	5.9
Race - African American	6.9%	Race/Ethnicity	5.9	Race/Ethnicity	5.9
Ethnicity - Hispanic	4.2%	Occupation	5.9	Housing Quality	0.0
Ethnicity - Native American	4.1%	---	---	---	---
Race - Asian	3.9%	---	---	---	---
Occupation	3.2%	---	---	---	---
Infrastructure Development	2.9%	---	---	---	---

From these three tables, several variables were found to be similar to Cutter *et al.*'s (2003) research, including income, age, and infrastructure development. Variables that were not ranked highly include race/ethnicity, occupation, and housing quality. Interestingly, while infrastructure development was not mentioned during any interviews, participants ranked it higher in importance than density of the built environment which was mentioned as a variable affecting vulnerability during the interviews. As well, race and ethnicity were given some of the lowest scores of importance and ranking throughout

all the surveys. This may be attributed to different understandings of terminology and, perhaps, lack of clarity of the terms used in the survey. While race and ethnicity could affect levels of vulnerability, an individual's racial or ethnic background was not seen as affecting levels of vulnerability unless there were visible manifestations of this ethnicity, specifically through language or cultural barriers.

Variables that were frequently acknowledged during this research which are not mentioned in Cutter's work are preparing, complacency, networks, access to information and resources, pets and animals, as well as large group gatherings and poor land-use. Access to information and resources is generally attributed to a variety of social and economic factors, including educational level, language, cultural barriers, and income. As such, this variable will not be discussed below as it was discussed in depth in the literature review. An in-depth discussion of the remaining variables, as well as variables where differences and complexities were acknowledged can be found below.

Section 5.2.1 – Preparing and Complacency

Preparing for disaster events through stockpiling of provisions and supplies necessary during the first 72 hours of an emergency event was identified as a critical tool for reducing vulnerability. Examples of necessary supplies included water, medical supplies, any special medications, documents, cash, food, flashlight, batteries, candles and crank radios. Becoming aware of hazards and risks in the community was also considered a part of preparing. When discussing characteristics and activities individual's and groups engage in to increase resiliency, one respondent noted:

> Preparedness is the biggest one and knowledge. If you know the kinds of hazards that are expected in the area and what can happen during those hazardous events. CO1

Complacency was acknowledged as one of the main reasons for individuals and groups not preparing themselves with information and resources for emergency events. When residents adapt an "it won't happen here" attitude, the coping capacity of the individual and the community overall is reduced.

Section 5.2.2 – Networks

Establishing networks and building social capital at the individual and community scale was seen to influence vulnerability levels. Individuals with access to informal social networks of family and friends who could assist during emergency events were seen as less vulnerable, while those who lacked social supports were identified as having higher vulnerability. Community scale networks and relationships between emergency responders, social service organizations and government officials was also recognized as an effective method for reducing vulnerability. This is discussed in further detail in Chapter 7.

Section 5.2.3 – Pets and Animals

Animals and livestock are increasingly recognized, not only as a vulnerable population, but also as affecting individual vulnerability levels. Individuals and families with pets may have increased vulnerability if they decide not to evacuate due to lack of services for their pets:

> Typically people who have pets that care a lot about their pets are excluded from a lot of things like shelters - shelters won't take people with their pets. So rather than leave their pets somewhere else they won't enter the normal system. So in the US they've actually put in legislation that requires shelters to take pets and the same thing is happening here in Canada because there is a fairly significant part of the population that won't accept the services unless their pet can too. RS2.

These types of legislative actions have arisen out the circumstances surrounding previous events whereby individuals and families refused to evacuate, or large numbers of animals and livestock perished during disaster events. Disaster impacts on livestock can also have significant economic ramifications.

Section 5.2.4 – Large Group Gatherings

The vulnerability of large group gatherings was acknowledged during a few interviews, specifically in terms of pandemic and medical emergencies. Schools, daycares, hospitals, and nursing homes were all seen as institutions where a large number of people were located in close proximity, sharing the same air, with a high rate of disease transmission. These types of large group gatherings increased the vulnerability to medical emergencies.

Large group gatherings can also be seen as a circumstantial vulnerability during an unexpected disaster event if the gathering is located in close geographical proximity to the hazard itself. Special events, tourist attractions, and time of year can influence the number of people located in certain areas and can have significant impacts on evacuation and response during emergency situations (Cova & Church, 1997; Wood & Good, 2004). An example for Waterloo Region would be the yearly Oktoberfest event in which nearly

one million tourists attend. Unfamiliarity with the area, local hazards and available resources could greatly increase the vulnerability of these populations.

Section 5.2.5 – Poor Land Use

Poor land use has increasingly been identified as a contributor to so-called human-induced natural events. While only mentioned explicitly in one interview, emerging concepts of sustainable development and environmental impacts of resource development and extraction were increasingly identified throughout many interviews. This is discussed in further detail in Chapter 7.

Section 5.2.6 – Urban vs Rural Vulnerability

Similar to Cutter's discussion of the distinctions between urban and rural communities, respondents discussed the different vulnerabilities and resiliencies that each community posses. In urban communities, vulnerabilities are seen to lie through the expectation of immediate help from responders and government, as well as lack of social networks. Rural communities, on the other hand, are seen as more resilient due to stronger social networks, decreased dependency on technological and resource networks, as well as increased personal planning and preparation. Rural communities are seen as more vulnerable due to distance from responder services, as well as infrastructure that is more vulnerable:

> If you are out in the country, it's a rural setting, so to speak. I think it goes to say that the response is going to be diminished. I think that a response is going to take a longer time and in terms of ramping up your resources, it's also going to take a greater time to do – just for the fact that it's going to take time for everyone to come in and to deal with the situation and find

> out what's going on and to know what they need...[but on the other hand] the fact that really they are in an isolated location and that they will need to have their own individual plan in effect first because they can't depend on the region or the city or the municipality or the township to respond in a timely fashion – that's going to make or break their livelihood. So there is better individual planning. If you're living in the city, you expect that if there is an emergency that the first responders and the emergency planners will look after those types of events. RS1
>
> In urban areas, you rarely know your neighbors very well, so they are not part of your extended family as much as in a rural community where you know everybody and everybody pitches together and helps and that adds a bit of vulnerability for those in the city. RS2

The interaction between various factors affecting vulnerability and resilience is highlighted through the urban versus rural example of the Mennonite community in Waterloo Region. The Mennonite community was persistently described as a resilient community through their culturally induced independence from technology and resource chains, as well as their cohesive community unit. When asked about resilient communities, one participant responded:

> If you are Mennonite living in Elmira, you're accustomed to dealing with nature and dealing with raw elements and being self-sufficient. So dealing with a disaster in a Mennonite community is far different than dealing with the disaster if it were to happen in town, because they are prepared to deal with it. It's their way of life – they can pick up and build again and rebuild. They are able to adapt to their environment a lot easier than we are because they are no dependent on power and the things that we have become accustomed to in the 21st century. RS1

This increased resiliency is also suggested by recent research which suggests that "rural or traditional societies may have stronger social capital relationships due to the increased and sustained interaction among community members" (Murphy, 2007, p. 302; Hofferth & Iceland, 1998). Recent research on the Mennonite community in Waterloo

Region has also recognized this community's resiliency, based not only on their geographic position in a "rural place", as well as their social capital, but also in their cultural perceptions of risks and hazards (Dabrowska-Miciula, 2007).

All together, these quotes suggest that determining vulnerability is a highly complex endeavor that should incorporate not only the variables and circumstances that increase an individual or group's susceptibility, but also their ability to cope and respond to the disaster event.

Section 5.3 – Who is Truly Vulnerable?

While participants identified individuals and groups that may experience increased vulnerability during a disaster event, they also noted the complexity of vulnerability issues. Many interviewees' indicated the value of incorporating the concepts of resiliency and coping capacity into discussions of vulnerability. Several participant comments are noted below which highlight the complexity of vulnerability:

> I have come to appreciate that who is vulnerable is actually a much more complex activity. It's more complicated...we as decision makers have been making assumptions about who is vulnerable and who is not vulnerable, but the reality is that there is a lot of community coping capacity out there to help us with our level of vulnerability. CEMC1

> Any of those groups that have been in war-torn countries and have seen devastation – they adapt easier to a disaster in terms of being able to personally pick themselves up and say – you know what, this is not that bad, we'll make ends meet, we'll make things work out. They have that individual component about their character that makes them say we will survive and they've got that drive whereas if you're born in this country and you're accustomed to certain things. It is a little more shocking to you and your adjustment phase is longer – your coping mechanisms are not that good. RS1.

> You've got children who are in custody or they live in these particular group homes – they could be considered a vulnerable population because of their history and where they come from...[but] they are not as vulnerable now that they are in that group home if the staff, if the plans that they have in place during an emergency situation, that they have very good business continuity plans in place, those particular individuals, those children, are actually not as vulnerable as other groups could be. They've actually done their due diligence and all their homework and they've got their plans laid out – it actually increases their resiliency. RSS1

> The immediate assumption is that people with mental health issues might have difficulty coping during an emergency situation and my comment was they might cope better than most people because all their life they've had to deal with struggles and problem solving and preparing for crisis and they might actually be better at adapting and have learned self-intervention skills that somebody who has just gone through life with everything fine and never had to deal with any kind of stress or crisis or loss might actually not be as resilient as those people who have dealt with that all their lives...these groups that we're identifying as being vulnerable may not be the vulnerable groups at all...it's hard to know and again those are part of our own stereotypes. HS3

This is supported by emergency management literature whereby some identified vulnerable groups were actually found to be more adaptive and resilient during an actual emergency event (Handmer, 2003; Buckle et al., 2000; Buckle, 2001). Handmer (2003) noted that the elderly, generally identified as vulnerable due to age, mobility and health issues, were actually able to cope and adapt more effectively during the 1998 gas crisis in Victoria, Australia than was expected by emergency managers. Their collective experiences, gained through life experiences such as the Great Depression and the Second World War, provided them with the experience and coping strategies that younger generations did not have (Buckle et al., 2000; Buckle, 2001). From this information, it becomes apparent that emergency preparedness officials and researchers should assume that all populations (individuals and groups) have an inherent ability to cope, adapt and rebuild on some level. This is summarized by one participant:

> I think inherent in people, both as individuals and groups, we are just inherently resilient. It's amazing what can occur or happen to us, be impacted by things, and still be resilient. We as people, as communities carry on trying to live our lives whether it's celebrating holidays or – there's lot of different examples. But I think it's the human-nature resilience that is of the most benefit to us. CEMC2

The issues surrounding vulnerability and coping capacity are also inherently related to the type of emergency. While this research assumes an all-hazards approach, it must be stated that the levels of vulnerability and resilience would change for individuals and groups based on the particular hazard. As well, the background and context of each emergency event needs to be taken into consideration when attempting to understand vulnerable populations. Levels of vulnerability and resilience will vary over time, place and experience (Smit & Wandel, 2006; Buckle, 2001; Adger, 2006; Handmer, 2003). Buckle et al. (2000) note that lists of vulnerable populations only examine one dimension of vulnerability and leads to an understanding of vulnerability outside of place (i.e. the unique and complex interaction of various hazards), community facilities (actions that may have been taken to reduce vulnerabilities), time (ignoring variations that may occur seasonally, or through repeating events such as droughts) and independent of social and economic trends (economic downturns or recessions and/or political circumstances/upheavals). This point was brought up by one participant who observed the interactions between emergency events themselves:

> I have always said that if it had not been for the 1998 ice storm, we wouldn't have done a lot of Y2K planning and most communities would have been in worse shape come the blackout. So you see how the disasters themselves are linked. CEMC1

Thus, vulnerability should be seen as a complex interaction between not only the social and physical processes, but also between time and place (Smit & Wandel, 2006). The complexity of vulnerability and attempting to depict that in a model is discussed in further detail in the subsequent section.

Section 5.4 – Conclusion

This section provided an overview of the variables that were seen to affect levels of vulnerability and compared them to those identified by Cutter *et al.*'s (2003) research. While the variables recognized as important for Waterloo Region were not totally consistent with those identified by Cutter *et al.* (2003), there were many similarities. This supports the basis for the 'Hazards of Place' model of vulnerability which argues that every place has a unique blend of variables and characteristics which interact with wider-scale processes to create its overall place vulnerability. Through this understanding of vulnerability, the importance of community emergency management is emphasized and the significance of establishing measures and understandings of vulnerability for each community is highlighted. As well, the results of this research suggest a more nuanced understanding of emergency management and vulnerability which recognizes the inherent resiliencies and coping capacities of the community, compared to Cutter's approach which focuses mainly on the conditions which create vulnerable populations.

6. RESULTS – PART III

The third research question examined whether the 'Hazards of Place' model of vulnerability provided an appropriate depiction of vulnerability as understood by emergency management personnel and community representatives. While respondents generally agreed to the overall applicability of the 'Hazards of Place' model of vulnerability, the depiction of the social vulnerability portion of the model did not appear to adequately represent the various and complex aspects of vulnerability.

Section 6.1 – Layers of Vulnerability

In the 'Hazards of Place' model of vulnerability, the social vulnerability is presented as one particular layer of the whole model, whereas many respondents noted that there were different components or layers to social vulnerability itself:

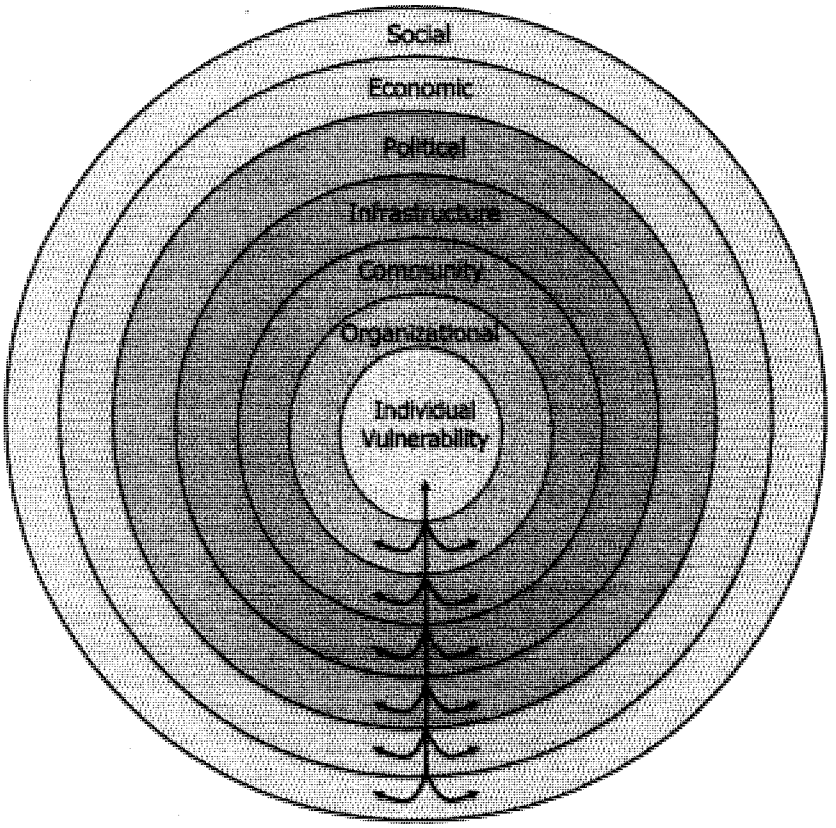
> I see it as an individual issue and as a community issue. The individual vulnerability is the personal obstacles that you may come across...there's also the external obstacles for that individual as well...so there is kind of like different layers if you look at it from a systems base. RSS1

> Vulnerability could be – it could be people in our community, it could be the vulnerability of us from a business continuity perspective, or it could be the vulnerability of any key services, or the vulnerability of our critical infrastructure. CEMC1

Participants also recognized the interrelatedness of these different layers which impacts overall social vulnerability levels. The 'Hazards of Place' model, while inherently dynamic, does not explicitly recognize the interactions between various levels or layers of social vulnerability. This is similar to many of the vulnerability models discussed in the literature review. While these models present the different variables and

processes that affect overall vulnerability levels, and the linkages *between* them, they fail to portray the linkages and networks that exist *within* them. For example, the Pressure and Release model portrays the progression of vulnerability from root causes to unsafe conditions, but it fails to explicitly acknowledge the linkages that exist within each progression. In this sense, different layers or sections of vulnerability are presented almost as though they are exclusive or independent of each other. Based on the observations of respondents in this research project, a modification of the social vulnerability portion of the 'Hazards of Place' model is presented below in Figure 6.1. This model clearly recognizes the various layers and interactions between types of vulnerability. Each layer of the model is discussed in further detail below.

Figure 6.1: Layers of Social Vulnerability



This 'Layers of Vulnerability' model is supported by an emergent literature which recognizes the different components and inherent interdependencies that exist between all processes affecting vulnerability (Buckle, 2001; Buckle et al., 2000). In the climate change context, Smit & Wandel (2006) note that "the scales of adaptive capacity are not independent or separate: the capacity of a household to cope with climate risks depends to some degree on the enabling environment of the community, and the adaptive capacity of the community is reflective of the resources and processes of the region" (p. 287).

Section 6.1.1 – Individual Vulnerability

This portion of the model represents the unique characteristics of each individual that impacts their overall ability to cope with a disaster event. Many of the variables identified in Chapter 5 relate to the individual scale of vulnerability, including age, health, language, preparedness, education, personal experience, adaptability, social capital and income levels. The interactions between these variables at the individual level will determine the person's overall ability to respond. This individual vulnerability influences the vulnerability of other layers. If the individual has high levels of vulnerability, this increases the vulnerability at other levels whereas low individual vulnerability will work to lower vulnerability levels of other layers.

In the interest of defining measures of individual vulnerability, the individual component of the model can also be viewed from the family or household unit of scale. Certain measures of individual vulnerability are usually related to the household or family unit, including language, preparedness, culture, and income, whereas others are

generally specific to the individual (i.e. age, health). In this sense, this layer could effectively be thought of as individual/household vulnerability.

Section 6.1.2 – Organizational Vulnerability

The organizational vulnerability incorporates the institutional and business capacities to respond and recover from disaster events. The vulnerability of this layer is determined by how well businesses and organizations are able to cope after an event and reestablish their services with minimal disruptions. During an event, many businesses will not be operating at full capacity, and therefore, revenues and operating procedures will be impacted. Organizations that have planned for disaster events, through a variety of methods, including continuity plans, reserves of funds, supplies and resources, as well as personnel, will increase their resiliency during a disaster event:

> Companies, if they're not following, even going so far as to say the ISO standards and following the standards - making sure that they have disaster plans in place and evacuation plans in place – that includes schools and institutions that deal with people - to institutions that deal with or private companies that create items or material things. They have to have things in place to make sure that they can respond to the emergency, so if they don't, if they are complacent about that it can cause some major problems. RSS1

This layer of vulnerability can have huge impacts economically within the community and rippling up through larger scales. Because of this, improving the ability of businesses and institutions to be able to withstand and recover from disaster events is an expanding field. This is seen by a growing literature that has been established focusing exclusively on developing business continuity and resilience during disaster events (see Seville *et al.*, 2006).

Organizational vulnerability both impacts and is impacted by other layers of vulnerabilities. Organizations with personnel who have increased coping capacities will also have higher coping capacities and vice versa. Similar to individual vulnerability, organizational vulnerability impacts other layers as organizations with decreased coping capacities will lower coping capacities at other levels. For example, a highly resilient individual who is employed by an organization that has failed to adequately plan and prepare for a disaster event will be negatively impacted and their overall vulnerability will increase. An example of how organizational vulnerability impacts individual vulnerability is provided from an example that occurred in Waterloo Region during the blackout event of 2003. Individuals who required oxygen supports were left highly vulnerable as vendors were incapable of reaching their customers:

> Right now what happens is that each of the vendors that supply the oxygen is supposed to take care of them. But in the case of the blackout, at least one of the vendors, all the employees lived out of town – they weren't here when the incidents started happening and couldn't get here because traffic lights were out and all those sorts of things in their own communities. RS2

Section 6.1.3 – Community Vulnerability

The community vulnerability layer of the model includes the variety of activities, programs and plans developed at the municipal or regional level to build resilience in the community. While the term community is complicated and has generated discussion throughout academia, the term is used here to describe the municipal and political boundaries of communities. Murphy (2007) describes municipalities as "local-level government bodies, rooted in place, charged with the management of a clearly delineated

territory" (p. 300). The term community is used instead of municipality because of the understanding of networks and kinships that exist at smaller scales. For example, the Regional Municipality of Waterloo includes three cities and four townships. The term community applies to each of these cities and smaller towns, as well as the larger regional area. While this understanding may not effectively describe the complex interactions that exist between various networks within the municipality, this understanding is effective in the emergency management context due to the responsibility of emergency planning, response, recovery and mitigation at the local and regional government level.

The community vulnerability is essentially comprised of four components: planning and preparation activities, emergency response capabilities, social programming and social capital. The planning and preparation responsibilities of the community were continually addressed during the interview phase. When discussing what increased community vulnerability, one respondent noted:

> Lack of tangent things like lack of plans, lack of communication protocols, lack of first response. All those kind of things that are basic to emergency management that are needed to be able to respond to emergencies. If you don't have those kinds of things it increases your vulnerability as a community. RSS1

Those communities that were planning and preparing for disaster events, establishing their resources and supplies and were seen as lowering their vulnerability:

> Public education and preparedness information can make us all, both as individuals, groups, corporate municipal entities more prepared and when you are more prepared you are less vulnerable. CEMC2

The emergency response capabilities of the community were discussed during many interviews, especially the first responders. Participants noted the significance of ensuring that supplies were available, or agreements were in place, in the event of a disaster event. Examples of resources and supplies included bandages, medical supplies, cots, blankets, water, food sources etc. This relates back to the principles of emergency management, focusing on the mitigation and preparedness aspects of emergency planning.

Several respondents also noted the importance of effective social programming at the community level. Ensuring that resources and networks were in place to provide individuals and families with the resources they require to effectively respond and cope with a disaster event were viewed as increasing resiliencies of the community. Social capital at the community level was also touted as a method for increasing overall levels of resilience. The role of social programs and social capital in increasing community resiliency is discussed in further detail in Chapter 7.

Similar to all levels of vulnerability, the community vulnerability will impact the overall vulnerability experienced at other levels. A community that has well-established and practiced emergency response plans, resources and programs will increase the resiliency and coping capacities of individuals and organizations, whereas a community that has failed to adequately prepare or lacks the resources for an effective response will increase the vulnerabilities experienced at other levels.

Section 6.1.4 – Infrastructural Vulnerability

The provision and maintenance of key services is incorporated in the infrastructural vulnerability layer. Ensuring that sufficient redundancies and capabilities for response have been built into critical infrastructure systems is essential for ensuring an effective response. When noting how regions can enhance the resiliency of its infrastructure, one respondent noted:

> Our overall program goes towards maintaining our infrastructure – regular inspections which help with safety and reducing the chances of any type of failure. CO1

This layer of the model has inherently high levels of vulnerability as the infrastructure can be seen as a hazard itself. The failure of infrastructure can cause significant emergency events, including dam failures, bridge or building collapses, water main breakages etc. Buckle (2001) remarked that "public utilities are fragile. And that if they fail through sabotage, accident, wear and tear or overload then the consequences for the community, and for the agencies and services that support the community, can be acute, widespread and protracted" (p. 13). Viewed from this sense, ensuring that infrastructure is properly inspected and maintained is seen as reducing vulnerability in that the likelihood of failure is reduced. These types of structural mitigation programs also help to prevent increases in the magnitude of damage of other hazardous events due to further infrastructural damages.

The infrastructural vulnerability can also be viewed from a building density perspective. Cutter *et al.* (2003) found that higher building density increased vulnerability due to the higher likelihood of damage and increased costs of repair. This was incorporated into the social fabric portion of the 'Hazards of Place' model and fits in this

layer of the Vulnerability Layers model. In this sense, building density is seen as increasing vulnerability, whereas rural areas are viewed as less vulnerable. On the other hand, similar to the dichotomy between urban and rural vulnerability discussed earlier, lack of effective infrastructure in rural areas can also be considered a vulnerability.

The maintenance of critical infrastructure and key buildings during an emergency event will have significant impacts on other layers of vulnerability during a disaster event. Power, water, gas and hydro facilities ensure the effective operation of households, businesses and institutions, as well as important community facilities such as hospitals and nursing homes. A diminished capacity to restore essential services after a disaster event will dramatically increase vulnerabilities of all the other layers.

Section 6.1.5 – Political Vulnerability

Political vulnerability encompasses a variety of governmental functions and operations, including government structure, response capabilities, and political leadership. The structure of the political system can have an impact on the response capabilities and capacities as noted by many respondents in this study. Speaking specifically of Waterloo Region, some respondents noted that the two-tier government system in the region affects levels of vulnerability. Complexities were observed whereby some cities and townships placed more emphasis on emergency management and planning, the difficulty in creating a seamless response, as well as ensuring effective human resources for all areas across the region. When discussing the two-tier political system in Waterloo Region, respondents noted:

> The issue that I have in regards to their ability is that sometimes there will be overlapping resources and overlapping jurisdictions and that sometimes can be quite confusing in regards to the roles and responsibilities – with respect to who is in control of what...so is it going to be a regional response, or is the city going to incorporate some of the cost because it happened in their city as well. RS1

> We have, not counting all of the individual agencies of our own, but we have eight emergency plans in the region - one for every municipality and one for the region. One of the issues that's always been a concern - when your regional service...if a number of municipalities decide to open their own emergency control center we are supposed to be represented on each of those groups and we don't have the manpower to do it. RS2

Respondents also noted the possibility of a lowered capacity to plan and respond to disaster situations for smaller communities and townships:

> I would say that it [two-tier system] does increase that sense of vulnerability in the community. One - because the smaller municipalities don't have the resources or the funding to be able to do that – so you see that some of the CEMC's – they have other jobs – like they are the clerk or administrator or treasurer or everything - so it's really hard for somebody to give their full attention to one particular aspect and do it well - so I think, in that sense, they are. But in regards to wanting to be involved - for the most part - for the vast majority - they do want to be a part of the larger Regional plan and do want to have something in place to ensure that in an emergency their citizens are looked after. So there is that does exist out there – that need, want, and desire to do that – it's just the capacity of whether they can or not. RSS1

These quotes also point to the importance of place in assessing overall vulnerability, as many of the circumstances and processes creating vulnerable situations are related to localized manifestations of larger processes as well as local procedures, customs and processes. In terms of response capabilities, respondents noted that political bodies need to maintain, or be seen as maintaining, control over the disaster response. An ineffective disaster response can generate political difficulties:

> The government can be very vulnerable if they are having trouble maintaining their key essential services. CEMC1

The importance of effective local leadership in establishing an effective disaster response and ensuring increased resiliency throughout the region was emphasized during the interview process. Successful interactions and relationships between leaders of various organizations are required to ensure increased resiliency during emergency situations:

> A lot of it has to do with how well a community will respond and some of it may be a question of local leadership...so local leadership can be very fundamental – we have our political leaders here locally on emergencies, we also have the heads of our various agencies and organizations that come together to be apart of our control group to be able to coordinate their efforts and their resources. CEMC1

Buckle (2001/2002) found that "the greatest assets we possess in dealing with these events are the experience, expertise and commitment of politicians, public officials and Non-Government Organization (NGO) staff" (p. 13). Many respondents noted the importance of establishing networks and communications between emergency response personnel beforehand to ensure collaboration and cooperation during the response and recovery period. This is discussed in further detail in Chapter 7.

Section 6.1.6 – Economic Vulnerability

The economic vulnerability layer incorporates the variety of economic activities of the household, community or region. At the community level, the type and diversity of economic sectors, as well as the overall prosperity of the community will affect levels of

vulnerability. The distribution of resources across the community will also impact vulnerability levels with increased resiliency in communities experiencing more equitable distribution of resources and income. This layer provides the basis for four of Cutter *et al.*'s (2003) composite factors, including personal wealth, single-sector economy dependence, occupation, and density of the built environment. Economic processes also form the basis of a variety of vulnerability literature and models, including the work of Chambers (1989) and Watts & Bohle (1993) who focus on the importance of access to assets and resources in creating vulnerability. Blaikie *et al.* (1994) also focus almost exclusively on the importance of income, access to assets, management of assets, income opportunities and investments in their 'Access' model of vulnerability.

Similar to other layers, the economic vulnerability will impact the vulnerability levels of other layers. Individual, organizational, community and infrastructural resilience can be increased through decreases in economic vulnerability – if economic gains are used to improve community services and the prosperity of a large number of households. For example, diversification of economic activities can lead to increased income levels for individuals, organizations and communities. If the community uses these increased revenues to further develop social programs and repair aging infrastructure, overall vulnerability levels can be greatly decreased.

Section 6.1.7 – Social Vulnerability

The social vulnerability layer, while permeating through the other layers of the model, incorporates the range of social activities, networks and processes that impact vulnerability levels. Socially condoned activities that increase risk and/or exposure (i.e.

expensive housing along hurricane-prone beach fronts) can impact levels of vulnerability. The importance of social networks at the individual, organizational, and community scales has been emphasized throughout this paper and is discussed in detail in section 7.2.

Social processes and customs can also impact vulnerability when they impact the ability of individuals and groups to take proactive measures to increase their resiliency. One participant noted how the social stigma of mental health illness limits the number of individuals who seek help and treatment, thereby reducing their resilience to any type of crisis event:

> Societies ignorance's and stigma's – it's not just that individual but also how other people perceive them that can create a certain vulnerability even for coming forward and asking for support and assistance. Often society does see – there is a stigmatization related to mental illness and so even when people are feeling that they need support or assistance, they might not come forward because of the stigma. HS3

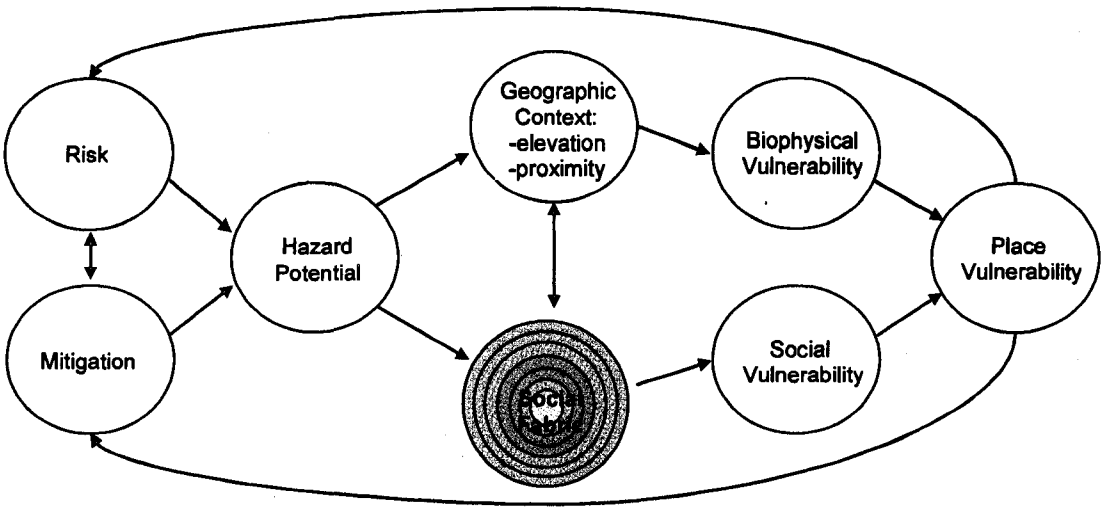
Similar to the other layers, social vulnerability levels will impact the vulnerability levels of other layers. Those individuals, groups, organizations and communities with equitable social values and systems, established social infrastructure, including informational, recreational and spiritual networks, as well as partnerships for sharing of knowledge, skills, experience and resources can increase the coping capacities and resiliencies of other layers, thereby reducing their vulnerability (Buckle *et al.*, 2000; Murphy, 2007; Foster, 1995).

Section 6.2 – Conclusion

This section has attempted to provide an alternative depiction of vulnerability as presented to the researcher throughout the interviews conducted. This model presents a

slightly alternative view of social vulnerability where different layers and the complex interactions between these layers are explicitly recognized. This model of vulnerability should not be seen as separate from the 'Hazards of Place' model, but as an enhancement thereof. Figure 6.2 below depicts the 'Hazards of Place' model with the 'Vulnerability Layers' model incorporated into the social fabric portion of the model.

Figure 6.2: Hazards of Place and Vulnerability Layers Model



While the above section focused on vulnerabilities and the interactions between different layers of vulnerability, the same layers model can be used for an analysis of resiliencies. When discussing resiliency, one participant noted:

> Again you can divide that into layers as well because there is individual resiliency – your ability to overcome an adverse event, and then as the community. How do you bounce back as a community? HS2

The individual, organizational, community, infrastructural, political, economic and social components of the vulnerability layers model would all have certain resiliencies inherently built into them.

While this enhancement of the 'Hazards of Place' model of vulnerability incorporates many of the ideas expressed throughout the research interviews, this model is still lacking in two main areas: its exclusive focus on vulnerability and lack of depth in the physical and environmental side of the model. Overall, the 'Hazards of Place' model of vulnerability fails to acknowledge the importance of resilience and coping capacities at various levels. This is explored in further depth in the discussion in Chapter 8.

The above sections focused on vulnerability, through a discussion of social and physical vulnerability, the variables that affect vulnerability and the overall depiction of vulnerability. The following section presents an overview of mitigation measures that could effectively reduce vulnerabilities and increase resiliencies in the community.

7. RESULTS – PART IV

The fourth research question examined methods for reducing the impacts of disaster events. Four themes were identified for mitigating vulnerabilities and building resiliency in the Region including public education, establishing networks, enhancing social programs and sustainable development. These are discussed below.

Section 7.1 – Public Education

Public education was widely recognized as an essential tool for reducing vulnerability in Waterloo Region. Through public education, emergency managers and responders hoped to educate individuals and groups on the nature of hazardous events and ensure effective preparations were taken. Ensuring that individuals and household have prepared for 72 hours without essential services in the case of emergency situations reduces the stresses on responder services and allows them to respond to the most needy individuals. One participant stated:

> So if we are able to use public education pamphlets, whatever form of information media you're looking at, if people receive it, accept it, act upon it and use it than they will be less vulnerable or less susceptible to the impact and again the emergency comes from when it starts right through to post recovery and how resilient they are in getting back to hopefully, better state than before the emergency. CEMC2

From this quote, two themes were emphasized in ensuring the success of public education programs. These include the importance of being able to access public information as well as taking the necessary steps to act on this information. Although the participants widely agreed on the importance of public education regarding emergency

preparedness, issues and concerns were raised regarding how to ensure that the preparedness message was heard by the general population and acted upon:

> One of the difficulties I think we face with limited resources in emergency management is that you can create a public awareness program or do targeted public education, but to what extent did the public receive the information, understand it, and then take action relative to it. CEMC1

Many respondents felt that general apathy and complacent attitudes restricted the number of individuals who ensured they were prepared for emergency events and increased vulnerability levels. Several participants felt that those individuals and groups who were immediately impacted by emergency situations would be the most likely to prepare for disaster events:

> You can educate and provide incentives and de-incentives if you like, but sometimes that is still not enough until they themselves are involved. Not to say that education does not work with some, it does. HS1

> I think the other thing is that there is nothing drives them to [prepare]. There isn't a need that requires them to do it. They live in a very good country that has all their needs being met and until there is something that makes them look further, in regards to what else is available, they won't. RS1

Issues were also raised as to the one-way nature of the current system of public education. In this sense, the public education program is decided upon by the emergency management community, without the input from the populace. Several respondents argued for the need to encourage public participation in the emergency planning process. Through the engaging of public participation, public education programs would be more successful as the general populace takes ownership over the emergency planning process:

> I would want the public to provide us with some feedback around what do they understand about the risks in our community. What do they understand about the strategies and allow them to bring their ideas forward and be fully engaged in a process with the public. Because today we don't really have a process in emergency management with the public: we do generic or broad level messaging out to the public. We don't target it specific enough and we don't get the public participation – we haven't created an environment for the public participation. CEMC1

Thus, while public education programs were seen as an essential component of emergency management programs in ensuring that individuals and household are prepared to respond during emergency situations, respondents also recognized some inherent difficulties with this particular mitigation approach.

Section 7.2 – Establishing Networks

The importance of establishing networks and building social capital at a variety of scales was emphasized by many participants. At the individual scale, social networks were viewed as a conduit for lowering vulnerability and increasing resiliencies. The presence of formal, and more importantly informal, networks and social supports, including social service responders, faith groups, family and friends, and neighbourhood communities, "may increase adaptive capacity by allowing greater access to economic resources, increasing managerial ability, supplying supplementary labor and buffering psychological stress" (Smit & Wandel, 2006, p. 288). This increases assurances that necessary supports are received by those in need. One respondent noted:

> The Christian community are very supportive of each other in the counseling sense...the faith communities would very much be a support mechanism to people need...so they would know their congregation and know which ones were in need – who were the elderly and infirm and the sick and be very supportive of them. RSS4

At a different scale, networks were recognized as a tool for increasing resiliencies at the organizational and community level. Establishing networks within the emergency management community, as well as with community and volunteer organizations is seen as a critical role of the emergency manager in reducing community vulnerability. These networks increase the probability of an effective emergency response with the variety of governmental, emergency response, volunteer and social organizations working and collaborating together towards a shared goal. One emergency manager noted:

> The glue that holds everything together to make that resiliency and ability to bounce back, is the relationships that are established. There is both professional and personal relationships that you've established with other emergency managers, other agencies, organizations and institutions and it is important that you do that ahead of time. They have the saying - that if you exchange business cards during the emergency - it's too late at that point. You should be doing that way ahead of time so that enhances that resiliency - in that I know exactly that if an emergency occurred in the city of Kitchener - I know exactly who to contact - the various CEMC's, people in fire, or within different facilities or departments. RSS1

These networks are also increasingly seen as a tool for distributing and providing access to information, especially for those who may not have had access to information and resources, due to a variety of reasons. One emergency responder noted:

> I think those informal networks are probably more important than the formal ones. When we're talking about the faith groups and the community groups - we are seeing more and more emergency planners are leaning towards using those groups to pass on their messages. Because those people - if you've got a bunch of new immigrants that aren't comfortable with their English yet as a second language - they are really left out. The only way to communicate with them is through their own ethnic groups – so you have to make that connection and there's no use waiting until the day of the emergency to make those connections with

> them - you have to make them very early in the equation to gain their trust and put the information out there. RS2

The use of social capital and networks to increase resiliency and coping capacity during disaster events is supported by recent findings in the literature. Murphy (2007) notes the ease at which information is disseminated using existing networks: "it is often possible to easily communicate with a block of people at once through existing community channels and to utilize their pre-existing organizational capacity to enhance resiliency or to aid in the response to a risk event" (p. 301). During the emergency response to the 1998 Victoria gas crisis in Australia, researchers recognized the value of incorporating organizations such as churches, Non-Government Organizations and community groups with "local networks, credibility in supporting people in need and with experience and capability of distributing aid" (Buckle, 2001/2002, p. 17 – 18). The use of these existing networks allowed emergency management personnel to establish a wide network for distributing information and aid, enhancing the overall response and resiliency of the community (Buckle, 2001/2002).

Handmer (2003) commented on the importance of networks and relationships in building resiliencies at a variety of scales: "the informal networks, relationships...may be more important to resilience than formal positions and access to resources" (p. 58). Murphy (2007) also suggests that "social capital, as a key component of informal institutions, is an integral part of resiliency" (p. 299). Therefore, building social networks, at both the individual, organizational and community scales, is seen as an effective tool for reducing vulnerability and increasing resiliencies at a variety of scales.

Section 7.3 – Enhancing Social Programs

The importance of effective social programming throughout the community was seen as a method for lowering vulnerabilities and increasing resiliency. Many of the programs that focus on aspects of day-to-day living, including social welfare, affordable housing, educational programs and training were all seen as methods for increasing the coping capacity of individuals throughout the region. Respondents noted:

> If you can build up the population that's within your area by giving them the supports they actually need in the first place – it enhances their opportunities to be able to prepare themselves for those days where something may happen and they need to be prepared to look after themselves or someone else. So it builds that resilience in the community. RSS1

> I think there needs to be more social programs to deal with those that have specific vulnerabilities - whether it with deals with language or income or culture. I think we need to address those issues. Until we address some of those underlying issues we're never ever – we're always going to be reacting to things, we're never going to be making any proactive or progressive steps to really establish a structure in which it becomes operational - because all those underlying things will always eat out at the core values. RS1

This supports many of the ideas discussed throughout the literature review on vulnerability, whereby lack of access to information, resources, power and assets were all seen as underlying processes in creating vulnerabilities (see Hewitt, 1997; Blaikie *et al.*, 1994). Ferrier (2008) suggests that improving access to assets is one of the primary roles of the community and the presence or absence of resources and assets can affect the community's overall ability to cope during a disaster event. Establishing systems which decrease these discrepancies enhances resiliencies on a variety of levels as individuals,

groups, organizations and communities are increasingly able to respond and recover from disaster events effectively.

Although resiliency and vulnerability are affected through social programs that develop and enhance the resources and assets that individuals and groups have access to, the generation of assets can also affect the level of risk the individual or community is exposed to (Ferrier, 2008). The social-ecological systems approach to vulnerability and resilience examines the interactions between the ecosystem and ecological processes and the impacts on the social aspects of the community (see: Folke, 2006; Smit & Wandel, 2006; Adger, 2000; Adger, 2006). Through this approach, social processes and programs are seen as inherently related to the ecological and environmental systems and the importance of sustainable development and appropriate environmental management is emphasized.

Section 7.4 – Sustainable Development

While participants noted mitigation projects that could increase the overall resiliency levels of groups and individuals from a public education and preparation point of view, they also noted the importance of incorporating sustainable development processes into the disaster mitigation framework. Respondents noted:

> I also think our unsustainable lifestyles – we just have so much such high demand on resources that I think that makes us more vulnerable. Because there are so many things that we take for granted. Take the blackout for example, we are so reliant on technology that people don't think to have emergency kits with candles and matches and extra food and water and blankets. CO1

> The other aspect of this is – talking about climate change and all that kind of stuff – is the adaptation and mitigation. So adaptive measures versus mitigation measures - meaning for climate change, global warming, the Kyoto protocol is the mitigation part -- the adaptive part is -- knowing what is coming at us in the last couple of years - the increase of these massive storms and so on - polar ice caps melting – rising of waters in the East Coast - increase in tornadoes – wind bursts. How do we basically work around that in the Region – we have to start paying attention to that. Does it mean we have to redo or rethink our building codes and so forth - we may have to do that - so as time goes by and we see these more severe storms coming through - we may have to do that. RSS1

Increasingly, disaster events are seen through the lens of climate change and sustainable use of resources. An emergent literature has evolved which understands this increase as a response to the human-induced transformations of natural ecosystems (i.e. deforestation), as well as increased pressures on vulnerable environments (i.e. development on hill slopes). Numerous studies have indicated that human processes, including land-use practices, settlement patterns, resource exploitation and human transformations on the environment, have lead to increased vulnerability to, and devastation after, a disaster event (Doberstein, 2006; Abramovitz, 2001). Through this understanding of the human-induced nature of disaster events, sustainable development has become a core issue in hazard mitigation. This approach to emergency management is linked to efforts to develop resilience into human-environment interactions and to incorporate adaptive behaviors and capacity building activities into resource management programs (Folke et al., 2002). As hazard mitigation is inherently linked to sustainable development and land-use processes, this framework is ideal for understanding hazard mitigation in a holistic manner.

Section 7.5 – Conclusion

A variety of mitigation techniques were espoused for reducing vulnerability and building resiliencies in Waterloo Region. These policies ranged from public education, the enhancement of social programs and the building of relationships and social networks to the encouragement of sustainable development. These mitigation policies provide insight into the emergency responder and community practitioners understanding of the underlying causes of vulnerability, including access to information and resources (public education), access to assets and power (enhancing social programs and networks) as well as developing more sustainable human-environmental interactions.

The previous sections explored the results as they specifically related to each research question. The 'Hazards of Place' model of vulnerability was found to be generally appropriate in a Canadian context. Many of the variables identified through Cutter *et al.*'s (2003) research were relevant for Waterloo Region, whereas some were found to be less important (i.e. race) and the relevance of several additional variables was acknowledged. The overall depiction of social vulnerability in the model was enhanced to explicitly acknowledge the inherent layers of vulnerability, as well as the complex interactions between these layers. Mitigation of vulnerability through the building of resiliencies and capacity building processes was discussed in the final section. Through these results, a complex understanding of vulnerability was depicted wherein the inherent dynamism, interdependency and networked nature of vulnerability was shown. The subsequent chapter approaches vulnerability from a theoretical standpoint using the results from this research.

8. DISCUSSION

Throughout the literature review and results sections, vulnerability has been approached from a variety of theoretical standpoints, including access to assets (Chamber, 1989; Watts & Bohle, 1993; Blaikie *et al.*, 1994), access to power (Hewitt, 1997), and access to information (Alexander, 2000). This chapter attempts to add to the vulnerability literature through a theoretical approach which understands vulnerability along one main theme – vulnerability as the absence of resilience.

Section 8.1 – Connecting Vulnerability and Resilience

Throughout this study, emergency responders and community organizations discussed their opinions on vulnerability and the variables that influence vulnerability. Similar to the literature review, a variety of theoretical approaches were recognized, although one main theme was dominant throughout a majority of the interviews. This theme views vulnerability and resilience as an interdependent concept. This approach to emergency management and disaster mitigation, where the positive characteristics and coping capacities of the individual and the community are focused upon, presents an opportunity to enhance the overall resilience and coping capacity of the community. This section will begin by providing a brief overview of the relevant vulnerability/resilience literature, followed by a discussion of how this research and theoretical approach fits into this developing theme.

An emerging vulnerability literature discusses the complexity that exists between the concepts of vulnerability and resilience. Adger (2006) remarked that "vulnerability

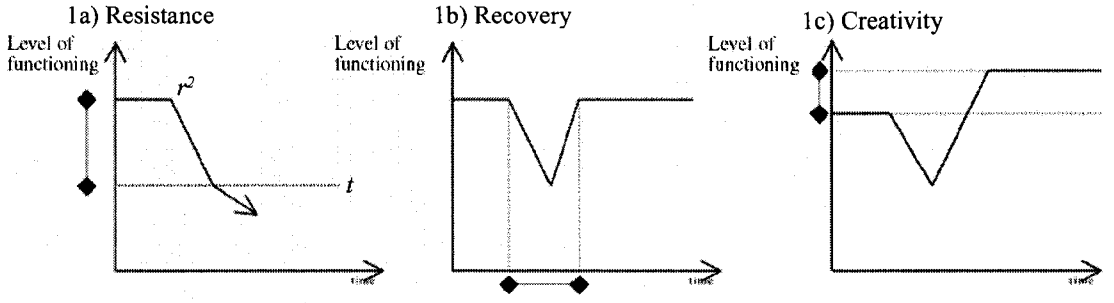
research and resilience research have common elements of interest – the shocks and stresses experienced by the social-ecological system, the response of the system, and the capacity for adaptive action. The points of convergence are more numerous and more fundamental than the points of divergence" (p. 269). Smit & Wandel (2006) suggest that the "vulnerability of any system (at any scale) is reflective of (or a function of) the exposure and sensitivity of that system to hazardous conditions and the ability or capacity or resilience of the system to cope, adapt or recover from the effects of those conditions" (p. 286). In this sense, vulnerability is not viewed as separate from resilience, but an inherent part of it. Vulnerability then, is comprised not only of the 'negative' characteristics that would make an individual, group, organization or community more susceptible to losses during a disaster event, but also the inherent and relevant coping capacities to respond to an emergency event:

> Vulnerability is those who would be susceptible to be impacted by the emergency. How they respond and react to it and obviously how they recover from it and then get back to the states that they were before, hopefully in a better or the same state before the emergency. CEMC2

Through this quotation, a new understanding of resilience is developed, which is supported by recent resiliency literature, also discussed in the literature review. While resilience was defined at the beginning of this paper as the ability of social entities (either individuals, household, groups or communities) to cope, bounce back or respond positively to adversity, external stresses and disturbances, an emerging theme has developed which understands resiliency along three dimensions: resistance, recovery and creativity (Maguire & Hagan, 2007; Adger, 2000). *Resistance* relates to the ability to withstand an external pressure or disturbance before long-term impacts are experienced.

This is represented in Figure 8.1a, whereby the resistance is the "distance between the community's pre-disaster level of functioning (r^2) and a threshold (t) beyond which the community would be unable to return to its usual state" (Maguire & Hagan, 2007, p. 17). The amount of time it takes the community to 'bounce back' to previous levels of functioning is the *recovery* aspect of resiliency (Figure 8.1b). The faster a community is able to return to pre-disaster levels of functioning, the more resilient the community is. *Creativity*, on the other hand, is related to the idea of increasing the functionality and resiliency of the community after an emergency event (Figure 8.1c). In this sense, creativity is the process of mitigating and "adapting to new circumstances and learning from the disaster experience" to create communities that have achieved greater resiliency and functionality through the recovery process (Maguire & Hagan, 2007, p. 17; Adger, 2000). Creative resilience, then, is similar to ideas of resilient reintegration discussed in the literature review.

Figure 8.1: Dimensions of Resilience



Source: Maguire & Hagan, 2007

The concept of creative resilience is implied throughout the social-ecological resilience literature whereby disturbances are viewed as having the "potential to create opportunity for doing new things, for innovation and for development" (Folke, 2006).

Through this emerging understanding of resilience, the emergency manager's role is not just to return communities to pre-disaster states of functioning, but also to build resiliencies and coping capacities into the community through, not only mitigation and preparedness, but also through the recovery process itself. This suggests that an understanding of vulnerability and resilience should be incorporated into all aspects of the four pillars of emergency management.

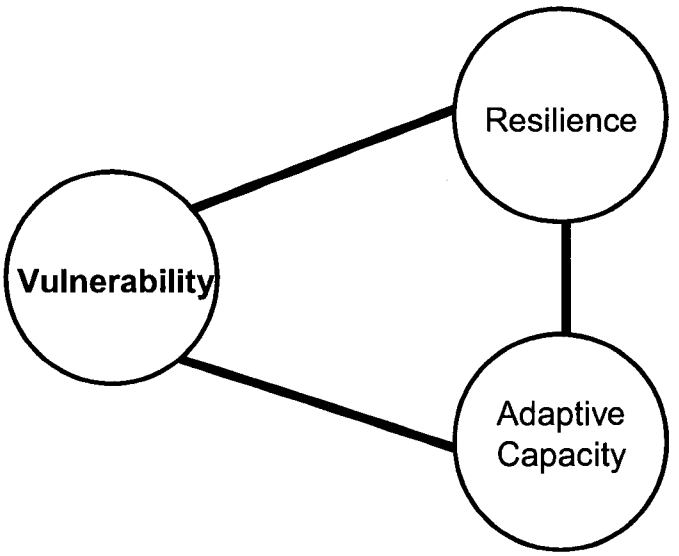
Through this conceptualization of vulnerability and resilience, the term vulnerability itself has come under critique. Handmer (2003) suggests that using the term vulnerability is unnecessarily negative, and proposes using resilience as a comprehensive term describing the overall vulnerabilities and resilience levels of individuals and groups. This viewpoint presents a positive approach to emergency management and is incorporated into the understandings of vulnerability presented below:

> We are all vulnerable, but we are also all resilient, and we all have adaptive capacity. Building resilience and capacity is politically appealing and a practical policy response to communities in difficulties – labeling or stigmatizing communities as particularly vulnerable or incapable is not usually politically appealing and is often strongly opposed by the communities involved (Handmer, 2003, p. 60).

This understanding of vulnerability and resilience, developed through the results of this research, as well as relevant discussions in the literature, led to the development of an alternative view of vulnerability and resilience. While vulnerability/resilience literature increasingly recognizes the importance of integrating resilience and coping capacity into our understanding of vulnerability, and acknowledges the inherent relationship between vulnerability and resilience, these arguments still present resilience

as one component of vulnerability. This is visible in the diagrammatic summary of the conceptual relationship between vulnerability and resilience shown below as developed by Gallopin (2006) in Figure 8.2. Gallopin (2006) developed this summary to demonstrate the relationship between these concepts, while maintaining that the linkages between these concepts are "not clear beyond the confirmation of the existence of the relationship" (p. 301).

Figure 8.2: Conceptual Relationship between Vulnerability and Resilience



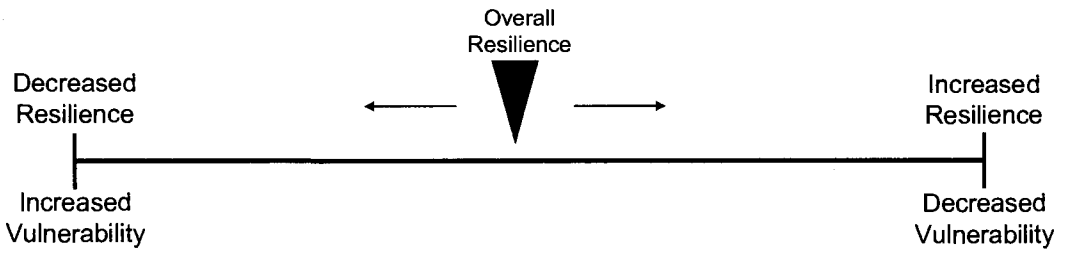
Source: Gallopin, 2006, p. 301

The argument presented here is that vulnerability and resilience are the positive and negative aspects of a singular concept – one cannot be discussed without the other. In this sense, to determine an individual, community or organization's coping capacity, the vulnerabilities *and* resiliencies must be examined together to determine the overall ability to respond and recover. This concept is not necessarily innovative in the literature - the term positive vulnerability has been used to conceptualize a similar understanding of

creative resilience mentioned above. In this approach, positive vulnerability is viewed as the opportunity to create, develop and enhance positive changes in the community through the building of resiliencies and coping capacities (Gallopin, 2006). This indicates that researchers increasingly have an understanding of the singular nature of vulnerability and resilience, although the argument that vulnerability and resilience are one and the same was not explicitly recognized.

This approach to understanding vulnerability and resilience can be conceptualized along a continuum. As this approach sees vulnerability and resilience as the positive and negative aspects of a singular concept, Figure 8.3 presents a diagrammatic summary of this position. The overall resilience level of the individual, household, community or organization is acknowledged as the interaction between the various vulnerabilities and resiliencies that characterize that particular unit.

Figure 8.3: Vulnerability as Resilience

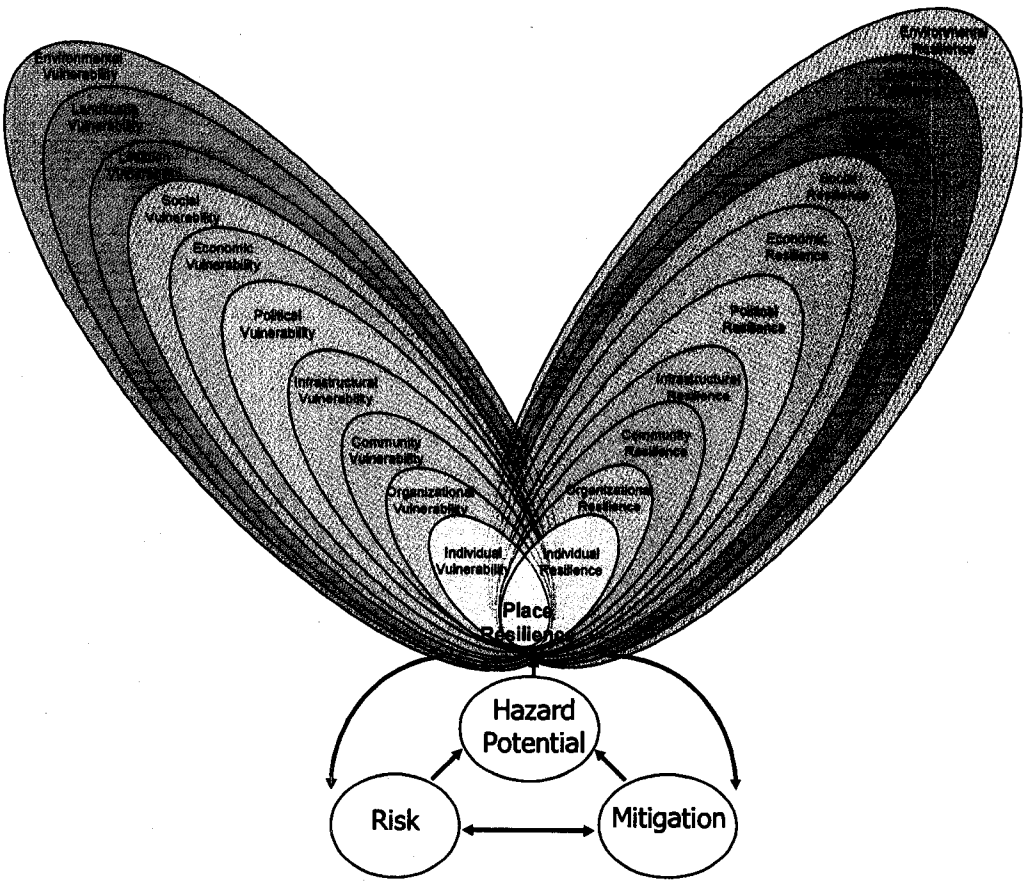


This particular view of vulnerability incorporates a variety of approaches, theories and understandings of the concepts of vulnerability and resilience. On the positive side, resilience understands the disaster event as a catalyst for change that can increase the functionality and resilience levels of the community. Concepts of positive vulnerability

are retained in this approach. On the flip side, increased vulnerability refers to the characteristics and/or actions of the individual, household, community or organization that increases its susceptibility to harm during an emergency event. In this sense, the overall resilience is created through a tug-o-war between the positive and negative characteristics of the social unit. This understanding of vulnerability and resilience is inherently dynamic – the overall resilience levels will change depending on the time of day and/or year, the various social, economic, and political processes that are occurring in the community, as well as at larger scales, and through the interactions of various events and circumstances. In this sense, the overall resilience is continually shifting along the continuum between the positive and negative aspects of vulnerability and resilience. This understanding of vulnerability and resilience, through the continuum diagram, is not necessarily meant to be operationalized, but is presented as a theoretical framework for understanding the relationship between these concepts.

Through this understanding of vulnerability and resilience as a singular concept represented along a continuum, the model of vulnerability presented in Figure 6.1 can be adjusted to reflect this argument. This model includes the core concepts of the 'Hazards of Place' model with modifications to incorporate issues of resilience and coping capacity. This model also provides greater detail in the biophysical sections through an incorporation of various geographic and physical layers. Included in these layers is a specific focus on the features of the place, as well as the importance of sustainable human-environment interactions. The adapted model is presented below in Figure 8.4.

Figure 8.4: Overall Place Resilience Model



The Overall Place Resilience model retains the depiction of the various layers of vulnerability and resilience and also continues to explicitly recognize the complex interactions between these layers. This model also incorporates the various layers of geographical vulnerability, including geographic location, landscape features, and sustainable human-environment interactions. The location vulnerability incorporates issues of proximity to hazardous events, as well as the actual risks and hazards that the area is exposed to. The landscape layer includes both the natural features which affect how the hazardous event will impact human populations as well as the human transformed environments which affect the impact of hazardous events (i.e. dams affect

ecosystem interactions and mitigate against flood events, but also creates new vulnerabilities through infrastructure failures and reliance on technology). The environmental sustainability layer provides insight into human-environment interactions and the impact of these interactions on the overall health and functioning of ecological systems. This incorporates the fourth mitigation concept discussed during this research which is not explicitly included in the 'Hazards of Place' model of vulnerability.

The interactions between these various layers create the overall place resiliency – similar to Cutter's (1996; 2003) 'place vulnerability' in the 'Hazards of Place' model. The model includes the mitigation, risk and hazard potential, similar to the original 'Hazards of Place' model, as well as the feedback loops from the overall place resiliency to the risk and mitigation elements. While the previous Vulnerability Layers model presented vulnerability and resilience as separate, almost independent spheres, this enhanced model recognizes the inherent and singular nature of vulnerability and resilience.

This conceptual model is also applicable in an emergency management and planning context through all pillars of emergency management programs. This model approaches vulnerability and resilience in layers and provides the emergency manager with an outline for all the components that should be included in an effective emergency management program. The emergency manager can apply this model by ensuring that vulnerability and resilience has been analyzed and assessed for all the layers mentioned above. This provides a framework for encouraging holistic emergency management

programs that incorporate all aspects of social, economic, political, geographical and environmental processes.

In this sense, the model can be practically implemented by emergency managers and the participants interviewed in Waterloo Region. Using this approach to vulnerability and resilience, the emergency management community can ensure that they have examined aspects of both vulnerability and resilience in all layers incorporated into the model. As the emergency management community in Waterloo Region is very proactive in ensuring the protection and preparation of individuals, groups and institutions, this model presents an essential checklist for ensuring they have met their own high expectations.

Section 8.2 – Conclusion

This section has attempted to provide a theoretical understanding of vulnerability/resilience which recognizes, not only the various layers and the interactions between these layers, but also acknowledges these concepts as singular in nature. Through this understanding, the overall place resilience can be understood through the complex interactions between the various social, political, economic and ecological processes that impact the particular place or community under consideration. This presents a positive approach to vulnerability research which recognizes and attempts to build upon the coping capacities of the community, as well as understanding the opportunity for enhancement and positive changes that a disaster event can create.

While this positive approach to examining vulnerability and resilience is inherently empowering and recognizes the abilities and skills of all individuals, groups, organizations and communities, there is one downfall to using this approach. When research results and academic literature suggests the intrinsic resiliencies, as well as the informal processes (such as social capital) that improve the overall coping capacities for communities and places, this approach can be used in a negative manner. This type of positive rhetoric can be used to push political and economic agenda's that limits the responsibility of society, government bodies and political organizations in reducing vulnerability and increasing resiliencies in the community, as well as larger scale regions.

While the Overall Place Resiliency Model recognizes the relationship between vulnerability and resilience, as well as the intrinsic coping capacities, the essential concept of the model pushes for an understanding of vulnerability/resilience that is essentially holistic. This involves examining, researching, analyzing and implementing programs through all the layers – both the vulnerability and resilience sections. This encourages emergency management organizations, as well as political and government bodies to examine and implement programs to both a) decrease identified vulnerabilities, as well as b) increase identified resiliencies.

9. CONCLUSION

Through an examination of vulnerability and resilience in Waterloo Region, this research examined the 'Hazards of Place' model of vulnerability as developed by Susan Cutter. This concluding chapter provides an overview of the results and their linkages to the literature review, as well as recommendations for future research.

Section 9.1 – Summary of Results

Through this study, the general relevancy and applicability of the 'Hazards of Place' model of vulnerability to a mid-sized Canadian city was recognized. The shift in the vulnerability literature towards a holistic approach which recognizes the importance of both social and environmental processes, as well as the inherent dynamism between them enhances the validity of this approach to vulnerability. Although the model was found to be generally applicable, a few modifications were deemed necessary through the results of this research project to further enhance our understanding of vulnerability and resilience.

An examination of the variables and processes that affect vulnerability and resilience found that many were similar to those recognized both in the literature and in Cutter *et al.*'s (2003) research. The importance of several variables, some previously unspecified, was also discussed, including preparedness and issues of complacency, large group gatherings, animals, poor land use and the dichotomy between urban and rural processes that generate levels of vulnerability and resilience. This also raised questions as to the complexity of vulnerability and encouraged the incorporation of resilience

concepts into the vulnerability discussion. Through the examination of these variables and complexities, the distinctive interactions between the social, political and economic processes occurring at a variety of scales and their manifestations at the local level were recognized as unique for each place. This continues to support one of the key concepts of the 'Hazards of Place' model of vulnerability.

Overall mitigation methods and programs to enhance community resiliencies were also suggested. These approaches were recognized across four themes, including the building of social capital, public education, social programs and the incorporation of sustainable development. These themes recognize the importance of the vulnerability research presented in the literature review. The theoretical approaches to vulnerability in the literature, and the associated underlying causes, including access to assets, access to power, and access to information presented in many of the vulnerability models, were acknowledged through these approaches to mitigation. Issues of sustainable development also incorporate aspects of the social-ecological literature on vulnerability and resilience through an understanding of the importance of environmental impacts on social, political and economic systems, as well as their significance for increasing or decreasing hazard risks.

While the overall applicability of the model was recognized, the lack of explicit dynamism within elements, the almost exclusive focus on vulnerability as opposed to resilience and the limited detail in the social vulnerability segment was critiqued. This led to an enhanced version of the 'Hazards of Place' model which recognized the layered and dynamic processes of vulnerability and resilience. Through this presentation of the

overall place resiliency, the vulnerability and resilience literature was merged to create a new understanding of the relationship between these two concepts. Through this research, our understanding of vulnerability and resilience was enhanced, resulting in a new model which recognizes the inherent singular nature of these two concepts.

Section 9.2 – Recommendations for Future Research

While this research attempts to fill a gap in the vulnerability and resiliency literature through the presentation of the singular nature of the relationship between these key concepts, future research is required. This research is based on the opinions and experiences of emergency managers and community practitioners in Waterloo Region, and as such, the emerging understanding of the 'Layers' vulnerability model and associated 'Overall Place Resiliency' model requires further study to determine the relevancy and validity of this approach. It would be important to know whether understanding vulnerability from a layers perspective is useful in the emergency management and disaster mitigation context. During disaster events, do the complexities of the relationships and interactions between layers undermine the usefulness of this approach? Furthermore, additional research could enhance this approach to emergency management through an analysis of the important measures, indicators and processes that are relevant to each layer.

The conceptualization of the relationship between vulnerability and resilience also requires future research. While the relationship continuum depicted in this paper is presented as a framework for understanding the nature of this relationship, further research is required to operationalize this understanding of vulnerability and resilience.

The positive approach to vulnerability and resilience presented in this paper, recognized through an understanding of the overall place resilience, may have some limitations in terms of policy applicability. Handmer (2003) acknowledges the political and administrative usefulness of making distinctions between vulnerable and resilient groups. The downfalls of using empowering language has also been noted through the use of this language as an pretext for limiting government and societal responsibility. As such, it would be important to know whether emergency managers and decision-makers find the overall resilience approach useful.

As well, through this approach to understanding vulnerability – is this providing us with new, useful information, or just another theory that provides a slightly different understanding of key concepts that further moves the academic community away from consensus? This indicates the need for vulnerability and resilience research that brings the community, not only into a deeper and fuller understanding of the processes of vulnerability and resilience, but also to a clearer, less contentious understanding of these concepts.

The examination of the variables used, not only in this research, but also through the creation of social vulnerability indexes (such as the SoVI developed by Cutter *et al.* (2003)) also present an underlying problem in vulnerability and resilience research. Many of the variables and processes discussed during this paper would be difficult, not only to quantify, but also to assess: "the small scale details of resilience may be inherently unknowable – especially in the case of complex communities undergoing constant change" (Handmer, 2003, p. 60). Determining key measurable indicators and variables to

represent levels of resilience and vulnerability is an issue that requires further study and resolution in the vulnerability and resilience literature.

Section 9.3 – Conclusion

This research presented an opportunity to examine issues of vulnerability and resilience in the context of a mid-sized Canadian city that has a well-developed, progressive and proactive emergency management program. This offered the unique potential to assess key concepts and issues in the literature and through this process, a new understanding of vulnerability and resilience was developed.

APPENDIX A – INTERVIEW QUESTIONS

1. Let's begin by talking a little bit about yourself:

    a. Can you tell me your job title?
    b. Can you tell me a little bit about your job responsibilities?
    c. Can you tell me about your responsibilities during an emergency event?

2. What does the term vulnerability mean to you?

3. On the other hand, what does the term resilience mean to you?

4. What factors do you think influence vulnerability?

5. Do you think there are certain individuals/groups in the region who are more vulnerable than others?

6. What characteristics do individuals and groups have which makes them more vulnerable to disaster events?

7. What characteristics do individuals and groups have which makes them more resilient to disaster events?

8. What activities do individuals and groups engage in which makes them more vulnerable to disaster events?

9. What activities could individuals or groups engage in to make them more resilient during disaster events?

10. What attributes do individuals and/or groups in Waterloo Region have that help to make them more resilient to disaster events?

11. What actions does your organization currently take to reduce the vulnerability of individuals and groups in Waterloo Region?

12. Can you tell me how your organization attempts to make people more resilient to disasters in Waterloo Region?

13. If you were given access to unlimited funding to reduce vulnerability to disasters in the Region, what types of programs or initiatives would you take?

14. If you were given access to unlimited funding to increase resiliency to disaster events in the Region, what types of programs or initiatives would you take?

15. How do the following impact your understanding of vulnerability and the actions your organization takes:

    a. Local regulations
    b. Provincial regulations
    c. Federal regulations
    d. Access to funding
    e. politics

16. Do other global events impact your understanding of vulnerability, and if so, how?

17. During recent disaster events that you have knowledge of, what factors contributed to increased vulnerability?

18. What could have been done to decrease the impacts of these disaster events?

19. Are you aware of any documents or proceedings or publications about the issues we have discussed that I would be able to examine?

20. Are you aware of any other individuals in the emergency management process that you feel I would benefit from speaking with?

APPENDIX B – REVISED INTERVIEW QUESTIONS

1. Let's begin by talking a little bit about yourself:

    a. Can you tell me your job title?
    b. Can you tell me a little bit about your job responsibilities?
    c. Can you tell me about your responsibilities during an emergency event?

2. What does the term vulnerability mean to you?

3. On the other hand, what does the term resilience mean to you?

4. What factors do you think influence vulnerability?

5. Do you think there are certain individuals/groups in the region who are more vulnerable than others? If so, what makes them more vulnerable?

6. What characteristics do individuals and groups have which makes them more vulnerable to disaster events? Can you provide an example?

7. What characteristics do individuals and groups have which makes them more resilient to disaster events?

8. What activities do individuals and groups engage in which makes them more vulnerable to disaster events?

9. What activities could individuals or groups engage in to make them more resilient during disaster events?

10. What actions does your organization currently take to reduce the vulnerability of individuals and groups in Waterloo Region?

11. Can you tell me how your organization attempts to make people more resilient to disasters in Waterloo Region?

12. If you were given access to unlimited funding to reduce vulnerability to disasters in the Region, what types of programs or initiatives would you take?

13. If you were given access to unlimited funding to increase resiliency to disaster events in the Region, what types of programs or initiatives would you take?

14. During recent disaster events that you have knowledge of, what factors contributed to increased vulnerability?

15. What could have been done to decrease the impacts of these disaster events?

APPENDIX C – SURVEY QUESTIONS

Please answer the following questions by choosing the answer that best represents your understanding of vulnerability in Waterloo Region. As you answer the questions, please briefly describe why you selected each answer.

1) Please tell me how important or unimportant the following variables are for influencing vulnerability in this Region (Please circle):

   ** Note – you are not required to fill in the 'Other' variables

   1 – Very important - - - - - 5 – Not Important

Variable:	Very Important ← → Very Unimportant				
Physical Proximity to Disaster Event	1	2	3	4	5
Gender	1	2	3	4	5
Age	1	2	3	4	5
Social Status/Class	1	2	3	4	5
Income Levels	1	2	3	4	5
Mobility	1	2	3	4	5
Language	1	2	3	4	5
Infrastructure Development	1	2	3	4	5
Housing Quality	1	2	3	4	5
Race/Ethnicity	1	2	3	4	5
Occupation	1	2	3	4	5
Density of the Built Environment	1	2	3	4	5
Disability	1	2	3	4	5
Other (Please specify)	1	2	3	4	5
Other (Please specify)	1	2	3	4	5

2) Please rank the following variables in order from most important (1) to least important (14) in relation to their influence on vulnerable populations

(**Note – You are not required to fill in the 'Other' variables)

Variable:	Rank:
Proximity to Disaster Event	
Gender	
Age	
Social Status	
Income Levels	
Mobility	
Language Skills	
Infrastructure Development	
Housing Quality	
Race/Ethnicity	
Occupation	
Density of Built Environment	
Disability	
Other (please specify)	

3) Based on the characteristics of the following families, please place them in order from most vulnerable (1) to least vulnerable (4) – Please assume that all families are composed of the same number of members, ages and genders.

Group A: High income family living close to a flood plain
Group B: Low income family living close to a flood plain
Group C: Recent immigrant family with low income levels
Group D: Family located in a medium hazard risk location

Most vulnerable 1 _____

2 _____

3 _____

Least vulnerable 4 _____

4) Please list three characteristics of a group that would increase its vulnerability to a disaster event:

i. _____

ii. _____

iii. _____

5) Please list three characteristics of a group that would increase its resiliency to a disaster event:

i. _____

ii. _____

iii. _____

6) Please list two actions an individual could engage in to increase his/her vulnerability during a disaster event:

i. _____

ii. _____

7) Please list two actions an individual could engage in to increase his/her resiliency during a disaster event:

i. _____

ii. _____

8) Please specify the two most important factors which have influenced your understanding of vulnerability

i. _____

ii. _____

9) Please specify the two most important external factors which have influenced the actions your organization takes to reduce vulnerabilities in Waterloo Region:

i. _____

ii. _____

10) Looking back at emergency events in the Region over the past 15 years, please list the top three factors which influenced vulnerable groups:

i. _____

ii. _____

iii. _____

Please describe which emergency event you were referring to in the above question:

_____

_____

_____

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