

Social Criteria for Multi-Criteria Decision Analysis in Flood Management

By

Monica (Toni) Morris-Oswald

A Thesis

**Submitted to the Faculty of Graduate Studies
in Partial Fulfillment of the Requirements for the Degree,
Masters of Natural Resources Management.**

**Natural Resources Institute
University of Manitoba
Winnipeg, Manitoba
Canada R3T 2N2**

November, 2000



National Library
of Canada

Acquisitions and
Bibliographic Services

395 Wellington Street
Ottawa ON K1A 0N4
Canada

Bibliothèque nationale
du Canada

Acquisitions et
services bibliographiques

395, rue Wellington
Ottawa ON K1A 0N4
Canada

Your file *Votre référence*

Our file *Notre référence*

The author has granted a non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of this thesis in microform, paper or electronic formats.

The author retains ownership of the copyright in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de cette thèse sous la forme de microfiche/film, de reproduction sur papier ou sur format électronique.

L'auteur conserve la propriété du droit d'auteur qui protège cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

0-612-57562-4

Canada

**THE UNIVERSITY OF MANITOBA
FACULTY OF GRADUATE STUDIES

COPYRIGHT PERMISSION PAGE**

Social Criteria for Multi-criteria Decision Analysis in Flood Management

BY

Monica (Toni) Morris-Oswald

**A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University
of Manitoba in partial fulfillment of the requirements of the degree
of
Master of Natural Resources Management**

MONICA (TONI) MORRIS-OSWALD © 2000

Permission has been granted to the Library of The University of Manitoba to lend or sell copies of this thesis/practicum, to the National Library of Canada to microfilm this thesis/practicum and to lend or sell copies of the film, and to Dissertations Abstracts International to publish an abstract of this thesis/practicum.

The author reserves other publication rights, and neither this thesis/practicum nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.

ABSTRACT

The primary purpose of this study was to provide a set of social criteria for use in selecting among alternative flood management strategies. These social criteria provide decision-makers with important considerations if enhancing the well-being of residents at risk from flood is to be an overall goal in flood management planning. While potentially applicable to a broad range of decision-making models, the social criteria are presented so as to be suitable to a multiple-criteria decision analysis framework, a decision-making framework suitable in addressing complex water resources management problems.

To obtain information on the flood-related concerns and needs of Manitoba residents, a survey questionnaire on the psychosocial impacts of the Red River flood of 1997 was administered to a sample of residents across several at-risk communities. This exploratory survey identified a broad range of impacts from the flood on individuals, families and to a more limited extent, communities. In addition to answering closed questions, respondents were given an opportunity to expand upon issues and offer additional insights if they chose. Data from the survey was organized under a number of dimensions of flood impact including *severity of flooding, evacuation impacts, economic impacts, family impacts, community impacts, knowledge, risk communication and warning, future plans, and behavior impacts*. In addition, there was particular emphasis in describing stress-related impacts which appeared as the primary dependent variables in the study, namely *stress and stress symptoms, psychosocial symptoms of distress, and physical health impacts*.

Flood history and flood management activities in Manitoba, and particularly the events of the 1997 flood, were also reviewed in some detail to provide context to the study. By condensing this information and the results of the survey questionnaire, several sets of factors were identified that must be considered if negative psychosocial impacts residents are to be minimized in flood management planning. By considering these factors and ways of mitigating negative impacts, six criteria were developed for decision-makers to use when evaluating flood management strategies and in selecting among several of

them. The six criteria include: 1) maximize community level involvement 2) maximize effective communication regarding flood risk and planning (3) maximize appropriateness and responsiveness of services to individual families (4) minimize personal economic losses of residents (5) minimize life disruption (6) minimize stress and stress symptoms (including physical health symptoms).

The six social criteria that are presented concisely address the most prevalent concerns of residents in at-risk communities in 1997. They are presented in terms of the direction in which they should be measured, in other words it is clear whether decision-makers should be maximizing or minimizing the criteria. This is consistent with a multi-criteria decision analysis framework. The criteria are also presented with reference to the three stages of flood management (*planning, emergency response, and recovery*) to show how applicable each criterion is to each stage.

Ultimately, it is decision-makers that will decide how much weight to give each social criterion as compared to other criteria (such as economic ones). Paying heed, however, to these social evaluation criteria will help them eliminate less socially desirable alternatives or solutions to flood management problems. A particular benefit of the multi-criteria decision analysis framework referenced in this study is that the level of importance placed on each social criterion (relative to any and all other criterion) will be clearly evident when decisions are made.

ACKNOWLEDGEMENTS

The writing of this master's thesis was a challenge in many ways. There was not only the challenge of delving into an area of research with which I was not familiar, but the challenge and excitement of working with an interdisciplinary committee. While at times difficult because of the differing perspectives and priorities of different disciplines, I have no doubt that I learned more, developed an appreciation for a more systemic approach to problem solving, and probably improved my diplomatic skills. Most of all I was fortunate enough to be able to employ the skills I learned previously as a clinical social worker, something I felt would be unlikely as I sought a research topic in natural resources management.

I wish to thank the members of my committee for their advice and encouragement: Dr. John Sinclair, Natural Resources Institute, University of Manitoba; Dr. Gary Johnson, Agricultural Economics Department, University of Manitoba; Dr. Slobodan Simonovic, Natural Resources Institute, University of Manitoba; and Dr. Doreen Smith, Sociology Department, University of Winnipeg. Dr. Smith gently reminded me that anticipating problems is better than having to deal with them retroactively – a lesson I will carry with me.

To Dr. Simonovic I owe a particular debt of gratitude. He provided the opportunity for me to do this work, with the assistance of the International Joint Commission and NSERC who kindly provided the funding. Dr. Simonovic always seemed happy to see me when I suddenly appeared at his door, allowed me a large measure of freedom, and responded to many of my queries with a "why not?". This permitted me to think and act independently, a show of faith which I valued greatly. His enthusiasm and commitment to the area of water resources management was contagious, and his concern for human welfare admirable.

I would be greatly remiss if I did not acknowledge the wonderful people in various communities who I interviewed in 1997. Many of them exposed their lives to my scrutiny

at a time when those lives were filled with enormous stress and upheaval. You have made a truly lasting impression on me. To all of you I wish only the very best in the future.

To Rolf, my husband, I need to express my love and heartfelt appreciation. When the computer crashed, or I mysteriously lost files, you managed to recover them (most of the time). On occasion, you edited my work into the wee hours of the morning when I fell into an exhausted sleep. Most of all, you always reminded me of what was truly important, and not to be too self-absorbed during this challenging time. I love you.

A warm thanks to Mitchell, my son, who sometimes had to patiently wait while I completed my work, and who was so excited the day I passed my oral defense that he told everyone at elementary school. You light up each of my days with your zest for life and your caring. If the world is filled with other children like you, it will be in very fine and capable hands one day!

TABLE OF CONTENTS

ABSTRACT	I
ACKNOWLEDGEMENTS	III
CHAPTER 1: INTRODUCTION	1
1.1 PREAMBLE	1
1.2 ORGANIZATION OF THE STUDY	1
1.3 BACKGROUND TO THE STUDY	2
1.4 RESEARCH OBJECTIVES	5
1.5 METHODOLOGY	6
1.6 SCOPE, ASSUMPTIONS AND DELIMITATION OF THE RESEARCH	8
CHAPTER 2: LITERATURE REVIEW	11
2.1 INTRODUCTION AND BACKGROUND	11
2.2 PSYCHOSOCIAL IMPACTS FROM NATURAL DISASTERS.....	12
2.2.1 <i>Individual Responses to Disaster</i>	13
2.2.2 <i>Stress and Stress-related Symptoms</i>	16
2.2.3 <i>Psychosocial Impacts and Community Planning</i>	20
2.3 FLOOD MANAGEMENT	23
2.3.1 <i>Flood Management Activities</i>	23
2.3.2 <i>Flood Management and Decision-making</i>	25
2.4 MULTI-CRITERIA DECISION ANALYSIS.....	29
2.4.1 <i>Introduction</i>	29
2.4.2 <i>The Multi-Criteria Decision Analysis Framework</i>	30
2.4.3 <i>Criteria use in Multi-Criteria Decision Analysis</i>	32
2.4.4 <i>Multi-Criteria Decision Analysis, Water Resources Management, and Flood Management</i>	35
CHAPTER 3: METHODOLOGY	37
3.1 INTRODUCTION	37
3.2 SOURCES OF INFORMATION.....	38
3.3 METHODOLOGY	38
3.4 SURVEY DEVELOPMENT.....	40
3.5 INDEPENDENT VARIABLES	40
3.6 DEPENDENT VARIABLES	44
3.7 ADDITIONAL VARIABLES	46
3.8 SAMPLE SELECTION	47
3.9 SURVEY DEVELOPMENT AND ADMINISTRATION	48
3.10 SOCIODEMOGRAPHIC VARIABLES	49
3.11 ANALYSIS	50
CHAPTER 4: FLOODING IN THE RED RIVER BASIN	52
4.1 INTRODUCTION	52
4.2 OBJECTIVE #1	52
4.2.1 <i>Description of the Red River and its Basin</i>	52
4.2.2 <i>The Causes of Flooding in the Red River Basin</i>	54
4.2.3 <i>Flood History</i>	56
4.2.4 <i>Structural and Nonstructural Flood Management Measures</i>	57
4.2.4.1 <i>Structural Measures</i>	57
4.2.4.2 <i>Non-Structural Measures</i>	61
4.3 OBJECTIVE #2	61
4.3.1 <i>Description of the Flood</i>	61
4.3.2 <i>Agricultural Impacts</i>	62
4.3.3 <i>Flood Preparation and Flood Fighting in 1997</i>	62

4.3.4	<i>Structural Measures in the 1997 Flood</i>	63
4.3.5	<i>The Military Role</i>	64
4.3.6	<i>Emergency Measures</i>	65
4.3.7	<i>Flood Recovery</i>	66
CHAPTER 5: DISCUSSION OF SURVEY AND SURVEY RESULTS		67
5.1	RATIONALE FOR USE OF A SURVEY ON PSYCHOSOCIAL IMPACTS.....	67
5.2	SURVEY ADMINISTRATION AND RESULTS	69
5.2.1	<i>The Interview Environment</i>	69
5.2.2	<i>Sociodemographic Data</i>	71
5.2.3	<i>Results by Dimension of Analysis</i>	74
5.2.3.1	Severity of Flooding Dimension	74
5.2.3.2	Evacuation Issues	77
5.2.3.3	Economic Issues.....	80
5.2.3.4	Family Issues.....	82
5.2.3.5	Community Impacts	85
5.2.3.6	Future Plans.....	87
5.2.3.7	Knowledge Dimension	90
5.2.3.8	Risk Communication and Warning	92
5.2.3.9	Behavior Dimension.....	94
5.2.3.10	Dependent Variables.....	97
5.2.4	<i>Qualitative Data Analysis</i>	111
5.3	CONCLUSION.....	116
CHAPTER 6: SUMMARY, RECOMMENDATIONS AND CONCLUSION		117
6.1	SUMMARY	117
6.2	SOCIAL CRITERIA.....	122
6.2.1	<i>Criteria 1</i>	123
6.2.2	<i>Criteria 2</i>	126
6.2.3	<i>Criteria 3</i>	127
6.2.4	<i>Criteria 4</i>	129
6.2.5	<i>Criteria 5</i>	131
6.2.6	<i>Criteria 6</i>	133
6.3	DISCUSSION OF SOCIAL CRITERIA.....	134
6.4	OTHER EMPIRICAL FINDINGS	135
6.5	RECOMMENDATIONS FOR RESEARCH	137
6.6	CONCLUSION.....	137
REFERENCES		139

LIST OF FIGURES

Figure 3.1 :	Methodology	39
Figure 4.1 :	The Red River Basin	54
Figure 4.2 :	Schematic drawing of flood control system to protect Winnipeg	60
Figure 5.1 :	Number of respondents per communities surveyed	72
Figure 5.2 :	Breakdown of age categories of respondents	72
Figure 5.3 :	Depth of water in home by stress level since flood	75
Figure 5.4 :	Length clean-up by stress post-flood (yes/no)	76
Figure 5.5 :	Personal losses-no losses, replaceable losses, and irreplaceable losses	76
Figure 5.6 :	Adequate notice by stress since flood	79
Figure 5.7 :	Total household loss of income by stress since flood	82
Figure 5.8 :	Family conflict by stress since flood	83
Figure 5.9 :	Perceived support of government	86
Figure 5.10 :	Property value concern by community	88
Figure 5.11 :	Considering move by stress since flood	89
Figure 5.12 :	Trouble coping with problems since flood by arguments within family	95
Figure 5.13 :	Respondents reporting stress above pre-flood levels during flood	101
Figure 5.14 :	Respondents reporting stress above pre-flood levels post-flood	101
Figure 5.15 :	Respondents' "fear" at time of interview	106
Figure 5.16 :	Respondents' "anger" at time of interview	107
Figure 5.17 :	General health before flood	108
Figure 5.18 :	General health since flood	108

LIST OF TABLES

Table 3.1 :	Independent Variables	42
Table 3.2 :	Dependent Variables	45
Table 3.3 :	Variables both Independent and Dependent	46
Table 4.1 :	Main Characteristics of the Red River Floodway	57
Table 4.2 :	Main Characteristics of the Portage Diversion	58
Table 4.3 :	Main Characteristics of the Shellmouth Reservoir	58
Table 4.4 :	Main Characteristics of the Winnipeg diking system	59
Table 4.5 :	Main Characteristics of ring dikes	59

LIST OF APPENDICES

APPENDIX 1 : MAP	A1-1
APPENDIX 2 : SURVEY AND COVER LETTER	A2-1
APPENDIX 3 : GRAPHS AND CROSSTABS	A3-1

CHAPTER 1: INTRODUCTION

1.1 Preamble

The Red River flood of 1997, referred to as the “Flood of the Century”, has reminded residents of Manitoba of their vulnerability to the forces of nature. It has prompted all levels of government to give renewed attention to flood management issues because of the extent and cost of damages.

There is no doubt that the flood significantly impacted people. Most residents of southern Manitoba were affected in some way, either directly or indirectly, as the waters rose. Most significantly affected were those people in communities under evacuation order. These people had to either abandon their homes or remain behind to engage in a difficult, protracted and dangerous struggle against the Red River. Many families and communities sustained heavy losses through damage to homes or property. When the waters went down it was evident that social impacts were considerable.

In this study, social criteria are proposed which decision-makers can use in selecting flood management strategies. The criteria were determined by identifying the psychosocial impacts of the 1997 flood, and those issues which must be considered in decision-making if negative impacts to residents and communities are to be minimized. The social criteria are presented so as to be applicable to a Multi-Criteria Decision Analysis (MCDA) framework, but could be applied generally to other decision-making models.

1.2 Organization of the Study

Chapter 1 contains a brief presentation of the background to the research problem to be examined in this study, i.e. development of social criteria for use in a Multi-Criteria Decision Analysis framework in flood management. A concise statement of the problem will be provided. Research objectives, a brief discussion of methods, scope, delimitation and the importance of the project will also be presented.

Chapter 2 contains a review of literature pertinent to the topic. The three broad topics considered are psychosocial impacts from natural disasters, flood management in the Red River Basin, and Multiple Criteria Decision Analysis.

Chapter 3 presents the proposed methods for the study and justification for the choices made.

Chapter 4 presents a discussion of flooding along the Red River in Manitoba, and overviews the events of the flood of 1997, including flood management activities.

Chapter 5 is a discussion of the survey questionnaire on psychosocial impacts from the 1997 flood. More analysis of the survey and the applicable graphs of variables appear in Chapter 6 and in Appendix 3.

Chapter 6 begins with a summary of the factors of most significance in deriving social criteria for use in flood management decision-making. Then the six proposed criteria are outlined, with the rationale for their selection if negative psychosocial impacts to individuals and families are to be reduced in future decision-making. This is the fulfillment of the primary objective of this study, namely to use the exploratory case study data to develop a set of social criteria. This is followed by a number of recommendations for further research that have emerged out of this study. A brief conclusion completes the chapter.

1.3 Background to the Study

Flooding is common to the Red River Valley; however the devastation of the 1997 flood has exposed a vulnerability to flood damage, a vulnerability to which many Manitobans have been indifferent until now. Much of this indifference has been due to extensive structural flood control measures implemented in the 1960's and 1970's. These works have created a sense of security in many communities, most particularly in Winnipeg. However, because of the enormity of damages in 1997, governments and at-risk

communities are looking to better prevent or reduce damages in the future. This requires a decision-making process that can evaluate which flood management strategies are best.

Flood management planning is a complex task. While decision-makers normally have a number of structural and nonstructural alternatives available for consideration, each one has various economic, environmental, and social impacts. All alternatives are subject to practical constraints, as well, such as financial costs of the project. For decades, most flood management decisions have been made based almost exclusively on economic criteria, most notably benefit-cost analysis. Traditional benefit-cost analysis has focussed on *costs* such as implementation and maintenance of a selected alternative, and direct and indirect *benefits* in the form of a total change in income resulting from the project. Broader social costs and environmental costs (costs borne by members of society) are often not fully included in benefit-cost analysis. Consequently, the results of traditional economic analysis do not provide sufficient information on the *real* costs/benefits, namely the tangible and intangible costs and benefits to *society* of a selected alternative.

One way to expand the information used in flood management decision-making is to include social criteria as well as economic criteria in evaluating alternatives. This research provides the social criteria to be used in evaluation of flood management alternatives. The major source of data on impacts was a questionnaire survey administered during the summer of 1997 to residents south of Winnipeg. This data was analyzed, and considered in the light of information obtained on flood management in the Red River Basin and, more specifically, on flood management activities which took place in 1997. An important underlying assumption in this study was that the reduction of negative psychosocial impacts should be one goal in selecting flood management strategies. The social criteria generated reflect the most urgent social considerations for decision-makers if negative social impacts are to be reduced or prevented in southern Manitoba.

There are a series of steps in the decision-making process. These steps include the following sequence: establishment of goals and objectives; problem identification and

analysis; formulation of alternatives and analysis; recommendations; decisions; operation and management (Goodman, 1984 in Simonovic, 1997). The criteria provided at the conclusion of this study constitutes input to the “formulation of alternatives and analysis” phase. It is in this phase that all criteria, including social ones, are selected and utilized in comparison of alternatives.

One decision-making approach which uses specific criteria, some of which are potentially conflicting or incommensurable, is Multi-Criteria Decision Analysis (MCDA). This approach actually strives to include a comprehensive list of criteria in evaluating various solutions under consideration. It can and will clarify the trade-off between social, environmental, and economic criteria (or objectives) in flood management. In fact, MCDA essentially takes a complex management problem, consults with decision-makers or stakeholders to explore the range of goals and objectives (criteria) sought, and represents and analyzes the trade-off between objectives (or criteria) in ranking all decision alternatives. This process requires decision-makers’ experience and judgments about the alternatives. No one “optimal” solution is sought; rather a set of compromise solutions to choose from is provided. MCDA employs a variety of techniques, some highly mathematical, which permit the comparison or trade-off between alternatives even when objectives are numerous, varied, and intangible. The MCDA approach guarantees that social criteria which are identified at the outset of the decision-making process will be included in the process of evaluating alternatives, and trade-off among objectives will be visible and not hidden.

In summary, the Red River flood of 1997 offered an opportunity to identify psychosocial impacts of flooding on select Manitoba residents (and their communities) for the purpose of generating social criteria for use in future flood management decision-making. Use of a concise set of social criteria can greatly augment the decision-making process in future by reflecting, at least in part, the needs and experiences of residents impacted by the 1997 flood.

1.4 Research Objectives

The primary objective of this research was to develop a set of social criteria that can be used in evaluating alternative flood management strategies. It was done using case study data on the psychosocial impacts of the 1997 Red River Valley flood, and information gathered on flood management practices in Manitoba's Red River Basin. The criteria are presented so as to be suitable for use in a Multi-Criteria Decision Analysis framework; however, it is important to note that the criteria could be readily applied in a number of decision models. In this research the focus is on the determination of suitable social criteria for use in flood management and not in determining *which* decision-making model should be used. That is well beyond the scope of this study. However, the use of MCDA in water resources management is established in the literature, most notably because of its ability to handle extremely complex decision problems characterized by multiple and often conflicting objectives.

The initial plan to develop the social criteria through use of a survey of flooded residents (in 1997) emerged because it was evident that there was very little information on the experiences and concerns of citizens who experience (or are at risk from) flooding along the Red River in Manitoba. It was decided that social criteria intended to improve quality of life for potential flood victims had to reflect residents' social reality in order to be effective, and that solutions for minimizing negative impacts from floods and flood management decisions had to be applicable to their social environment. Information attained directly from residents themselves was seen as the best means of understanding their social reality. Hence, a survey was used to gather information on residents' experiences and concerns following the 1997 flood and to provide a broad picture of their struggles and concerns, and the resources they required to cope with the flood situation. The survey was specifically on "psychosocial" impacts of the flood. In this study, the term "psychosocial impacts" referred to impacts of the flood which affected psychological processes (eg. emotions, beliefs), and ultimately the well-being of individuals at risk for flooding *within* the context of their social environment.

Information of many types was sought from residents; the survey probed individual psychological impacts (e.g. emotional and cognitive responses) and impacts at the social level (e.g. family, community). The survey data was later organized and aggregated into key themes that reflected the most prevalent concerns of residents. Then, to address the concerns and problems faced by residents, six criteria were developed that decision-makers should be considering when decisions related to flood management are made.

The specific objectives of the study were:

1. to present an overview of the characteristics of flooding along the Red River in Manitoba, and review the flood control system
2. to describe the 1997 flood including flood management activities during the event in order to provide a context to the case study
3. to overview psychosocial impacts of the 1997 flood on members of selected communities through analysis of survey data
4. to develop a set of social criteria applicable to Multi-Criteria Decision Analysis for use in evaluating alternative flood management strategies

1.5 Methodology

To accomplish the above stated objectives it was necessary to review related literature. Sources of information for the literature review included various books, journal articles, public records and government personnel.

A literature search was required on the psychosocial impacts of flood and natural disasters, with particular attention to the types of information which should be sought in determining flood impacts on humans. Literature review was also done related to flood management, and specifically how decision-making is done. Objectives 1 and 2, related to flooding in along the Red River and events of the flood of 1997, required literature

review and the results are discussed in Chapter 4. Finally, the scholarly literature was reviewed on the topic of Multi-Criteria Decision Analysis and the role of criteria in that decision-making framework.

After the literature review was completed the survey used in this study was designed. It was intended to be exploratory and effectively provide a “snapshot” of a broad range of impacts felt by the interviewed flood victims, their families, and to a more limited extent, their communities. Two methodological priorities of this study included 1) getting into the field as soon after the crisis event as possible 2) minimizing any stress to victims that could arise from participation in this study.

The survey interview schedule included factual and attitudinal questions, and resulted in collection of both quantitative and qualitative data. Open-ended questions enhanced understanding of people’s experiences and attitudes and identified some factors or variables that victims felt may have increased the negative impact of the flood.

The questionnaire was administered to fifty-two households in all and drawn from victims in six different “community” types. These six communities represent broad categories of victims in the 1997 flood. The interviewees came from:

1. An urban community
2. A suburban community
3. An urban fringe community
4. A diked / protected rural community
5. An undiked / unprotected rural community
6. Rural homesteads and farms

The survey questionnaires were administered by one interviewer, who went door to door in the communities to locate willing respondents. Breadth rather than depth was the focus of these interviews, since the generation of a set of social criteria must reflect a wide range of impacts in order to be sufficiently comprehensive to be used in decision-making.

While possible associations between some variables (which affect psychosocial impact) were noted in analysis, this study is clearly exploratory. Hence, its major purpose is to develop ideas from the data as to what social criteria may help reduce the negative impacts of future flooding on Red River Basin residents in Manitoba. Verification of hypotheses related to impacts of flooding is not intended in this exploratory work. Recommendations for further research were an anticipated outcome. Statistical significance was not possible given that sampling was problematic, sample size was small, and not sufficiently random. This is discussed further in Chapter 3.

Once the survey data was analyzed to depict the nature and magnitude of psychosocial impacts, in the context of what is known about flooding and flood management in the Red River Basin, it was synthesized into a concise set of social criteria. These criteria are appropriate for use in a multi-criteria decision-making framework in flood management, and in considering both structural and non-structural flood damage reduction measures.

1.6 Scope, Assumptions and Delimitation of the Research

The survey to identify psychosocial impacts of the 1997 flood is limited geographically to a region within roughly 80 km of the city of Winnipeg, in the province of Manitoba. Therefore, all outcomes of the research may not be generalized to all parts of the Red River Valley; the valley itself extends close to 900 km (550 miles), to the south of Winnipeg (See Figure 4.1).

The case study method (which involves a selection of several communities among many) places constraints on applicability of results because there are many diverse communities in the Red River Valley. However, because the communities selected were chosen deliberately to be representative of a variety of different community types, there is an assumption that, given the limited resources available, the interview results yielded a useful overview of psychosocial impacts on individuals, families and communities in the Red River Valley. This is one of the most valuable contributions of this research.

It may further be possible, with care, to generalize results to other regions in which there are significant similarities in the flooding environment (e.g. very flat terrain, slow moving floods). The Red River Basin has various geophysical characteristics which result in slow moving floods and substantial warning time for most at-risk communities (especially as compared to areas that experience flash floods). The water also tends to remain for days or even weeks in the case of large floods. Overall, the increased warning time enhances the ability to prevent loss of life, but the longer duration flood increases damage significantly because of the standing water. Consequently, victims in areas which are prone to flash flooding for instance, would have some experiences that are markedly different than in the Red River Basin; therefore results of this study must be applied cautiously to those areas.

There is another reason that the results of this study should be applied cautiously outside of Manitoba, particularly in other countries. Because flood management is such a complex issue, the institutional, ecological, economic, and cultural characteristics of a region will significantly affect the types of impacts from flooding and the types of flood management options available to decision-makers. The social criteria generated in this research will consequently have more applicability to other developed countries than to developing countries.

Attainment of the primary objective of this study makes two major assumptions, namely, 1) reduction of negative psychosocial impacts is desirable, and 2) decision-makers and/or flood managers are willing to use social criteria in an analytical framework for decision-making and to somewhat structure their judgements according to residents' preferences.

Flooding in 1997 in the United States and Canada along the Red River Valley has resulted in enormous damages, with total damages in Canada of about \$600 million dollars. As of September, 2000 the government expenditures alone were \$500 million. In addition to dollar losses are the less tangible, but no less significant, personal and social costs of the flood to individuals, families, and communities. This is ultimately a cost to the public as assistance of various types must be provided to victims during the recovery

process (e.g. temporary housing, counseling). Government departments responsible for evaluating the range of options available to reduce, mitigate and prevent flood impacts need accurate information on the psychosocial and other impacts of flooding, and the associated costs, if they are to effectively manage the flood-risk. This research has explored the nature of many of the impacts on residents, examined it in the context of flood management in Manitoba, and most importantly, synthesized this knowledge into a form useable by decision-makers (i.e. a set of social criteria). The goals to reduce the rising human costs and institutional costs from successive floods may well be advanced through use of these six social criteria in decision-making.

The issue of the human dimension in flood impact evaluation is also an increasingly prominent theme in recent flood research due, in part, to adoption of more holistic approaches in natural resources management. This research was particularly timely given the deployment of the International Joint Commission (IJC) on the Red River Basin. It has had a bi-national (Canadian-American) mandate to take a cooperative basin-wide approach in searching for solutions to the escalating frequency of floods in the Red River Valley (Floodnet Research Conference, Oct, 1997). The IJC, in keeping with a more holistic philosophy in decision-making, has promised an approach which incorporates to some extent a public participation model. They have asked for information on the impact of the 1997 flood on victims, showing the timeliness of this study. In addition, the IJC and all levels of government within Manitoba have been striving to recommend and operationalize plans to mitigate future flood damages. To make these decisions effectively, social criteria (against which to compare alternate flood management plans) are of great importance, particularly to more comprehensively address the needs of residents. Inclusion of social criteria is also consistent with the concept of sustainable development, the guiding paradigm for development locally, nationally, and globally.

Finally, the use of psychosocial impact data to generate a list of social criteria which can then be used in flood management activities, and ultimately reduce the severity of disruption for victims, is unprecedented in the literature. This study has much to contribute to the area of flood management decision-making, particularly in the Canadian context.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction and Background

The literature available on the use of social criteria for use in flood management decision-making is very limited at best. None is available in the form of analysis of a case study (as accomplished in this study) which looks at psychosocial impacts of flooding on residents specifically for the purpose of generating social criteria to use in making flood management decisions.

While limited literature relates directly to the topic, there are three distinct areas which have relevance to the study. One area which was broadly reviewed was related to the psychosocial impacts of natural disaster (with particular emphasis on floods) on individual residents and families. The literature review in this area was used to gain insight into some of the questions that might be asked in the survey given to residents. An overview of the concept of *stress* with reference to *stress symptoms*, *symptoms of distress*, and *physical health impacts from stress* was provided for clarification because these constitute the main dependent variables in the survey questionnaire. Also discussed under Psychosocial Impacts from Natural Disasters are some of the broader impacts of flood disasters that have been examined in the literature, most particularly at a societal or community level. Information regarding some of these impacts was also sought in the survey administered to victims.

The second major area of literature review included an outline of what constitutes “flood management”, the primary stages involved, and how decision-making is typically done. This is to offer some clarification of the role that criteria may play in decision-making.

The role of social criteria was further explained through the third major area of literature review, namely an overview of Multiple Criteria Decision Analysis, and the potential use of social criteria in evaluating alternative flood management strategies.

2.2 Psychosocial Impacts from Natural Disasters

The term “disaster” is defined extensively in the literature. Two key factors are most commonly incorporated in the definition. One is the acknowledgement that a disaster has a physical component where there is either destruction to the environment, some type of physical threat, or loss of life. Secondly, there is a disruption to the social context within which individuals or groups function; most commonly it is a fairly widespread social disruption which reduces the normal adaptive capacities of people. At a family level, for instance, members may have to rely heavily on their own resources because access to outside resources are reduced (Giel,1990; Figley and McCubbin, 1982; Quarentelli and Dynes, 1977).

In recent literature, “ psychosocial impacts” from an external agent (such as a disaster) can be defined as the complex of *distress, dysfunction, and disability* which are manifested in a wide range of *psychological, social and behavioral* outcomes (Dunn et al., 1994). However, it must be noted that psychosocial effects may also involve some positive outcomes (Taylor et al., 1991) such as feelings of competence or increased community solidarity. The three categories of impact are more specifically described below.

The *psychological impacts* from a widespread event can happen at various levels of a social scale ranging from individual, social network, or community levels. For example, emotional effects from disaster at the individual level may include negative *emotions* such as fear, anger, sense of loss of control, sadness. At the social network level, effects can include family disruption, interpersonal conflict and social isolation, and (more positively) increased social cohesion. Community level effects can include such impacts as dislocation or community empowerment. (Taylor et al., 1991).

Behavioral impacts from a disaster can include a range of responses including, for example: changes in task performance, information seeking activities, decision-making, and other new or changed behaviors. In this study there are questions in the survey which

relate to behavioral effects resulting from the flood such as 1) changes in contact with community support systems or 2) ability to cope with problems.

Social impacts from natural disaster can be numerous, including a multitude of environmental and natural resource impacts, as well as more personal impacts. This research is concerned more particularly with the “strictly personal” types of social impacts. Hasu Naik (1981) states that *personal social impacts* are those related to social well-being such as: income impacts; life, health and safety impacts; educational, cultural and recreational impacts; emergency preparedness impacts. Specific examples can include such factors as family disruption, isolation, social cohesion, public activism or emergence of self-help groups.

2.2.1 Individual Responses to Disaster

The following discussion of some of the prevalent research in the field of psychosocial impacts, and more particularly flooding, provided input to the selection of social indicators (particularly independent variables influencing stress-related symptoms) in the developed survey.

Hansson et al., (1982) examined three variables important to understanding individual responses to disaster, namely *knowledge*, *warning* and *prior experience*. He considered whether these variables mediated the *stress* associated with urban flooding. Relationships between each of these three variables and stress were evident, but of a complex nature. For instance, *knowledge of factors affecting flooding* resulted in actions consistent with greater calm, perceived control, and less support generally for government intervention. Greater *warning* was associated with intensified stress (including *physical health impacts*), which researchers speculated may be due to uncertainty/anxiety, and an unspecified waiting period for the disaster to strike. Previously flooded residents, namely those with *prior experience*, were more *fearful*, *depressed*, and had more *physical health symptoms* than never-flooded residents. They also found that the more recent a victim’s last flood experience had been, the more likely they were to support adaptive community

interventions. How recent the prior flood experience was did not appear linked to psychological or health measures in their work.

One study of 1993 floods in the Upper Midwestern United States (Tobin and Ollenburger, 1996) stated that within the disaster literature it is not unusual to find various degrees of *stress* exhibited by victims, and for negative *emotional* and *psychological* responses to last for prolonged periods. This study revealed that 71% of 120 respondents suffered from post-traumatic stress. Also *age*, *gender* and *income* were not significant predictors of post disaster stress while some other variables such as *previous health conditions*, *employment status*, were. This contradicted some previous studies, making for ongoing debate. In the conclusion of their study, Tobin and Ollenburger (1996) emphasized the need for further assessment of post-traumatic stress symptoms in victims of flood. They suggested further research be done in other communities. As well, they saw a need for disaster studies to span a longer time frame than a mere few months post-disaster.

How individuals *adapt* or cope with natural hazards such as flooding has been one area of focus in the research. Data was used in one study (Laska, 1990) to develop a Flood Coping Scale from a pre-existing model of societal coping to natural hazards (that of Burton, Kates, and White, 1978). The data looked at factors believed to be associated with decisions to adjust to a hazard and to move from one mode of adaptive coping to another. Variables which they identified as significant in considering adaptation and coping of victims to flood events included 1) *flood-proofing activities / measures undertaken*; 2) *consideration of moving* because of the possibility of flooding; 3) *damage cost*; 4) *household income*; 5) *lobbying activities post-flood*; 6) *insurance purchase*; 7) *perceived flood severity*; 8) *future flood control (perception of)*; 9) *belief in a technological fix*; 10) *anticipated future water damage*; 11) *responsibility of homeowners to protect their property*; and 12) *length of expected residence* in the community. The first five factors appear in this study as independent variables.

The effects of *evacuation* or *relocation* (both temporary and permanent) on individuals, families (and even communities) also appear in the literature. There are some factors related to the evacuation/relocation process which are known to have an impact on *environmental, social and psychological stress* of disaster victims (Riad and Norris, 1996). These factors include: *where evacuees were relocated* (i.e. family, friends, government facility), *type of housing and perception of the quality, and degree of contact with social network*. These appear in this study.

In general the literature on the *stress* effects of *evacuation/relocation* are mixed. Some studies have shown that many families are able to cope well; others have shown a significant increase in new *family conflicts*. Studies in the 1980's showing women to have more symptoms of depression resulted in a theory that this was due to women being at home in the disrupted environment while men went out of the home to work. Yet a subsequent study (1996) did not bear this out as working women and homemakers showed no significant difference in depression levels. The causes of many impacts, such as depression in women, are unclear and require more research.

There are also differences in impact from one disaster to another, which are at least partly due to the *type* of disaster and *severity*. It is difficult to draw comparisons across disasters and also to discriminate between the significance of the many stressors apparent during disasters (such as floods) according to Tobin and Ollenburger, 1996. They make a case that a greater number of well-conducted case studies are required to clarify disaster impacts on people rather than a rapid transition by researchers into explanatory theoretical frameworks. Such frameworks may be greatly flawed given the contradictions and inconsistencies in case studies to date related to the psychosocial (and other impacts) of disasters.

2.2.2 Stress and Stress-related Symptoms

The current study uses stress, stress and distress symptoms, and stress-related physical health impacts as the primary dependent variables when considering the impacts of the 1997 flood on its victims. Here, stress and its affects and consequences on individuals exposed to a stressor will be considered.

Historically, much research on *stress* came out of a desire to understand breakdowns in adaptive behavior, that is, disturbances to functioning during stress as observed in extreme situations such as war, imprisonment, bereavement (Holroyd and Lazarus, 1982). More recent research has tended to expand into looking less at extreme situations and more at conditions under which people experience impairment to factors such as morale, performance, overall functioning, or somatic health due to stress (Holroyd and Lazarus, 1982).

The literature on *stress* alone is vast and contains many differing opinions, differences in emphasis and perspectives, and ultimately a lack of consensus on a definition. To complicate things further, in stress research a lack of standardization in approach has resulted in a lack of resolution on many basic questions relating to the effects of stress on adjustment or adaptation (to a stressor), often a most salient issue in studies related to stress and disaster. Perhaps it is easiest to think first of “stress” in terms of defining “stressors”. *Stressors are external events or conditions that affect an organism with a resulting impact* (Breznitz and Goldberger, 1982). Each organism also has characteristics of its own which affect the impact of the stressor. Breznitz and Goldberger (1982) claim that somewhere between the stressor and the effects lies the subjective experience of *stress* itself, an experience they believe to lie outside the realm of objective inquiry.

Hans Selye is an influential researcher on stress who proposed the General Adaptation Syndrome, a paradigm that looks at an organism’s nonspecific response to a stressor through a series of stages in response (the stages include the *alarm stage*, *stage of resistance*, *stage of exhaustion*). His paradigm functions largely independent of the

source or type of stress. In fact, he defined “stress” as the *nonspecific (i.e. common), result of any demand upon the body, be the effect mental or somatic*” (Selye in Goldberger and Breznitz, 1982, p.7). He claims that a variety of dissimilar situations ranging from concentration, fear, pain, humiliation, and even success can produce stress, and given this, the keys to stress lie perhaps in human biology rather than the factor causing the stress. Other authors agree with Selye that the consequences of stress cannot be understood merely in terms of the nature of the stressful event, but their emphasis is less on the biology of stimulus and response and more on *how* an individual who is experiencing stressful circumstances attaches personal meaning to the event(s) and struggles to cope with the new circumstances.

In other words, part of struggling with a stressful event such as a flood disaster, according to some researchers, is partly attributable to certain psychological characteristics (e.g. independence) which may operate directly on how an individual appraises a situation. This appraisal predisposes them to perceive a particular class of events as highly threatening (or not) to personal security. Thus certain psychological characteristics may contribute to predisposing the individual to appraise a wider (or lesser) range of events as threatening, or perhaps predispose certain individuals to biologic biases in appraisal of stressful events that can lead to disease (i.e. physical health impacts) [Depue, Monroe, & Shackman, 1979 in Goldberger and Breznitz, 1982].

Holroyd and Lazarus (1982), in looking at psychological stress and individual psychological characteristics, state that the individual’s efforts to manage and shape the stress experience are actually conceptualized in terms of two interacting processes: *appraisal* and *coping*. The *appraisal* process following a stressful event “refers to the evaluative process that imbues a situational encounter with meaning for a person” (Holroyd and Lazarus, 1982). During appraisal something of importance is recognized as at stake or in jeopardy, and evaluation of options, opposing demands, constraints and resources help to moderate the sense of jeopardy. According to Holroyd and Lazarus, events are “appraised” as *benign, positive or stressful*. The stressful events can be placed in one of three categories 1) threat (anticipation of harm), 2) harm-loss (damage has

already been judged to have occurred) and 3) challenge (where harm potential exists but also the potential for mastery (or gain), *and* the outcome can in fact be influenced by the individual).

Coping then follows appraisal. By one definition *coping* refers to “efforts to master conditions of harm, threat, or challenge when a routine or automatic response is not readily available” (Monat and Lazarus, 1977, p.8). Another definition, by Pearlin and Schooler (1978) in Goldberger and Breznitz, (1982) considers “coping” relative to emotional distress where coping is seen to refer to any response to external life-strains that serves to prevent, avoid, or control emotional distress. Pearlin and Schooler look further at coping, and identify two types of resources that are available to individuals which impact coping strategies. First there are *psychological characteristics/resources* which would include personality characteristics that are drawn upon to help withstand threats. Second there are *social resources* which refer to environmental supports like family, friends, neighbors.

Holroyd and Lazarus (1982) explain that coping options are influenced by previous experience, generalized beliefs about self and the environment, and the availability of personal (eg. problem-solving skills) and environmental (eg. social support; available money) resources. They note that in sociological and epidemiological literature these environmental resources are seen to moderate the health consequences of stress by facilitating effective coping (Holroyd and Lazarus, 1982). There is an increasing acknowledgement in the health field that health outcomes from exposure to events are a product of effective coping rather than simply a consequence of the presence or absence of stress.

The actual literature related to the relationship between stress and physical illness is filled with much confusion and controversy about the nature of the relationship. Zegans (1982) discusses stress responses as characterized by several stages. He maintains that each of the five stages of Stress Response that he describes (*alarm, appraisal, searching for a coping strategy, stress response, and relation of stages of the stress response to*

alterations in body processes) can be accompanied by physiological reactions. Physical health problems, he claims, can occur with prolonged alarm, inadequate appraisal, inadequate coping, and prolonged coping. These reactions form the basis for *stress related disease*. While much remains unknown about the details of the link between health and stress, it is generally accepted to exist. Researchers continue to try to understand whether negative health impacts from stress are related to certain factors, for example, the nature of the stressor, nature of the appraisal, the coping mechanism, affects of failure of a coping mechanism, or constitutional factors.

In addition to physical symptoms related to stress, emotional arousal or response is seen as one of the most ubiquitous reactions in situations that are considered stressful (Mandler, 1982). Lazarus (1977) maintains that the quality and intensity of emotional responses to events (such as a flood) are determined by cognitive processes, and that these processes also underlie coping activities and continually shape the emotional reaction by altering the ongoing relationship between a person and their environment. *Emotional states then reflect the person's ongoing adaptation to their environment*. This of course can vary from person to person depending upon individual differences. Constant feedback and coping with a situation regulate emotions, and emotions are dynamic rather than static over time (Lazarus, 1977). In this study respondents were asked about their experience of the following emotions during or since the flood: *sense of control over life, confusion, fear, sense of dependency on others, anger* (considered under Symptoms of Distress) and *depression/unhappiness, trouble coping with problems and irritability* (considered under Stress Symptoms). The use of the term *distress* is broadly used here to refer to harmful consequences of damaging stress; this term was actually defined as such by Selye in 1974.

To evaluate much of the psychosocial and psychological impacts of disasters on individuals, there are numerous studies that look at stress and related symptoms (including emotional, psychological, cognitive, or health symptoms) that resulted from the event. Some of these studies were done by applying existing or modified psychological / somatic indices, e.g. Louisville Older Persons Event Scale (Hutchins and

Norris, 1989); State-Trait Anxiety Inventory (Phifer and Norris, 1989); General Health Questionnaire (Taylor et al., 1994). Some studies attempted to identify impacts on particular populations - according to life cycle stage - such as children or the elderly (Hutchins and Norris, 1989) or focus particularly on flood victim characteristics and relationships between these characteristics and coping – such as gender, socioeconomic factors, education (Laska, 1990).

There is also a sizeable literature which gives more attention to broader societal issues rather than mere individual response to disasters such as flooding. Below, some of this literature will be reviewed for what it targets as some of the most salient issues to consider in assessing broader impacts of disaster and the implications for community level planning. They are relevant to this study as some of these impacts and concerns have emerged in the current analysis.

2.2.3 Psychosocial Impacts and Community Planning

The literature reveals strong proponents of a view that disaster preparation and response is a social issue, with successful response being dependent to some degree on the ability of social groups (most commonly the “community”) to assess, organize and respond to the threat (Quarantelli and Dynes, 1977; Dynes, 1993; Hannigan and Kueneman, 1978). This literature aided the selection of some of the independent variables (in the developed survey), which influence stress responses in a flood disaster.

One noteworthy case study on flooding actually conducted in Winnipeg, (Hannigan and Kueneman, 1978), focussed on group level coping mechanisms (i.e. termed “ disaster subculture”) to deal with flood threat. They found that the current trend to transfer everyday functions of society (disaster notwithstanding) over to government institutions has weakened *individual* interest/involvement in flood matters. In Winnipeg, this was exacerbated by the Floodway’s construction and the sense of security which followed. Ideally an at-risk community will both understand and support the efforts of an organizational core to mitigate flood damage (i.e. usually government). In Winnipeg, however, their study concluded this was not the case. They caution that a flood of proportions comparable to 1826 (the largest flood on record) would enhance the disaster

subculture by eliminating indifference to flood related matters (in the wake of enormous damages). Research into the 1997 flood offered an opportunity to examine how victims feel about the *response/support of various levels of government* to the flood disaster, what role the public feels government *should* play in flood fighting and recovery, and what community responsibility in flood management, if any, exists.

The view that natural disasters are a “social” rather than natural phenomenon where prevention and mitigation of disaster must stress social rather than physical or technical fixes is further evident in the literature. R.R. Dynes (1993) maintains that solutions rest more with *social units* rather than the *nature* of the physical agent or cause of the disaster.

Dynes’ perspective has much to say about how disaster planning is done, including a need for mobilizing at a community level the human and material resources that are available, and the need for government to foster not “dependence” among potential victims but “independence”. He disputes the idea that a “military model” of essentially “command and control”, is the most effective way to deal with threat. Instead he advocates a civilian organization model. Most importantly for this study, Dynes suggests that problem solving is enhanced in an emergency through a bottom up approach utilizing latent problem solving abilities from within the community rather than a top-down approach. His assertions verify the importance of trying to understand how victims in 1997 felt aided or thwarted by emergency decision-making strategies, and if communication between community, municipal, provincial, and federal governments was effective.

Green et al. (1991) also criticize a command and control or public order model. Similarly, they maintain that an enabling model which does not expect the public to await instructions, would be better than a top-down command and control model. However, their work considers the assumptions under which emergency planners function. They suggest that planners are more concerned about the *risks* of public response than the actual risk of flooding; they see excessive concern about legal liability for warnings as a problem in government decision-making. In one case study they showed that emergency

planners' fear of "panic" (by the public) delayed decisions to evacuate residents in a flood situation with unfortunate consequences. Interestingly, Green et al. note that actual "panic" phenomenon is rarely observed, according to the disaster research.

Rochford and Blocker (1991) make some observations about the potential for future social and political conflict in the aftermath of some "natural" disasters. They refer to increased concern by victims that some disasters are not entirely natural, but partially the result of human activity and choices. They looked at the rise of public activism and protest following a flood disaster in Tulsa Oklahoma in 1986. They tested a social psychological model of activism which looked at disaster interpretation, appraisal of future threat, and individual coping strategies as predictors of activism. They examined the view of some experts that how victims interpret and appraise stressful events can predict how they cope and respond. To summarize a detailed investigation into cognitive processes and adaptive strategies, Rochford and Blocker found that those victims in the study who viewed flooding as within human control were more likely to feel threatened by the prospect of future flooding, and become active in social protest. This study prompted the inclusion of the questions in this survey related to *community activism* both before and after the flood.

Society's response to natural disasters is greatly influenced by public risk communication. Fitzpatrick and Mileti (1992) developed a causal model of public risk communication. They concluded that *warnings* to the public, in order to be complied with, should be communicated in such a way that: 1) they are *personalized* by those they are intended to reach and not by others 2) they elicit *belief* in the message 3) there is accurate public *understanding* of what is being said in the warning, and 4) the message is accurately *heard* by the public. Almost immediately after the 1997 flood, queries were made about the types of warnings that were issued, who they applied to, who was actually at risk, and the amount of time given to some communities to prepare. Public inquiries have been held into the issue of whether information was deliberately withheld from certain communities (e.g. Ste. Agathe), which delayed preparations. Fitzpatrick and Mileti (1992) found that a "suspicious" public, who do not believe they are hearing the

“whole truth”, will behave according to their suspicions and likely ignore emergency instructions or orders. It may be of particular importance to deal successfully with the concerns/suspicions of the public in Manitoba following the 1997 flood if future flood management and emergency plans are to be successful.

A further issue touched on by Fitzpatrick and Mileti (1992) is the inclination of people to attempt to *confirm* warning messages. This may take the form of communication with social networks or with public authorities. It raises the issue of the importance of *consistency of information* from various sources, such as government agencies and departments.

There are also some broader societal issues that arise from the *evacuation/relocation* of disaster victims during a flood. For instance, research shows that social *stress* rises after a few weeks for victims if they go to live with friends or extended family groups. Heightened social support or altruism during the crisis phase of a disaster is a common response within extended social networks, but can significantly outlive the recovery phase (Riad and Norris, 1996). High levels of support typically last only for several months after a disaster. At that point, non-victims' support capacity diminishes, and this can sometimes have significant negative consequences for victims who still need emotional and practical support, particularly if they are still evacuated from their own home.

2.3 Flood Management

2.3.1 Flood Management Activities

Flood management encompasses a wide range of water resources activities employed to *prevent, reduce or mitigate the effects of flooding* on people, economic activity, and the environment. In Canada, there are four levels of decision-making in flood management: federal, provincial, local (city and rural municipal), and personal (affected people) (Simonovic, 1998). Responsibility for coordinating the multi-level decision-making process lies with the Emergency Management Organization (EMO), a civil defense agency with a federal mandate per the Emergency Preparedness Act. Manitoba EMO is

responsible for this function in Manitoba, and works closely with the Manitoba Conservation Department – Water Resources Branch whose responsibility it is to do local flood planning and management. Various other branches/divisions within the Conservation Department have areas of responsibility in flood management such as field operations, emergency response to floods, operation of flood protection systems, search and rescue, and security. Some of these functions come into effect only during a flood.

Not only are there numerous authorities at various levels of government, there are local communities and individual residents as well who are major stakeholders in decision-making related to flood management. With so many stakeholders it is inevitable that there are conflicts of perception, conflict of interests, and differing interpretations of conditions/events. What is needed is a means of decision-making which can incorporate these differences. MCDA is one suggested framework to aid in finding solutions to flood dilemmas that arise in all three stages of flood management: **planning, emergency management and post flood recovery.**

During the **planning stage** of flood management, different alternative measures (structural and nonstructural) are analyzed and compared for possible implementation in order to minimize flood damages in a region. Analysis of these alternatives involves project formulation, understanding advantages and disadvantages of each alternative, evaluation of project impacts (positive and negative), and relative comparison of alternative measures (Simonovic, 1999).

The **emergency management** stage includes regular appraisal of the current flood situation and operation of control works. Part of the appraisal process is identifying potential events which can affect the current flood situation and affect the outcome (e.g. rainfall, wind setup). At this stage temporary emergency structural works are often done at great cost, and flood-proofing to existing structures. As part of the appraisal, information is gathered to determine the necessity of evacuation of some areas (Simonovic, 1999). During a flood emergency various institutional arrangements are revived or called upon to assist with the crisis including various federal acts, disaster cost

sharing arrangements between the province and the federal government, and even military mobilization.

Post flood recovery involves the evaluation of damages, rehabilitation or restoration of property, and flood assistance to victims under the compensation/rehabilitation model instituted by government, supplemented by non-government organizations and charity.

2.3.2 Flood Management and Decision-making

While flood management contains three stages, *decision-making* related to flood management is best divided into two distinct phases of related activities; these are **planning** and **operations**. The **planning** phase is primarily concerned with planning for the minimization of damages from flood waters over a relatively long timeframe. Time is available to decision-makers to consider and weigh various options in floodplain management.

The classic systems approach to **planning**, commonly used throughout the world, includes the following four major steps:

1. **statement of specific objectives** related to flood damage reduction
2. **generation of alternatives** to meet the objectives (chosen primarily from among structural and nonstructural measures)
3. **establishment of a set of constraints** (economic, social, environmental etc.)
4. **evaluation of alternatives** (benefit-cost analysis traditionally)

Detailed studies of flood management *alternatives* do tend to follow flood events, when flood awareness is high. The studies ultimately consist of evaluation of both the costs and benefits of alternative flood control schemes (Platt, 1987). *Costs* include the costs of the scheme in question. *Benefits* in most analyses are discounted average annual damages prevented by the proposed scheme. These damages are estimated from standard stage-damage curves developed for different property types and site-specific stage-frequency relationships.

The second major phase of flood management decision-making is that of **operations**. This is essentially emergency management, although it extends into what is considered the *recovery* stage of flood management. It is primarily done in response to an anticipated flood threat. The time frame for development and implementation of plans is thus shortened considerably. Consultation time with stakeholders is curtailed by the need for prompt decision-making. Most often this results in a decision-making process that is, to varying degrees, hierarchical. The command and control approach discussed earlier often becomes evident, most particularly in those communities which lack highly developed flood response plans (as is typical of parts of Manitoba).

Ultimately in the **operations** phase, decisions are still based largely on a benefit-cost model, but because of time constraints this analysis is done quickly and without thorough assessment of the potential impacts of the decisions. Impacts which are frequently overlooked in the urgency of flood operations, are social impacts on individual residents and communities. Social impacts of floods and flood management decisions are more poorly understood, less tangible, and less easily quantifiable than other considerations such as economic and technical ones. Engineering and economic assessments, often done rapidly, continue to be the basis of the decision-making process for flood planning and operations.

Because traditional benefit-cost analysis dominates the decision-making process, a few additional comments about its use are necessary. The US Army Corps of Engineers (USAC) uses economic analysis in tackling water resource problems throughout America. The USAC's flood damage analysis calculations are used in evaluation of costs of flooding. They are also used to also evaluate costs of proposed flood damage reduction programs, to identify problem areas in flood management strategies, to complete post-flood analysis of impacts, to develop flood insurance premiums, and to evaluate future land development according to flood risk (An Integrated Software Package for Flood Damage Analysis, Engineering Center, 1989). Their flood damage reduction activities and methodologies are followed throughout the world.

USAC use state of the art computer technology to evaluate damage potential caused by flooding under various scenarios or interventions; this is referred to as Flood Damage Analysis, or “FDA”. It involves complex analysis using multiple sources and types of data, and data management software to link hydrologic, hydraulic and flood damage computer programs. FDA allows for calculation and comparison of expected annual damage under base conditions and the expected annual damage given a proposed measure. Significantly, the final crucial step in the USAC’s FDA is determination of the cost and benefits associated with a proposed measure and computing the benefit-cost ratio (An Integrated Software Package for Flood Damage Analysis, 1989). This last step is not contained within the FDA software package, but is actually done by economists.

The use of traditional benefit-cost analysis in decision-making with regard to flood damage reduction activities can be quite problematic. A primary difficulty is that how adequately *costs* and *benefits* are defined has a major impact on the cost-benefit outcome; very often the more difficult to quantify benefits and costs are overlooked in calculations and ultimately in decision-making. However, it is possible using decision analysis tools such as MCDA to include consideration of a wide range of criteria (including social ones) in selecting among flood management alternatives. These social criteria may represent some of the less tangible factors relevant to the decision and therefore bring these factors under consideration at the time the decision is made.

Problems other than the persistent use of traditional economic analysis exist in floodplain management. Emphasis on ad hoc, short-term measures rather than on long-term vision and planning are a problem in some regions (Bhattacharyya and Bora, 1997). In other areas there are particular problems with the structures of authorities. More specifically, floods are no respectors of political boundaries (Platt, 1987) which complicates the decision-making process as multiple types and levels of authorities have jurisdiction and responsibility over various aspects of planning and over different geographic areas.

Also, in the United States and perhaps applicable to Canada, two widely held values-i.e. the sanctity of the “rights” of the individual property owner and the right to local self-

government- have perhaps hurt attempts to develop a more realistic, effective and broader regional planning approach to floodplain management (Platt, 1987).

In Canada, including Manitoba, Conservation Authorities are often primary administrative bodies over watershed units; however, these management units also are problematic. One problem relates to regulatory power (or lack of) over land use. Provincial authorities have stymied regional conservation authorities by attempting to limit their roles in all areas and providing only uncertain commitment of funds and technical support. Ultimately, the conservation authorities do not neatly fall into normal bureaucratic boundaries (Platt, 1987). This lack of clarity over both the authority and practical function of conservation authorities has exacerbated difficulties in decision-making at both the planning and operational level of flood management in parts of Canada.

Selection of a flood damage reduction scheme also depends on *who* is doing the selection. It is possible for some pressure groups to influence the cost-benefit analysis outcomes, and consequently costs and benefits are poorly or selectively defined for use in evaluating alternatives.

While the legal and political institutions may differ from country to country, several themes emerge in reflecting upon floodplain management and decision-making. One theme is the difficulty of curtailing private enterprise (on land prone to flood hazard) through government intervention. The second is the debate between the use of structural versus nonstructural measures. A third is the inclination of government to look at flood damage reduction much more vigorously in the immediate aftermath of a flood and become increasingly less committed as flood-free years accumulate (Platt, 1987). In addition, in Manitoba the dominance of government in flood damage reduction initiatives *and* in providing compensation to flood victims removes personal responsibility from residents to prioritize flood damage reduction considerations in their personal decision-making.

2.4 Multi-criteria Decision Analysis

2.4.1 Introduction

Decision analysis, in general, attempts to judge a range of feasible options/alternatives to a problem, using as a basis of judgment a set of relevant evaluation criteria. The evaluation criteria are used to eliminate less desirable options and to identify the most favorable alternatives(s) (Nijkamp et al., 1990). In recent years decision-making frameworks have undergone significant revision and a shift in emphasis from outcome to process. There are several reasons for this change.

Prior to the second World War, most evaluation methods for projects/planning were based on “financial trade-off analysis”, as regions competed for development opportunities. After World War 2, cost effectiveness principles became popular with planners, particularly in market based economies. This was manifest in the proliferation of cost-benefit analyses as a basis for decision-making. Decision-making within such traditional economic constraints involved(s) highly linear reasoning and had (has) as its goal a single quantitative maximum of a single objective (Zeleny, 1983). There were some obvious limitations with a decision analysis model that emphasized only the economic considerations of maximized benefits or reduced costs. Thus, in the 1970’s, when the negative social and environmental consequences of some development projects were becoming recognized, there was a search for alternative decision making models.

One of the problems with a decision-making approach that looks only at economic efficiency is that there is little means for inclusion of intangibles such as, for example, quality of life, environmental quality (ostensibly “benefits”) or negative environmental externalities (“costs”). Related to this, in the last two decades, there has been more concern with issues of equity in assessment of development impacts. The result has been an increase in public and/or stakeholder consultation to address anticipated impacts from development decisions. This means more emphasis on decision-making process rather than outcome.

Finally, the increasing sophistication of information systems has had a profound impact on how decision problems are solved. Information systems aid decision-making through systematically organizing information necessary to the choices to be made. Multi-criteria decision analysis, with its emphasis on structuring and analyzing complex choice problems through information systems, has recently become an important option in decision analysis.

2.4.2 *The Multi-Criteria Decision Analysis Framework*

Multi-criteria decision analysis offers decision-makers the opportunity to make decisions in the face of multiple criteria or objectives rather than forcing the selection of a single goal within prescribed constraints. This is very useful in searching for solutions to complex problems. In fact, in MCDA, explicit attention is given to all dimensions of a problem; as comprehensive a picture as possible is sought. Because MCDA uses multiple judgment criteria which allows for consideration of the divergent aspects of a choice situation it is an “operational framework” for a multidisciplinary approach to decision problems (Nijkamp, 1990).

MCDA forfeits the idea of the “ideal” solution to a view of achieving balance with respect to all (often conflicting) objectives. A multiple criteria model for decision-making finds a way to weight various attributes and objectives, effectively trade-off between them, and find a balanced solution in complex circumstances (Zeleny, 1983).

One term in the literature to refer to the acceptance of a compromise solution rather than a strictly optimal one is the “satisficer principle” (Nijkamp, 1990). Often MCDA involves a process where achieving less with one objective will be accepted to gain more with respect to other objectives. Because there is no one optimal solution possible, multi-criteria decision analysis provides a small set of feasible solutions (called “alternatives”) worthy of consideration.

Multi-criteria techniques typically generate what is referred to as a set of “non-dominated” solutions; that is, those which satisfy the definition of Pareto optimal in

economic terms. “Dominated ”solutions are eliminated from consideration because, by definition, there are one or more solutions (i.e. the non-dominated ones) that are preferable on all accounts. Users of MCDA have several techniques and methods, many highly mathematical, to systematically generate a set of feasible alternatives for consideration, and aid decision-makers in selecting among them. The choice of method depends on the characteristics of the problem (Simonovic, 1993) including such factors as the nature of the decision-makers’ involvement, the complexity of the problem, types of data used, and practical considerations such as time and resources. Three major considerations in choosing the appropriate method are 1) it must be computationally feasible and relatively efficient 2) it must foster the explicit quantification of the tradeoffs among objectives, and 3) it must provide sufficient information so that an informed decision can be made (Goicoechea et al., 1982).

MCDA methods exist for using a wide variety of different information, including qualitative. The evaluation techniques are able to include intangible and incommensurable effects in the conventional cost-benefit methodology (Nijkamp, 1990). Some multi-criteria evaluation methods do convert qualitative data to cardinal data; other methods do not. By necessity, some qualitative data requires sophisticated treatment to be used in analysis (Nijkamp et al., 1990).

MCDA requires that different goals and objectives be weighted according to the relative value decision-makers place on them; this information must be sought, often through questionnaires and interviews (Zeleny, 1983). Thus, inherent in the design of alternative plans is the statement of and adoption of social values and preferences as articulated by both planners and policy makers (Goicoechea et al., 1982). These values are in fact purposefully sought, and the final objectives are determined through various iterative processes that force the participants to make repeated value judgments. As with all types of decision making approaches “success” is not merely a product of mathematical calculation, but largely the result of the ability and willingness of the human players to cooperate in an analytical process, complete with their personal biases.

There is also a strong case for an analytical approach such as MCDA in flood management because evidence shows that exclusively intuitive judgments in decision-making have significant shortcomings (Simonovic, 1993; Nijkamp, 1990). Solutions to decision problems are best made when decision-makers are able to clearly see the trade-offs (i.e. choices) potentially to be made, and then make informed decisions. This is where MCDA makes great contribution because it offers to decision-makers both an analytical framework and informed human judgment.

More specifically, MCDA allows for new decision alternatives to emerge in a dynamic process. In current decision making environments sudden changes in the social or political relevance of certain solutions, or new information regarding impacts, can alter the judgements of decision-makers. This requires a highly adaptive decision-making framework (Nijkamp, 1990). This is possible with MCDA using advanced computer systems because new relevant information can be incorporated immediately.

Computers are in fact essential for use in MCDA when it is applied to structuring and analyzing complex problems and conflicting goals. Sophisticated statistical and econometric tools help in the design and implementation of operational decision-making models, and allow for the manipulation and aggregation of data quickly. MCDA can also greatly complement the use of complex computer simulation models provided the information is relevant to the criteria/objectives sought (Nijkamp, 1990).

2.4.3 Criteria use in Multi-Criteria Decision Analysis

Criteria, as applied in MCDA, are the measures, rules, and standards that guide decision making. It is possible to view criteria as “all those attributes, objectives, or goals which have been judged relevant in a given decision situation by a particular decision-maker” (Zeleny, 1983, pg. 17). Nijkamp expands on this definition further by stating that criterion are considered to be *measurable* aspects of judgment by which a dimension of the alternatives under consideration can be characterized.

For the purposes of this study, “criteria” will provide a scale for measuring the degree to which particular social objectives are achieved, including the direction in which we should strive to do better in order to achieve the objective (Goicoechea et al., 1982). Criteria (or attributes) according to Keeney and Raiffa (1993) can be either objective or subjective; the former refers to criteria which are more commonly understood and more easily measured scales (e.g. labor costs, numbers of insurance claimants). Subjective criteria on the other hand often require the construction of a scale to measure a less easily definable and measurable characteristic e.g. quality of life, prestige, stress. Ultimately, the criteria should be able to be used to indicate the degree to which each of the alternatives generated meets the corresponding objective.

Finally, selected criteria are to be used to evaluate and choose between alternative decision choices available. They can thus be viewed as *evaluation* criteria. The table below (Table 2.1) outlines the use of criteria in generating a payoff matrix which shows, in a general way, how alternatives are weighted using criteria.

Table 2.1 MCDA Payoff Matrix

Alternative	Value of k^{th} criteria						
	Z_1	Z_2	...	Z_k	Z_p
a^1	M_1			Z_k^1			
a^2		M_2		Z_k^2			
...					
a^k	Z_1^k	Z_2^k	...	M_k	Z_p^k
...					
a^p				Z_k^p			M_p
W_p	W_1	W_2		W_k			W_p

Simonovic et al., 1997

Steps in Use of Criteria in Multi-Criteria Decision Analysis:

1. create Payoff Table specifying alternatives and criteria
2. assure criteria do not overlap
3. quantify the various criteria (e.g. Z_2^k) and assign a value for each criteria under each alternative
4. obtain preferences from decision-makers to be used in weighting criteria
5. order the alternatives using values of various criteria and preferences (weights) of decision-makers

The Payoff Table specifies the set of alternatives available, a , and the common set of criteria, Z , as determined through discussion with decision-makers and/or stakeholders. The table is constructed to show in row k the maximum value of the k^{th} criterion as M_k and the associated values of the other criteria as $Z_k^!$. All criteria in the table must address one or more of the overall goals initially established by decision-makers. Decision-makers must ultimately declare preferences regarding criteria and relative weights are therefore assigned, W . The ranking of alternatives rests with the assignment of the value (level) of each criteria and their relative weights. That is, the relative capacity of each alternative to meet each criterion is determined by multiplying each criterion's weight by the rating of the alternative's ability to meet the criterion. The overall worth of the alternative is the sum over all criteria.

Ultimately, the social criteria for use in flood management which will come out of this research will expand the set of criteria, Z , to be included in evaluating each flood management alternative. MCDA as a decision-making framework is able to use the established criteria (both social criteria and other criteria) to analyze the differences among alternative plans which includes portrayal of the tradeoffs among the various criteria for each alternative. The use of such social criteria in a decision-making model prohibits a decision-making process which neglects the social consequences to focus exclusively on economic and political considerations.

2.4.4 Multi-Criteria Decision Analysis, Water Resources Management, and Flood Management

Goicoechea et al. (1983) maintain that multi-criteria analysis has developed into a legitimate framework for planning in water resources development. They support this claim by reviewing the activities of U.S. government departments and various case studies related to water management. They show that in the 1980's, American federal, state, and local governments were implementing MCDA planning frameworks in planning, designing, and implementing water resource activities.

In reviewing a number of MCDA case studies, the derivation and use/inclusion of social criteria is only cursorily mentioned, if at all. For example, in one quoted study on evaluating flood remedies in Dallas, Texas the evaluation criteria used to finally rank eight alternative plans included 1) relative flood protection 2) relative neighborhood improvement 3) number of families relocated 4) project cost 5) maintenance cost, and 6) legal considerations. While some social concerns appear implicitly under this assignment of criteria, social criteria in water management could be more comprehensively and explicitly represented in a MCDA framework. The study here provides such an opportunity through the collection of relevant data, and explicit and purposeful generation of social criteria.

The issue of using less commensurable and difficult to define social measures (i.e. such as social indices like quality of life) along with analytical tools such as MCDA is raised by Keeney and Raiffa (1993). They offer that a key problem facing many decision-makers is that of making order out of social measures/ indices, and that specifically multi-attribute utility theory (one available method in MCDA) offers an appropriate methodology to potentially address social objectives. Given this, the use of MCDA to address social dimensions of a problem such as flooding is appropriate if the social criteria are carefully derived.

Within the literature there appears to be a more confident and thorough review of the appropriateness of MCDA models for use in addressing various engineering and business objectives rather than social objectives. However, social objectives (like environmental objectives) are of particular importance when considering the *implementation* of alternatives that appear to satisfy various development criteria such as economic and financial; in essence, they are an extension of economic and financial considerations. In fact, per Simonovic (1999) the success of flood management decisions always depends on an effective balance of local costs and distributed benefits. This assumes a comprehensive definition of “costs” and “benefits” including social costs/benefits (and environmental), and not merely economic. Further social assessments are essential in suggesting appropriate tradeoffs of these costs and benefits (Simonovic, 1999). The results of this study will contribute to the literature by enlarging the body of knowledge on social criteria suitable for use in flood management specifically, and potentially generalizable to other decision making scenarios in both natural resources management and/or disaster management.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This study's primary purpose was to develop social criteria for use in selecting among alternative strategies for use in flood management along the Red River in Manitoba. There were two distinct types of information used to generate the social criteria. One was general information on past flooding in Manitoba and more specific information on the 1997 flood and how it was managed. This provided a context, including a social context, under which flood management decisions have been and continue to be made in Manitoba. Chapter 6 summarizes the key themes related to past and current flood management practices in Manitoba that have relevance in developing social criteria for use in flood management.

The second type of information used to generate the social criteria came from the survey, an interview schedule with questions which were answered by a sample of victims of the 1997 flood living within and south of the City of Winnipeg (See Appendix 2). The survey provided a snapshot picture of a broad range of impacts experienced by these victims of the 1997 flood, with particular emphasis on potential stress related impacts (psychological and physical) which appear as the primary dependent variables. The results of the survey appear in Chapter 5, with a summary of the survey content used to generate the social criteria noted in Chapter 6.

The six social criteria which are recommended and discussed in Chapter 6 address the major issues that emerged in examining the victim surveys, in the context of what was learned about the historic, social, political, and economic context in which flooding occurs in Manitoba. An assumption of this study is that concerns for social well-being (i.e. quality of life) are important in the selection of flood management strategies.

3.2 Sources of Information

Initially, a literature review related to three distinct areas was done, namely psychosocial impacts of floods and other natural disasters, flood management, and Multi-Criteria Decision Analysis - to provide a conceptual understanding for the primary objective of the study. This information was obtained from the University of Manitoba and University of Winnipeg libraries and through use of Internet resources. This information is summarized in Chapter 2. Information required for fulfillment of the study's objectives 1 and 2 related to flooding in the Red River Basin and the 1997 flood in particular (in Chapter 4) was compiled from libraries, Internet sources, and Manitoba Conservation - Water Resources Branch, Manitoba Emergency Management Organization, and other government departments. Finally, a major source of information for this study was the survey developed and administered to flooded residents. This is discussed in some detail in the latter part of this chapter.

3.3 Methodology

The following figure (Figure 3.1) summarizes the methodology used throughout the study from information gathering through determination of the social criteria. The methodological steps were as follows:

- Information was gathered from a number of sources to provide a context to the study, and to identify potential factors important to assessing psychosocial impacts of floods (for inclusion in the survey)
- The survey was then developed for the purpose of eliciting information on the impacts of the 1997 flood
- Survey data was collected through in-person semi-structured interviews with residents from six "community" types
- Analysis included description of the survey data (Chapter 5) and broader identification of factors contributing to negative psychosocial impacts (Chapter 6)

- Social criteria were recommended that would help address some of the most prevalent contributors to negative impact using survey data and information on flood management; reference was made to the importance of each criteria at each of the three stages of flood management (Chapter 6).

METHODOLOGY

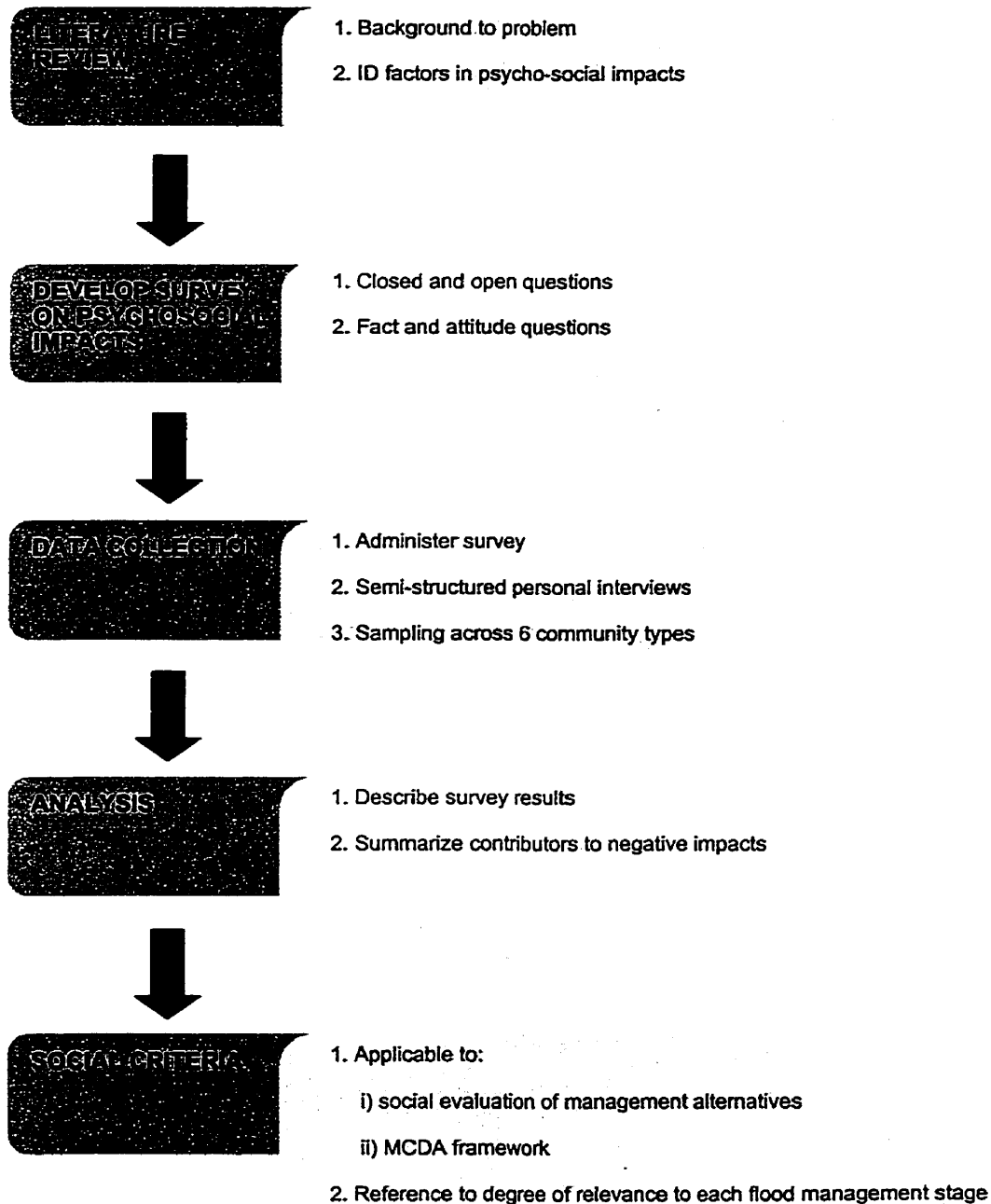


Figure 3.1 - Methodology

3.4 Survey Development

Tables 3.1, 3.2, and 3.3 discussed below present the dimensions of impact considered in the survey, and show how they were operationalized through selected social indicators. “Indicators” served to operationalize impacts that were not directly measurable as can be seen in the tables. The dimensions noted in the tables relate to various areas of psychosocial impact from flooding, most of which were discussed in the literature review in Chapter 2. Any dimension not discussed in that Chapter was added at the researcher’s discretion from questions that arose in reviewing the literature and in discussions with individuals involved in the field of flood management in Manitoba. A copy of the survey appears in Appendix 2.

3.5 Independent Variables

By definition *independent variables* are those that *cause, influence or affect outcomes* (Creswell, 1994). In this study, Table 3.1 presents those variables that the scholarly literature suggests may serve to influence stress and stress-related impacts particularly in a natural disaster such as flood. They are included in the survey.

The **Severity of Flooding** dimension looked at cost (in dollars) of **physical damages**, and the extent of the **recovery period**. The latter was operationalized through questions on the **need for** and **length of a clean-up period** post-flood. The Severity of Flooding dimension also attempted to account for impact of loss of personal items under the **personal loss** heading where respondents were asked about loss of personal items (not house) including those that were **irreplaceable**.

Evacuation questions in the questionnaire considered issues such as perceived **quality** of the accommodation, and **number of moves** a family had to make during evacuation. The survey explored preparation time for evacuation, including if **alerts** were received, **how long in advance** of the flood, and whether the respondent felt they had received

adequate notice. Respondents were also asked **how long** (in days or weeks) that they were evacuated.

Economic impacts to families were examined through questions related to changes in income such as **lost livelihood** earnings, **amount** of the loss, **cause** of the loss (e.g. lost job, forced absenteeism from work).

Under the **Family** dimension respondents were questioned about **conflict levels**, specifically if there was increased **conflict** in general within the family, increased **arguments / disagreements within the family**, and **arguments / disagreements with people outside the family**. They were asked if they perceived any **positive outcomes** for the family from going through the flood experience. Respondents were asked if they or a family member sought **counseling** during or since the flood (omitting brief crisis intervention at the time of evacuation).

The **Community** impacts dimension considered if a respondent's **social life** was impacted by the flood. They were asked about the **level of support** they felt from both their **community** and the **provincial government** respectively - ranging from "a lot" of support to "no" support. Post-flood **activism** was considered under **Community** impacts as respondents were asked about their **degree of involvement** in their community prior to and since the flood. They were also asked if they had worked on a community problem of any type prior to the flood or on a flood-related **community problem** post-flood.

The issue (dimension) of residents' **Knowledge** related to floods was considered through asking about their **prior experience** with a flood event or lack thereof. They were asked if they felt prior experience **helped them cope** with the flood of 1997, and if they had been **aware that their property was at risk** from flooding.

Risk Communication and Warning was examined as residents were asked questions about **how much "warning"** they had of the flood, whether they received **"official" notification of their risk**, and if they felt the **warning increased/decreased their stress**.

The literature on adaptation and coping of disaster victims (eg. Laska, 1990) prompted additional questions of residents including whether they had **future plans** such as **considering/planning to move** out of their home, and if they were **concerned about property values**. Respondents who indicated that they had **business property** impacted by the flood were asked if they plan to **relocate/ close/ sell** their business.

Under the **Behavior** dimension, **social life** impacts were considered under **social behavior**. (This question also appears under the Community dimension). Respondents were asked about how much contact they had with their usual **support network** in the community while evacuated. They were asked if they took measures to **protect property** during/since the flood. Related to **individual coping**, they were asked if they had more **trouble coping with problems** that arose, both during and then after the flood.

Table 3.1
Independent Variables influencing stress-related impacts
Indicators of psychosocial impacts

Dimension	Specific concern	Indicators (operationalized dimension)	Question / Variable #	
Severity of flooding	a) Physical damage	1. Depth of water	4a	
		2. Damage estimate personal property	4d	
		3. Damage estimate business property	5a	
	b) Recovery period	1. need for clean-up period	49	
		2. length of clean-up period	49a	
	c) Personal Loss	1. Loss of personal items	51	
2. Loss of "irreplaceable items"		51a		
Evacuation	a) Quality of accommodation	1. Rank quality of initial accommodation	9d	
		2. Number of moves required	9f	
	b) Preparation time	1. Receipt of alert notice?	8	
		2. How long on alert?	8a	
		3. Adequate notice?	9b	
	c) Length of dislocation	1. How long evacuated?	9a	
	Economic	a) Income	1. Any lost income from job?	7
			2. Estimate of household loss (in dollars)	7c
			3. Cause of loss	7d

Family	a) Conflict Levels	1. Generally more conflict in family?	27
		2. More disagreements / arguments within family?	25
		3. More disagreements / arguments outside family?	26
	b) Positive outcomes (from flood experience)	1. Any positive outcomes?	29
	c) Counseling	1. Sought subsequent counseling? (not crisis intervention)	24
	Community	a) Social life	1. Social life impacted? (positive or negative)
b) Perceived Levels of support		1. Perceived support from community	47
		2. Perceived support from provincial government	48
c) Activism		1. Degree of involvement in community prior to flood	44
		2. Degree of involvement since flood	44a
		3. Prior work re. community problems?	43
		4. Community work specific to post-flood problems?	43a
Knowledge	a) Prior Experience	1. First flood experienced?	18
		2. Prior experience helped with coping?	18a
	b) Awareness	1. Aware property at risk?	19
Risk communication and Warning	a) Warning	1. How much warning received?	20
		2. Received "official" notification of risk?	3
		3. Warning increased / decreased stress?	21
Future Plans	a) Personal property	1. Considering / planning to move?	53
		2. Concerned about property values?	52
	b) Business property	1. Plan to relocate/close/sell business?	50d
	Behavior	a) Social	1. Social life impacted?
2. Contact with usual support network during / since flood			11a
b) Individual coping		1. Took measures to protect property	6
		2. More trouble coping with problems since flood?	34
		3. More trouble coping with problems during flood?	34a

3.6 Dependent Variables

By definition, dependent variables are the outcomes or results of the influence of the independent variables (Creswell, 1994). Table 3.2 lists the selected dependent variables and how they are operationalized in this study, organized under three headings: **Stress and Stress Symptoms, Psychosocial Symptoms of Distress, and Physical Health Impacts.**

The selection of these stress-related dimensions as the primary dependent variables emerged from the literature as discussed in Chapter 2, where these were common consequences of natural disaster, or in a more general sense, often a consequence of a significant stressor.

The 1997 flood event fulfilled the requirements of a “stressor”, namely it was an event which prompted anticipation of threat, or resulted in actual damage, and required the taxing of coping capacities among residents (see Literature Review for more details). As a stressful event, it follows that it may have resulted in impairments in functioning among some impacted individuals. To clarify levels of stress and associated symptoms, questions were asked in the survey about the experience of “stress” (and level of stress) during and post-flood, if respondents felt more depressed/unhappy, had more trouble than usual coping with problems that arose, or felt more irritable. These are listed under Stress and Stress Symptoms. Under Psychosocial Symptoms of Distress, a number of additional factors commonly associated with stress were provided in the survey for ranking on a Likert scale (see Table 3.2). These factors included: sense of control over life, confusion, fear, sense of dependency on others, anger. These helped in understanding the emotions that were prevalent during residents’ appraisal and coping during the flood and in the recovery period. Finally, in order to assess potential somatic responses to the flood, respondents were asked about their general health status comparing before the flood with after the flood, and about other more specific health symptoms (eg. chest pain, dizziness, tingling in extremities, change in appetite, excessive tiredness, digestion problems). They were also asked if there was a family member “injured” in the flood.

Table 3.2

Dependent Variables

Indicators of stress related impacts

Indicator	Question / Variable
<u>Stress and Stress Symptoms</u> (assessed both during and after flood, as compared to before flood)	
• More stress than before flood?	30
• Perceived level of stress?	30d
• More stress since flood?	31
• Perceived level stress since flood?	31d
• More depressed/ unhappy? (during / since)	33 / 33a
• More trouble coping with problems? (during / since)	34 / 34a
• More irritable? (during / since)	35 / 35a
<u>Psychosocial Symptoms of Distress</u> (Respondents were asked to rank how strongly they experienced the following emotions both during and after flood, as compared to before flood):	
• Sense of control over life	22a
• Confusion	22b
• Fear	22c
• Sense of dependency on others	22d
• Anger	22e
<u>Physical Health</u>	
• Rank general health (comparing before / since)	36 / 36a
• Chest pain ?	38a
• Dizziness?	38b
• Tingling/numbness?	38c
• Change in appetite?	38d
• Excessive tiredness ?	38e
• Digestion problems?	38f
• Family members injured in the flood?	37

3.7 Additional Variables

Table 3.3 below outlines those variables considered both as independent and dependent variables in analysis. With them are listed other variables in relation to which they were considered “dependent” in this exploratory study. In all other areas of the study these variables are treated as independent variables.

Table 3.3 Variables Considered as Both Dependent and Independent

Variables predominantly independent except under the following circumstances:	
Dimension of Impact	Relative to:
1. Sought counseling (family member)	a. Arguments outside family b. Family conflict c. Family member injured d. Positive outcomes from flood e. Lost income
2. Arguments outside family	a. Estimate of damages (\$) b. Family member injured
3. Support of government (perceived)	a. Estimate of damages (\$)
4. Concern regarding property values	a. Estimate of damages (\$) b. Prior flood experience
5. Community work regarding flood related problem	a. Stress post-flood
6. Trouble coping with problems (either during or post-flood)	a. Prior flood experience b. Arguments within family c. Arguments outside family
7. Consider / Plan to move	a. Anger b. Post-flood stress
8. Property value concerns	a. Had / did not have damages

3.8 Sample Selection

Time to develop the survey interview schedule was greatly constrained by a request from funding sources that the researcher get into the field “as soon as possible” following the flood. Another methodological consideration was that the most accurate account of impacts of an event can be obtained immediately afterwards while memories are fresh, and before other incidental factors begin to influence memory significantly. All empirical information was therefore gathered within six months of the 1997 flood.

Developing a strategy on how to obtain information from victims of the 1997 flood posed a number of practical challenges. In the first few weeks post-flood a large number of people in some communities were still not back in their homes. Some were in temporary housing supplied by government or other sources, often outside their community altogether. Some were in trailers of various types on their property. Others, who had sustained less damage, were back in their homes although under less than ideal conditions. Many victims had no phones restored to their homes and were given temporary phone numbers. Contact with the Manitoba Emergency Management Organization (EMO) revealed that attempting to track people from various communities through EMO’s records would be extremely difficult; information on people’s whereabouts could not be given out without EMO first contacting them for permission. Hence, neither random nor systematic samples of victims could be accurately generated; total victim numbers were not even known at the time. Therefore, purposive rather than probability sampling was used with the intent of sampling across various groups of victims (spread across several community types). These communities/groups represented six main categories of victims. They included:

1. urban community (Kingston Row and Kingston Crescent in Winnipeg)
2. rural community protected by structural measures such as dikes (St. Adolphe)
3. rural community not protected by dike (Ste. Agathe)
4. suburban community (St. Norbert)
5. urban fringe community (Grande Pointe)
6. rural estates/farmers (includes Red River Drive residents)

Going door-to-door to find willing respondents was determined to be the best way to access a sample of residents because formalized sampling would not work. Many people could only be located by going to their property, and people's willingness to respond was thought to be higher if contacted in person. A major anticipated difficulty was that victims would refuse to participate due to the demands on their time and personal resources. Many also had no working phones, so telephone surveys were not possible. While sending an introductory letter prior to personal contact with flood victims is preceded in the research (Tobin and Ollenburger, 1996), this was a problem because the postal services were still rerouting mail and some residents were not regularly retrieving it.

3.9 Survey Development and Administration

The survey developed for this research had elements of both *attitudinal* and *factual* survey types. *Factual* surveys aim to get information (hard data) on individuals' material condition or situation, rather than their opinions. *Attitude* surveys intend to gain information on what people think about things, such as certain life events, as in this case of the 1997 flood. Both factual and attitudinal questions were asked.

The decision on what *type* of interview to conduct considered the high level of life disruption and stress of flood victims, with a priority being to not contribute to their stress through interviewer insensitivity. For this reason a semi-structured interview method was used. The major emphasis in semi-structured interviews is the freedom to obtain both clarification and even elaboration on some responses (May, 1993). This is for the purpose of allowing the interviewees to better explain their experiences and observations, to feel "a part of the process". In fact, the context of the interview, and not just the content, is important in dealing with survivors of stressful events. Because of the greater latitude in the semi-structured interview, only one interviewer was used to try to reduce interviewer bias, and enhance consistency.

Both closed and open-ended questions were used. Closed questions limited the number of possible answers to be given, with responses designed to be both mutually exclusive and

exhaustive. Open questions were used alone or as “follow-up” to some closed questions to allow for further exploration of some issues or responses. The survey was also piloted among four respondents to gain feedback on revisions or improvements needed to the original questionnaire, and particularly to identify questions which were unclear. It should be noted that respondents were free to interpret the meaning of questions or concepts (e.g. stress, anger, depression) and received only minimal input if they questioned the meaning.

A letter of introduction was read to each respondent at the outset of the interview (see Appendix 2). It included information on the purpose of the study, who was conducting and supervising the study, and the source of financial support. Assurance of confidentiality was given in every interview as well as a contact person (besides the interviewer) to whom respondents could make inquiries after the fact. Given the trauma of the flood event, it was thought possible that disclosing certain types of information might cause some respondents emotional distress; thus the establishment of rapport at the beginning of the interview was prioritized.

Fifty-two surveys were completed and included in the analysis. The average survey length was 1 ½ to 2 hours.

3.10 Sociodemographic Variables

Sociodemographic information on respondents was collected as part of the survey to provide a general profile of the sample group. These characteristics, with the exception of the *community* in which the resident resided, were used only to describe the sample. They are not discussed as independent or intervening variables. The sociodemographic variables include: *community, gender, age, highest education level achieved, number of years in community, number of years at current address, ethnic identity, number of children under 18 living in the household.* A breakdown of the sociodemographic data appears in Chapter 5.

3.11 Analysis

This study is exploratory; it charts new territory. There is a limited amount of information available on psychosocial impacts on flooding in the Red River Basin in Manitoba, and none on the development of social criteria for use in floodplain management.

Exploratory studies, such as this one, are empirical research investigations. They may be used to increase an investigator's familiarity with a phenomenon (often for the purpose of more precise future research). Relatively systematic procedures (such as a survey) may be used, and both quantitative and qualitative descriptions of a phenomena are often provided, as well as description of new conceptualizations of the interrelationships among properties of the phenomena (Tripodi et al., 1983). Interviewing, as done in this study, is a common method used in exploratory research.

Descriptive statistics were used to describe what was learned from survey responses to closed questions. Graphing techniques were used to represent the data. Some possible *associations among variables* (i.e. dependent/independent) were noted for possible investigation in future studies. Statistical inference using the data was not possible due to the exploratory nature and lack of formal sampling technique.

Qualitative data collected was sizeable, yet used primarily to expand upon themes that emerged in the study. It was analyzed by *coding* answers to open-ended questions. [*Coding* is a means of categorizing data results in a way that is appropriate for the research objectives (May, 1993)]. Coding of this qualitative data meant it was organized according to apparent similarities in responses.

Once the quantitative and qualitative data collected from flood victims had been analyzed to reveal recurrent patterns in responses among victims and some possible associations among variables, it was then considered in the context of what was learned about flood management in Manitoba. Factors of particular importance to impacted residents and factors of general significance to flood management in Manitoba were identified and

noted in Chapter 6. This was followed by presentation and discussion of the six social criteria that were derived to help address/mitigate contributors to negative psychosocial impacts; that is, if decision-makers use them to evaluate flood management alternatives. The social criteria can be used in a MCDA framework to help select among these alternatives. To further simplify its application to flood management decision-making, each social criteria is described in Chapter 6 with reference to its applicability to each of the three stages of flood management (planning, emergency response, recovery).

There are three assumptions that are required to use the psychosocial data to generate social criteria for use in Multi-Criteria Decision Analysis of flood management alternatives. One assumption is that a future decision maker is concerned about the impact of flood management decisions on potential victims and reducing negative impacts. By extension, there is a further assumption that the decision maker(s) will structure his/her judgments to some extent on what she/he believes to be the preferences of victims. A third assumption is that the victims interviewed would articulate their experiences with sufficient clarity that aggregation of data into common themes (and ultimately “criteria”) would be possible.

CHAPTER 4: FLOODING IN THE RED RIVER BASIN

4.1 Introduction

The following chapter discusses the fulfillment of the first two objectives. They were accomplished as a result of literature search, a review of recent documentation on the 1997 flood, and contact with individuals, primarily government officials, who are directly involved in flood management in Manitoba.

4.2 Objective #1

Overview of the characteristics of flooding along the Red River in Manitoba and review the flood control system

4.2.1 Description of the Red River and its Basin

The Red River is a large meandering river that flows north through parts of eastern North Dakota, northeastern Minnesota, and southern Manitoba to finally end in Lake Winnipeg. It is part of the Hudson Bay drainage system. It actually originates about 885 kilometers (550 miles) south of Winnipeg in the northern United States. The river, and its surrounding valley, occupy a fraction of an area once occupied by a glacial lake — Lake Agassiz. This normally slow river does not cut very deep channels, making it relatively easy for overbank flow under flood conditions. This flow can spread over a wide area, and remain for days or even weeks.

The Red River has several tributaries, the most significant of which is the Assiniboine River; where the two rivers drain together the drainage area of the Red River increases from 124,300 (48,000 mi²) to 287,500 (111,000 mi²) square kilometers. The Assiniboine River flows out of the province of Saskatchewan in an easterly direction, and into the Red River at the center of downtown Winnipeg. At some westerly points the Assiniboine River is confined to a deeper channel but by the time it approaches Winnipeg the slope of the land is sufficiently reduced to prevent development of deep channels to contain the water. Thus the Assiniboine too is subject to easy overflow near the junction of the two

rivers and the excess water flows overland into the Red River and Lake Manitoba. This increases the flood risk to the most highly populated area of the Red River Basin, i.e. Winnipeg and surrounding area.

The area commonly referred to as the Red River *Basin* (See Figure 4.1) consists not only of an old glacial bed (i.e. the Red River Valley), but also about 72,500 additional square kilometers with a total area of close to 116,500 km². Of this area, about 13,000 square kilometers are in Canada and 103,600 square kilometers in the United States. The drainage area of the Basin is shared by North and South Dakota, Minnesota, and Manitoba – areas of 47, 1, 41, and 11 percent respectively (Krentz and Leitch, 1993). On the eastern side of the Red River drainage basin, landscape is so level that wetlands drain to either side. On the western side, natural drainage systems have been interrupted in places by deposits from glaciers causing surface water to collect there rather than drain, until it evaporates or seeps away. The type of soil in this region also contributes to flooding because, while topsoil is rich, beneath it lies anywhere from 1.2 meters to 18.3 meters of largely clay, and clay has a low absorptive capacity. Water tends to sit on the surface for extended periods of time.

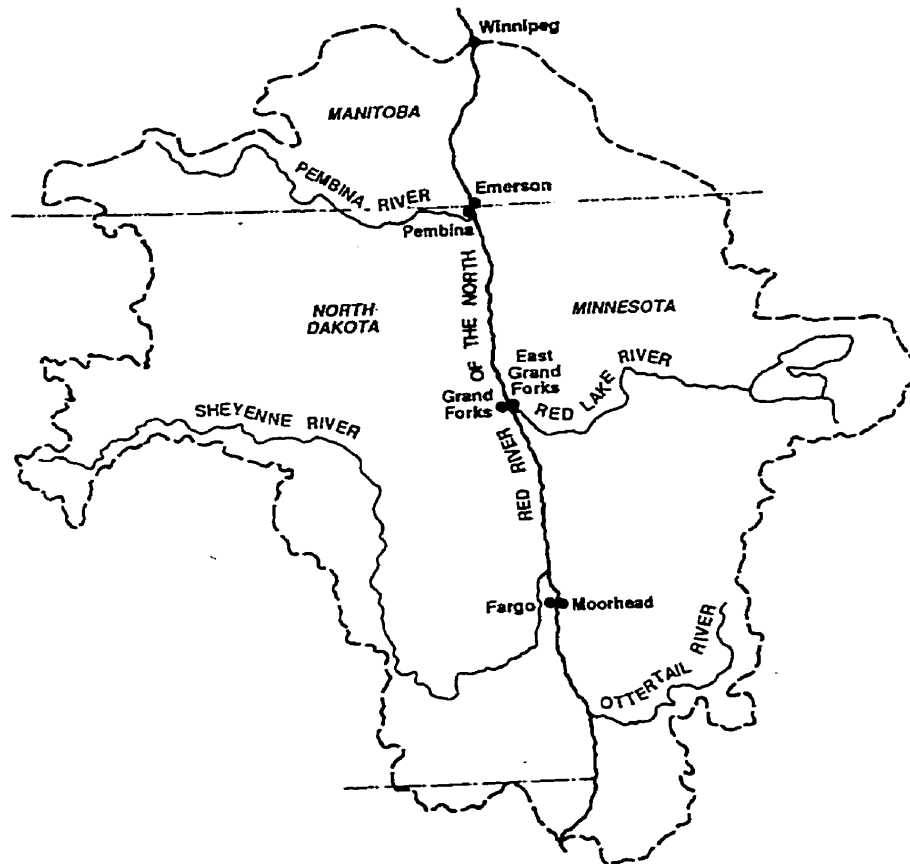


Figure 4.1 - The Red River Basin (without the Assiniboine River)
 (Source: Krentz and Leitch, 1993)

4.2.2 The Causes of Flooding in the Red River Basin

There are several factors that contribute to the flooding potential of the Red River. These factors cause either stream banks to overflow and/or runoff (due to snow or rainfall) to get trapped on sections of land (Krenz and Leitch, 1993). Area topography is one of the major factors; land is relatively flat with slow moving water and consequently longer duration floods. Floods in this region approach slowly, with days or even weeks warning. These longer duration floods provide more opportunity for evacuation of people at risk; however, they are likely to increase property damage. The flat topography of the Red River Basin and the shallow river channel are also a problem because of the large number of sub-basins which feed into the Red River basin—more than 20 sub-basins by most

estimates. These many sub-basins can produce heavy run-off that can easily exceed the river channel's capacity.

A particular problem is overland flows from the Red River's tributaries. These overland flows are also difficult to monitor and forecast. The International Joint Commission on the Red River Basin (IJC, 1997) stated that much of the devastation caused to some communities in the 1997 flood (e.g. Grand Forks - East Grand Forks, Ste. Agathe and Grande Pointe) was greatly increased by overland flooding. Overland flooding in the Red River Basin, under adverse weather conditions, can result in a flooded area of over 2590 to 5180 square kilometers which can then last from 4 to 6 weeks (Krenz and Leitch, 1993).

Weather is a pivotal factor in determining if flood conditions will occur each year along the Red River. In general the climate of southeastern Manitoba is classified as *sub humid* to *humid continental* with resultant extreme temperature variations. Annually, most of the precipitation received is in the summer rather than the winter. However, periodically weather conditions exist which instead promote widespread flooding through the valley. The most troublesome conditions (especially when most or all exist in the same year) are as follows:

- a) heavy precipitation in the fall
- b) hard and deep frost prior to snowfall
- c) substantial snowfall
- d) late and sudden spring thaw
- e) wet snow / rain during spring breakup of ice (IJC, 1997)

Another factor in the Red River Basin that can contribute to flooding is the unusual south to north flow. As noted previously, a large majority of the area of the Basin lies in the United States. Weather and thaw conditions in the southern reaches of the river thus affect the timing, amounts, and duration of water flowing northward.

4.2.3 Flood History

Serious floods on the Canadian side of the Red River Basin were experienced in the years 1776, 1826, 1852, 1861, 1916, 1950, and 1979; less serious floods occurred in 1882, 1897, 1904, 1948, 1956, 1966, 1969, 1974, and 1996.

The flood of 1826 is the largest flood on record; it was larger than the devastating 1997 flood. A sudden thaw in April of 1826, followed by ice jams on the river and simultaneous heavy rainfall, had water on the Red River rise 1.5 meters downtown in just twenty-four hours. Preservation of life took precedence over preservation of property, thus losses were enormous (Bumsted, 1997).

A pivotal event in Red River flood history was the 1950 flood, which was classified a great Canadian natural disaster. A very cold winter and heavy snowpack in the United States, combined with heavy rain during runoff, were the primary causes. All towns within the flooded area in the upper valley had to evacuate. Over 10,000 homes were flooded in Winnipeg and 100,000 people evacuated. A plan to evacuate all 350,000 people in Winnipeg was prepared, although fortunately was not required.

This flood was also highly significant in terms of flood management in Manitoba because both provincial and federal governments, albeit reluctantly, began formally to contribute financially to flood relief restoration for the first time. Following this, large-scale structural flood damage measures were constructed to protect Winnipeg and some valley communities. The most extensive structural measure for flood protection was the Red River Floodway system.

The 1969 flood was the first after the Floodway was complete, and the gates were used for the first time. There was virtually no flooding in Winnipeg although there were claims that gate operation worsened the situation immediately south of the Floodway. This was the pattern throughout successive floods i.e. little damage to Winnipeg, escalating damages to communities south of Winnipeg, and social conflict over perceived inequities in protection. The 1997 flood was no exception to this.

4.2.4 Structural and Nonstructural Flood Management Measures

4.2.4.1 Structural Measures

The Red River Basin in Manitoba has an extensive system of structural works to mitigate flood damage. The most impressive is the system to protect the city of Winnipeg. It consists of the Floodway, Portage Diversion, Shellmouth Reservoir (See schematic Figure 4.2), and the city diking system. The following tables (Tables 4.1 – 4.4) are a summary of the main characteristics of the four parts of the system. Table 4.5 describes community ring dikes outside of the city of Winnipeg.

Table 4.1 – Main characteristics of the Red River Floodway

Measure	<ul style="list-style-type: none"> excavated channel about 30 miles long
Implementation	<ul style="list-style-type: none"> on advisement of 1958 Royal Commission , based on benefit-cost analysis completed in 1968, at cost of \$62.7 million
Responsibility	<ul style="list-style-type: none"> operation and maintenance done by Manitoba Conservation - Water Resources Branch
Goal	<ul style="list-style-type: none"> to divert flood waters in excess of 30,000 cfs around the city of Winnipeg from south to north
Efficiency	<ul style="list-style-type: none"> highly successful within technological limitations
Issues	<ul style="list-style-type: none"> inappropriate development in highly vulnerable areas due to exaggerated sense of security within the protected area institutionalization of flood damage reduction (perception that flood damage reduction is a government function and not a public issue) if flood waters exceed channel capacity, damages could be extremely high capacity insufficient to handle flood equal to that of greatest flood on record (i.e.1826) operation is poorly understood by the public, prompting criticism allegations that operation caused excessive flooding south of structure currently the Floodway is being refurbished , a three year project costing over \$3 million provincial government claims Floodway has saved over \$4.5 billion in potential damages to Winnipeg

Table 4.2 – Main characteristics of the Portage Diversion

Measure	<ul style="list-style-type: none"> • consists of a diked earth channel, a diversion dam and spillway dam • channel is two miles west of city of Portage la Prairie • diverts water from Assiniboine River to Lake Manitoba 18 miles to the north
Implementation	<ul style="list-style-type: none"> • recommended by Royal Commission (1958) • completed in 1970 • cost \$20.5 million
Responsibility	<ul style="list-style-type: none"> • Water Resources Branch
Goals	<ul style="list-style-type: none"> • To keep water levels in Winnipeg at acceptable level – below 17 ft. or 18 ft. at James Avenue • Protect agricultural land and communities downstream from Portage la Prairie
Efficiency	<ul style="list-style-type: none"> • Highly efficient, subject to: Problems with ice jams which can significantly reduce diversion channels capacity Technological limitations
Issues	<ul style="list-style-type: none"> • Diversion is most essential when the Red River and the Assiniboine both crest at or close to the same time; Winnipeg floodway would otherwise be heavily taxed • Reduces flood damages along lower Assiniboine River, much of which is agricultural land • May have contributed to false sense of security along lower Assiniboine River

Table 4.3 – Main characteristics of the Shellmouth Reservoir

Measure	<ul style="list-style-type: none"> • Consists of earthfill dam, overflow spillway, and reservoir • Located on Assiniboine River near Russell, Manitoba
Implementation	<ul style="list-style-type: none"> • Recommended by Royal Commission (1958) • Completed in 1972 • Cost \$10.8 million
Responsibility	<ul style="list-style-type: none"> • Water Resources Branch
Goals	<ul style="list-style-type: none"> • provide water storage and control reservoir outflows to minimize downstream flooding in spring or during summer rainfall flood conditions • ensure adequate water supply in summer

Table 4.4 – Main characteristics of the Winnipeg diking system

Measure	<ul style="list-style-type: none"> • earth dikes and pumping stations
Implementation	<ul style="list-style-type: none"> • recommendation of Royal Commission (1958) • initially implemented by the Greater Winnipeg Diking Board 1950-52 with involvement of three levels of government, later enhanced • initial cost (1950-51) \$6 million, cost of enhancements in subsequent years undetermined
Responsibility	<ul style="list-style-type: none"> • Water Resources Branch (per the Diking Authority Act)
Goals	<ul style="list-style-type: none"> • protection of Winnipeg property from flood waters • pumping stations operate to lift water and sewage waste over boulevard dikes and prevent sewage back-up
Efficiency	<ul style="list-style-type: none"> • adequate only to a limited water level • easily breached under bad weather conditions or in very long duration floods • must be properly maintained
Issues	<ul style="list-style-type: none"> • permanent dikes are insufficient for highest water levels on record • some Winnipeg riverbank properties could not be protected by dikes due to proximity to river • some residents have removed the dikes on their property for aesthetic reasons, placing entire community at risk

Table 4.5 – Main characteristics of ring dikes

Measure	<ul style="list-style-type: none"> • ring dikes around select communities (earth)
Implementation	<ul style="list-style-type: none"> • recommended by Royal Commission(1958) • cost – benefit analysis conducted prior to construction on 8 communities • first ring dikes completed in 1972, cost \$2.7 million • from 1982-1991 new ring dikes and old dike enhancements cost \$4 million; this figure is \$6.9 million if <i>total</i> expenditures on the diking systems are included (such as pumping stations, communications equipment...) • new ring dikes under construction following the 1997 flood
Responsibility	<ul style="list-style-type: none"> • Water Resources Branch – regional engineering staff (for maintenance and operation)
Efficiency	<ul style="list-style-type: none"> • Adequate, subject to water level heights, weather conditions and maintenance/monitoring of dike
Issues	<ul style="list-style-type: none"> • dikes must be maintained, monitored and often enhanced during flood conditions • dike openings such as roads and railways must be closed with earth during floods • adequate pumping facilities must be in place • municipal cooperation required for construction and maintenance of dikes

The Floodway, Portage Diversion, and Shellmouth Reservoir were constructed from 1962-1972 as a federal-provincial cost shared project upon the recommendation of a Royal Commission on Flood Cost-Benefit Analysis (1958). This commission had been given the task to evaluate various measures that would reduce flood damages in the aftermath of the 1950 flood. The Commission also recommended an extensive diking system be constructed in Winnipeg, as well as ring dikes in vulnerable communities to the south (see Table 4.5). Typical of the common decision-making model in those days, the Royal Commission's decision to construct the flood protection system was based on traditional benefit-cost analysis. They also suggested that benefit-cost analysis be done to determine if ring diking was appropriate for the individual communities to the south. This was the method later used to justify the eight ring dikes constructed in subsequent years. This method of decision-making, so prevalent in flood management decisions, did not consider in any way the direct social costs nor include any type of social criteria when plans were developed or implemented. Even in recent years, with various government projects to enhance structural measures, social impacts have often not been formally included in decision-making.

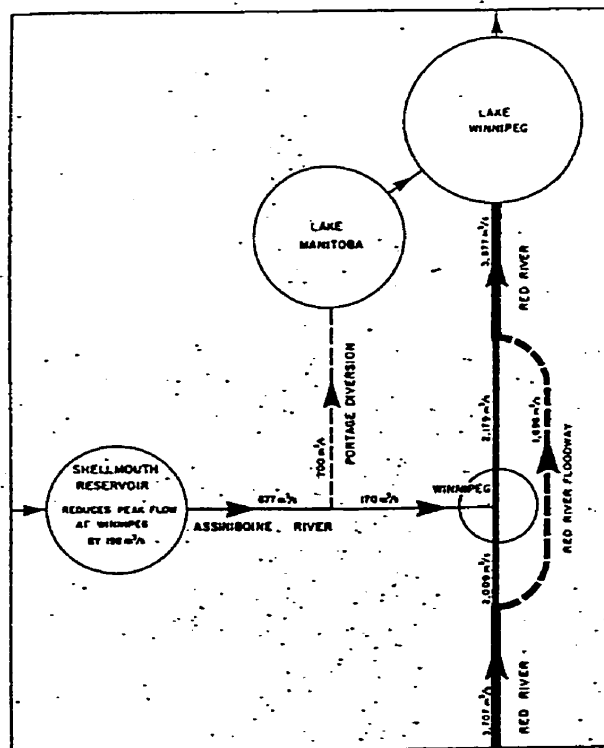


Figure 4.2 - Schematic drawing of flood control system to protect Winnipeg
(Source: Mudry et al., 1981)

4.2.4.2 Non-Structural Measures

Just a few comments will be made about non-structural flood mitigation measures because a detailed review is beyond the scope of this study. In essence they are any flood mitigation measures that do not involve structural work. They do play an important part in flood management decision-making because they are among the alternatives available in selecting flood management strategies. Non-structural measures include: zoning and land use regulations; flood-proofing programs which allow property owners to protect individual properties; flood insurance; warning systems and forecasting; and flood recovery issues.

4.3 Objective #2

Describe the 1997 flood in order to provide a context to the study

4.3.1 Description of the Flood

The 1997 flood, commonly referred to as the “Flood of the Century”, was the highest recorded this century. It officially began on March 30th, when the Red River first began to flood in the United States. On April 18th and 22nd the American cities of Fargo-Moorhead and Grand Forks respectively flooded, with enormous damages and human hardship. As it progressed, peak stages from the United States Boundary to the Red River Floodway Control Structure south of the city of Winnipeg were 0.6 to 1.5 meters higher than for the great floods of 1950 or 1979 (See Appendix I for the map of flood levels). Levels in Winnipeg were 1.5 meters higher than for any flood since the use of the Red River Floodway (i.e. 1969). In fact, floodwaters crested at the Red River Floodway inlet south of Winnipeg at 0.46 meters to 0.52 meters higher than the forecast range (International Joint Commission, 1997). The river rose 12 meters above winter levels, and flooded at least 1840 square kilometers of valley lands (Warkentin, 1997).

Altogether 28,000 Manitobans were evacuated to ensure their safety. They had to be provided with services and housing. Nine thousand evacuees were from the city of

Winnipeg (particularly St. Norbert), and urban communities where water levels were determined to be too high for safety or there was great risk in the event of dike failure. Rural residents were also evacuated because of fear of dike failure or the threat of overland flooding.

The main cause of the flood was an extreme snow pack. There was also high topsoil moisture due to fall rains in 1996, unfavorable timing of runoff from parts of the Basin, and a major storm in April which dumped 50-90 mm of water either as rain or snow. In fact, in many areas snowfall for the winter reached levels two to three times the average (International Joint Commission, 1997).

Structural measures previously discussed, such as the diking systems and the Red River Floodway, are known to have prevented enormous losses, as did emergency diking. Estimates of those prevented damages run as high as \$6 billion. Actual damage claims ran at over \$400 million.

4.3.2 *Agricultural Impacts*

Approximately 5% of Manitoba's farmland was under water when the flood peaked. It was necessary for some farmers to move livestock such as cows, hogs and poultry. About 2000 cattle and 45,000 hens were moved out of the valley; more than 90 hogs died in flood waters. Some farmers made preparations to remain on their property using emergency structural measures such as dikes. Various authorities, EMO, and commodity boards coordinated and assisted in relocating livestock, and in moving stored grain when possible.

4.3.3 *Flood Preparation and Flood Fighting in 1997*

With the leadership of the Manitoba Conservation - Water Resources Branch and EMO, a variety of activities needed to be managed during the flood in spring 1997. To name only a few of the key ones, these included: flood monitoring and forecasting; coordination and communication with government and non-government agencies; implementation of emergency structural works; operation of the flood control system; volunteer

coordination; organization of victim's services, particularly for evacuees; implementation of evacuation procedures; transportation routing; public communications; security and; search and rescue. Overall, it was EMO's job to provide necessary support to local communities when local capacity to cope was exceeded in the emergency (Rahman, 1997).

4.3.4 Structural Measures in the 1997 Flood

Several types of structural measures were instituted or enhanced during the 1997 flood. The most astounding was the construction of the Brunkild "Z-dike", a 40 km temporary emergency extension to the permanent West Dike. Its construction was supervised by a temporary Flood Management Task Force comprised of various experts, hydrologists, and government officials. This dike was designed to prevent flood waters from spilling into the LaSalle River west of the city and therefore flooding the city from the west. The worst case scenario planned for by authorities was a breaching of the Z dike; as it turned out, only 12 kilometers of the extension was actually required to hold back water.

The Task Force also devised a management strategy that would maintain a flow of 79,000 cfs in Winnipeg or 7.5 meters (24.5 ft.) at James Avenue through the use of the floodway. In adopting *this* level the Task Force had altered one of the formal operating rules of the Floodway (which designated 7.8 meters or 25.5 ft. as the level to be maintained at James Avenue). This has been subject to controversy because of concerns by residents south of the Floodway that their flooding was thereby intensified (to save Winnipeg). This is an example of a decision made in a flood situation with perceived negative consequences for flood victims.

When the severity of the 1997 flood was realized, most valley communities south of Winnipeg with ring dikes were advised that their permanent dikes were insufficient for the anticipated inundation. This resulted in expensive temporary dike construction and enhancements of existing community dikes.

Problems however arose in many valley communities. Although Water Resources Branch had been advising municipal governments since late winter that a sizeable flood was likely, municipalities were slow to respond until the blizzard of April 5th and 6th (I.J.C., 1997). This additional snow also slowed the process of building dikes and transportation of sand and sandbags. Many rural residents not protected by community dikes had to work feverishly to construct temporary dikes and other emergency flood proofing measures; a shortage of resources (such as sandbags and volunteers) ensued.

Dike works were also needed within Winnipeg. Earth dikes were constructed in 80 locations throughout Winnipeg. Fifty were modified to later become permanent structures. In Winnipeg, 3.9 million sandbags were needed just to protect 800 properties to the required heights; the total number of sandbags produced was 6.6 million, 2.3 million of which were filled by hand by volunteers and the military. Various other structural activities and operations occurred within Winnipeg to reduce flood damage, including: plugging watercourses and pumping out water; sealing manholes on the land drainage sewer system (McNeil and MacBride, 1997); construction of secondary sandbag dikes; flood-proofing of the sewer systems on the major rivers; operation of pumping stations; operation of storm water retention basins and; sewer modifications on various residential and commercial properties. A large degree of organization, coordination, and decision-making was required to handle the flood situation.

4.3.5 *The Military Role*

The flood of 1997 was in some ways slow to evolve. Given hydrologic conditions over winter and spring, a flood was anticipated; however, the blizzard in April and some under-estimations of peak stages south of the border had resulted in under-estimations all around until very close to the event. In early April, concerns began to escalate and it was at that point that provincial and municipal authorities began to realize that they may need additional assistance to heighten preparations and deal with the crisis.

Ironically, the initial request to the military in April was for “100 soldiers to help fill sandbags for three days” (Flynn, 1997). The quick escalation of events was evident when

two weeks later a formal Joint Force operation was instituted, and 8500 military personnel, 2850 vehicles, 131 watercraft, and 34 aircraft from across the country were brought into Manitoba. The seriousness of the flood situation was also evident in the establishment of a first priority for the Joint Force - "to save lives , prevent injury, and relieve suffering". After the event the military admitted that the lateness of the deployment and the scope of the flood resulted in limitations to the amount of preventative work that could be done (Flynn, 1997). Therefore, in pre-flood planning, military assistance was used primarily for diking, and facilitating evacuations. During the flood they continued to aid in evacuations, particularly emergency ones, rescue activities, and monitoring of both the water and airspace above the flood. They also did dyke maintenance, law enforcement for control of access to evacuated communities, and preparation for reentry. In recovery they provided engineering, and labor and transport assistance as necessary for establishing normal conditions in the evacuated communities.

4.3.6 *Emergency Measures*

Execution of formal emergency measures is particularly difficult during flood situations, and the 1997 flood was no exception. Although the formal declaration of the flood as a national emergency allowed additional financial and other resources to be brought into Manitoba, there were problems. Risk communication and response was one major problem. In fact, risk communication and response is one of the most important aspects of emergency measures, not only because of potential for injury or damage but because issues of moral and financial liability for damages inevitably result where problems occur. In Manitoba in 1997 there were communication issues which led to evacuation problems and other difficulties. In addition, lack of knowledge, training and experience among leaders in many municipalities resulted in decisions which were contrary to emergency preparedness practices (I. J.C. 1997).

Emergency preparation was particularly inadequate in some communities. Crest forecasts for some areas that were hard hit, such as Ste. Agathe (see Red River Valley map Appendix 1) were continually revised upward throughout April as it became evident that

high crests on many Manitoba tributaries would occur at the same time as peak flows arriving from the U.S. In Ste. Agathe, poor assessment of community risk - especially from overland flows from the west (the river is to the east of the town) – resulted in huge losses and a devastated community.

4.3.7 Flood Recovery

There were enormous financial and economic costs to the province, local communities, and individuals in the wake of the 1997 flood. This does not begin to represent the social and personal costs to victims and their communities.

Assisting people with compensation for losses and physical damages is in many ways simpler than assisting them to regain a sense of control over their lives. Financial compensation to victims in Manitoba was provided following a declaration of emergency according to a federal-provincial cost-sharing model established after the 1950 flood. For the 1997 flood, the federal-provincial split was 90-10 for all eligible expenses. However, the practical application of the specifics of the cost-sharing model was difficult and contentious. It was EMO's job to provide compensation and liaison with the federal and provincial authorities regarding the eligibility criteria for disaster compensation and the amounts to be paid.

The types, amount, and process of compensation in the wake of the 1997 flood was subject to much criticism from victims, with some communities organizing formally to take their grievances to the government. The survey done in this study revealed some of the concerns of flood victims, and some of the impacts the flood had on their lives, families, and communities. To prevent future decisions from reflecting almost exclusively the traditional perspectives of engineers and economists, it is important to look at social impacts and synthesize them in a way that is useful to flood managers in future. The following chapter looks more specifically at what survey respondents had to say about their experiences, and begins to identify prevalent themes among responses to questions.

CHAPTER 5: DISCUSSION OF SURVEY AND SURVEY RESULTS

5.1 Rationale for use of a Survey on Psychosocial Impacts

The purpose of this research was to develop social criteria for use in making flood management decisions. The primary data used was from a survey of psychosocial impacts administered to flood victims. The reasons for this are as follows.

First of all, the study outcomes, namely social criteria, are intended to promote improvement of quality of life or social wellbeing for those residents who live in the floodplain and who are regularly at risk from flooding. Decision-makers need to consider the impacts of their flood management decisions on these residents. The social criteria are used to measure to what degree proposed management alternatives fulfill the overall objective of social well-being. Key features of social well-being or “quality of life” (of both individuals and their communities) are the objective and subjective factors which contribute, both positively and negatively, to well-being. These factors make up the “social environment”. To understand people’s social environment requires understanding of their perceived and subjective reality which is best learned through their own report (Carley and Walkey, 1981). Thus the survey was designed to obtain residents’ own report on impacts they experienced in 1997, including some broader social impacts (e.g. family impacts, community-level impacts). This information provided a snapshot of the social environment in which residents live, and suggested areas of concern to be addressed to reduce negative impacts on residents in future. This knowledge gained during the interviews was critical to understanding people’s social behavior in a flood- a critical factor in flood management planning because it is social groups that ultimately prepare for, respond to, and recover from a flood.

It was through examining survey results that the experiences of residents could be consolidated into major themes, namely areas of impact and concern that should be brought to the attention of those authorities making flood management decisions. Knowledge of the people's social environment offered clues to how impacts could potentially be prevented, reduced, or mitigated. Thus the survey information on psychosocial impacts was essential to generating social criteria for use in decision-making.

Obtaining primary data directly from residents was also prioritized in this study because there was a significant lack of baseline information available on the impacts of flooding on residents in this region, and little attempt to quantify them. To adequately address a problem as complex as that of flood management in the Red River Basin, especially if the intent is to reduce negative impacts on residents, this type of information is essential. No decision problem can be systematically addressed, as in the case of MCDA, without adequate information. Decision-makers need appropriate information on flood impacts and citizens' perceptions in order to adequately represent their interests.

Residents were not asked direct questions about what they felt should be the priorities of those making flood management decisions because the interviews were conducted so close to a flood event itself. It was thought that responses to questions about what government should address in making decisions might heavily reflect respondents' personal experiences with the recovery process *at the time of the interview*, along with the attendant and often extreme emotional responses. The responses by residents as to what should then be priorities for government could conceivably vary dramatically over time as recovery issues were resolved for individual families. Rather, the approach taken in this study was to independently assess respondents' experiences during the flood and aggregate responses into themes which identify sources of stress and negative impact on families. Social criteria for use in decision-making were then objectively developed from information obtained from respondents about their experiences and perceptions of the flood event.

It should also be noted that the any recommendations or social criteria that flow from the survey of flooded residents would be greatly enhanced by an ongoing public participation process through which decision-makers would receive regular public input on potential flood management strategies.

5.2 Survey Administration and Results

The details of survey administration and the results of the survey will now be addressed. First, the interview environment (i.e. the circumstances under which the survey was administered) will be discussed. Second, sociodemographic information on the survey sample will be presented, and finally the results of the analysis of the quantitative variables under each selected dimension of impact will be described. The dimensions of impact are *severity of flooding, evacuation issues, economic issues, family issues, community issues, knowledge, risk communication and warning, future plans, stress and stress symptoms, psychosocial symptoms of stress, and physical health impacts*. There will be some references to qualitative data gathered during the interviews that supports, disputes, or expands upon the quantitative findings. This is followed by a section that provides a brief overview of some of the most prevalent themes to emerge out of the *qualitative* data collected. Review of the survey results constitutes fulfillment of the third objective of this research, namely, *to overview psychosocial impacts of the 1997 flood on members of selected communities through analysis of survey data*.

5.2.1 The Interview Environment

Doing interviews with victims of the 1997 flood was more difficult than initially anticipated. There were several reasons for this. First, because the interviews fell in the 3-6 month period post-flood, many residents in impacted communities were extremely busy. Many were particularly conscious of the amount of work to accomplish before autumn and colder weather. Many were also not living in their homes.

Selection of whom to interview was done as randomly as possible, although the assistance of the Flood Recovery Office for the Municipality of Ritchot was sought once going door-to-door (done for roughly 70% of interviews) was proving difficult, too time-consuming, and residents were having trouble committing to interview times.

The residents of *Grande Pointe*, *Ste. Agathe* and *farmers* were most difficult to access by going door-to-door. Without the assistance of the Flood Recovery Office the majority of interviews would have been with those residents who sustained less damage i.e. those who were once again living on their properties, thereby biasing the results considerably. It was also difficult to locate those residents who were no longer in their own community. Efforts were made to get a sample of residents under a wide variety of post-flood circumstances, and because this research was intended to be exploratory, getting assistance when required was considered to be acceptable.

Some residents dismissed the whole idea of being interviewed, others were very suspicious about who was conducting the interview and the purpose of it. Some were concerned that government would be privy to any negative comments that they might make. Fear and uncertainty were readily apparent in some communities. Many assurances, particularly related to confidentiality, were necessary for some to agree to participate at all.

However, it was found that once many residents sat down to talk, it opened a flood-gate of emotion-laden accounts about the 1997 flood. It was difficult in many cases to begin the formal part of the interview, namely the questionnaire, because people wanted to convey so much at one time. It was impossible to stick with a scripted routine of questions under these circumstances. What quickly became evident was the extreme need that some people had to share their ordeals. This sense of people's need to tell their story was verified by the many comments that people made at the end of the interview about how "good" it had felt to tell their story. One family even telephoned the next day to express thanks for being given the opportunity to tell their story, and said it had been "cathartic".

When the survey was first developed, it was intended to be administered to one individual in privacy. During the interviews, however, it quickly became obvious that the need to recount events and feelings was so intense in some households that spouses and other family members sometimes insisted on joining the discussion. It was also evident in some homes that children were eavesdropping, or trying repeatedly to actively participate. It made at times for a chaotic interview environment and required some diplomacy to set limits.

Thus the information was gained in as structured a manner as possible for the situation, but clearly the needs of the flood victims needed to be a paramount ethical consideration. It was obvious that respondents felt that there had been insufficient opportunity to tell their stories to other people, and some families voiced general feelings of abandonment by others who were not directly affected by the flood. This included friends and family as time passed, and as non-flooded people “resumed their normal lives”. Some felt the media was also not sufficiently sympathetic to their plight as time passed, that media representations were not comprehensive, and that eventually “they” (i.e. flood victims), were abandoned because they were no longer newsworthy.

Of the families interviewed, the average length of time of interviews was between 1.5 and 2 hours. That was the time required to actually administer the survey, not including time for preliminary explanations which were, in some situations, very time consuming.

5.2.2 Sociodemographic Data

The following is a synopsis of the sociodemographic data collected on respondents to the survey. Fifty-two residents of the Red River Valley were interviewed. The percentage of respondents interviewed under each defined community category are as follows: Ste. Adolphe 17% (some within and some outside the community dike); Grande Point 17%; Kingston Row/Crescent 17%; St. Norbert 15%; Ste. Agathe 15%; farms 14%; Red River Drive 4%. The latter two communities were combined under rural homesteads/farms

because they identified less readily with a specific community. At times in the detailed analysis of the survey they are considered separately, and at times together.

Communities Surveyed

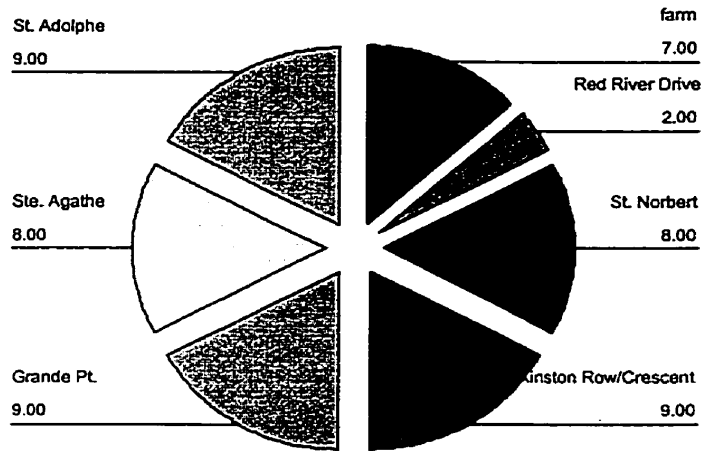


Figure 5.1 – Number of respondents per communities surveyed

Thirty-nine percent of those interviewed were male and 62% female. There was a wide variety of ages among respondents. Most common categories were ages 35-44 and 45-54 of which each had 25% of total respondents. The category of 55-64 contained 17% of respondents and 15% were in the age range 25-34. Eight percent were over 65 years and 4% were from 18-25. Four percent did not answer the question and 1 respondent did not know her exact age.

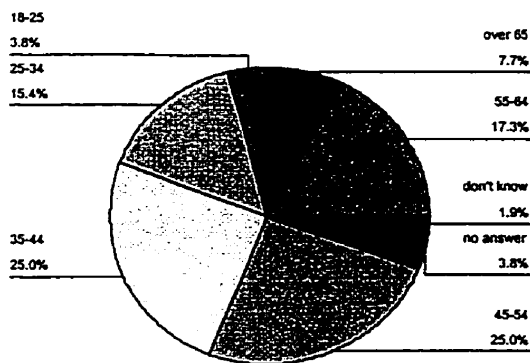


Figure 5.2 – breakdown of age categories of respondents

The *highest* education level achieved by respondents was determined. Results were as follows: university degree, 29%; community college graduate, 21%; some post-secondary education, 21%; high school graduate, 12%; some high school, 6%; less than grade 10, 7%; no answer, 8%; refusal to answer question, 2%.

Respondents indicated the number of years that they had lived in their current community: 4% were two years or less; 15% were 3-5 years; 10% were 6-8 years; 23% were 9-11 years; 15% were 12-14 years; 2% were 15-17 years; 6% were 18-20 years; 19% were between 20 years and 50 years; 6% were more than 50 years in the community.

It is evident that more than $\frac{3}{4}$ of respondents had been in their community approximately a decade or more. In comments made during interviews some residents stated their commitment to remaining in their community. Some, particularly those in the more rural communities, spoke highly of the quality of life that they have and their desire to stay in the communities even given the need for extensive rebuilding, or flood-proofing, and regardless of the continuing flood threat. A few who were extremely stressed and anxious expressed concern that they could not remain in their community because of the losses that they had sustained as a result of the flood of 1997.

A vast majority of respondents indicated that they do not identify with any particular ethnic group, namely 73%. Ten percent identified themselves as French, followed by 2% claiming to be Ukrainian, Canadian, and English respectively. Four percent selected the *other* category, 6% gave *no answer* to the question, and 2% *refused* to answer it.

There was a wide variety of family compositions within single households interviewed; many had adult children living in the home. In total 52% claimed to have children under 18 years of age living at home. Of these, twenty-one percent had two children, 15% had one child, 12% had three children, and 4% had four children. Several respondents expressed concern about their child(ren)s' responses to the flood event, and wished that they had someone outside of the family that their children could talk to about their

feelings. Some reported that they were seeing different or unusual behaviors in their children that they were concerned about and which they attributed to the flood.

5.2.3 Results by Dimension of Analysis

(Note: numbered graphs appear in Appendix 3)

5.2.3.1 Severity of Flooding Dimension

For analysis of “severity of flooding” the indicators were *estimate of the cost of damage*, *depth of water*, need for a *clean-up period*, and its *duration*. Loss of *irreplaceable* versus *non-irreplaceable* items was also considered.

Overall, *during* the flood, most respondents understandably had more stress than before the flood. Those with water in the home were more apt to report *high* levels of stress during the flood rather than *moderate* or *low*, with a slightly greater percentage reporting *high* as the level of water climbed. The depth of water was determined by whether water was reported to be in the basement only, first floor, second floor or to the roof. None responded that they had water to the roof level. It was discovered during the course of the interviews, that a more comprehensive question about the home and its contents would have been helpful because, for instance, split-level homes may refer to a level as a “basement” level while in fact it is the major living space for the family.

After the flood, overall less respondents felt increased stress as compared to before the flood; of those who had no water at all in their homes 13/18 (72%) reported *no* stress post-flood above their pre-flood levels while only 12/34 (35%) of those *with* water in their home reported *no* increased stress post flood as compared to before the flood. And a large majority of those with post-flood stress who also had water in their home reported that the actual level of stress that they felt was either *moderate* or *high* (rather than selecting *low*). Stress impacts overall were greater for those with water in their home.

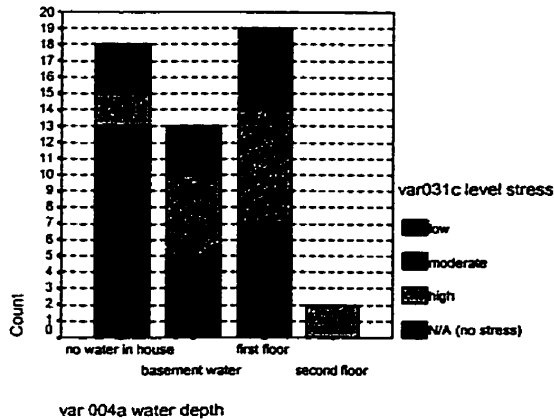


Figure 5.3 – depth of water in home by stress level since flood

Looking at the estimate of damages provided by this sample (Graphs 115-116) it is evident that those with damages versus without damages did have increased stress post-flood. And for the three major categories of damage (\$10,000-\$50,000; \$50,000-\$100,000; \$100,000-\$250,000) the higher the damage, the more report of *high* or *moderate* levels of stress rather than *low* levels.

With regard to clean-up, (Graphs 74-76), only four respondents had no clean-up to do whatsoever. Only one of these reported stress post-flood greater than pre-flood. Of those with clean-up, 54% had more stress since the flood. Twenty respondents had a clean-up period of less than two months, and only about 25% of them had an increase in stress post-flood while of the 32 with clean-up still continuing at the time of the interviews over 65% had increased stress post-flood. Thus the ongoing clean-up process may have been partly a contribution to stress levels. Timely clean-up may be one way to assist individual families in recovering from a flood.

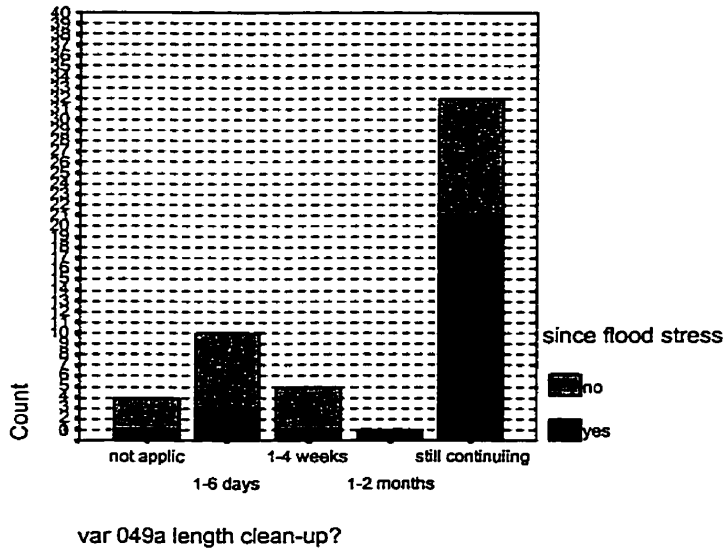


Figure 5.4 – length clean-up by stress post-flood (yes/no)

In this sample the loss of personal items (considered distinctive from the loss of a house) was considered and respondents were asked to indicate if they lost any irreplaceable items. As the figure below shows, 17% of respondents had no losses of personal items, 52% had replaceable losses and 31% had losses of irreplaceable items. *During* the flood, stress was higher than pre-flood levels for respondents whether or not they lost personal items.

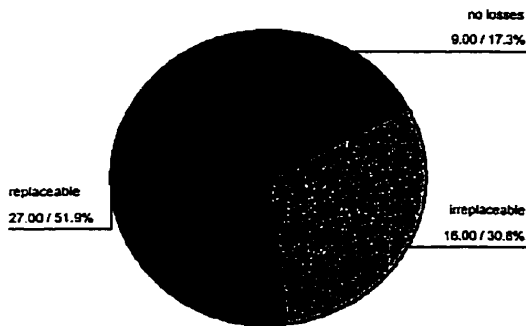


Figure 5.5– personal losses-no losses, replaceable losses, and irreplaceable losses

After the flood 42% of respondents claimed stress levels to be higher than pre-flood. However, of those who had no losses whatsoever, only half as many respondents had elevated stress post-flood. In comparing type of loss, namely irreplaceable versus replaceable losses, there was no difference in the proportion who had post-flood stress nor more evidence of higher levels. Just having loss of personal items of any type seemed most critical to stress. During interviews however, when asked about irreplaceable losses, some people became quite upset; many had lost items that would be passed down to children. It may be possible that the full ramifications of the loss will be recognized only over time.

Summary:

It is evident that having water in the home, more damage in dollars, a longer clean-up period, and loss of some personal items had a negative impact on stress (particularly post-flood) among these respondents.

5.2.3.2 Evacuation Issues

Evacuation issues were covered in the survey by asking respondents if they had received an evacuation alert, if they had been evacuated and how many days, and the adequacy of accommodation. They were also asked about the adequacy of the notice they had received about the need to evacuate, and about the number of moves their household had to make.

All but two respondents were in fact evacuated and the majority (almost 70%) were back living on their property (some in trailers) within six weeks post-flood. Looking at length of evacuation, the collected data showed that among this sample, those that were evacuated longer than 1 month (particularly) were more apt to report increased stress after the flood than those evacuated a lesser amount of time.

Eighty-eight percent of respondents who were evacuated described their accommodations as *good* or *excellent* showing that, for the most part, government provision of temporary accommodation and personal arrangements for evacuation accommodation made by evacuees were not a major problem in this sample. The anecdotal information gathered in

two interviews in particular did show that in cases where government provided accommodation that was inadequate, this did put tremendous burden on the flood victims. Others also reported that when staying with family, over time there was increased stress in the extended family relationships, and perhaps less sympathy or understanding for the plight of the victims.

Respondents were also asked if they felt they had adequate notice of the need to evacuate. Graphs 7, 8 and 9 show that those respondents who did not feel they had adequate notice did not report more incidences of increased stress *during* the flood as compared to *before* the flood. Both those with and without adequate notice had higher levels of stress *during* the flood than prior to the flood (over 90% both groups); however, there was an increase in the proportion of those reporting *high* versus *moderate* or *low* levels of stress among those who felt they had inadequate warning. So the “level” of reported stress may be associated somehow with (perceived) inadequacy of the notice to evacuate.

After the flood, twenty percent *more* of those who reported they felt they had not had adequate notice (versus those who felt they had adequate notice) felt more stress than they had before the flood event and a greater number of this group reported *high* levels rather than *moderate* or *low*. It would seem in this sample that while most were stressed during the flood, having inadequate notice was perhaps linked with an increase in the *level* of stress, and that post flood those with increased stress and slightly higher levels also claimed they did not have adequate notice.

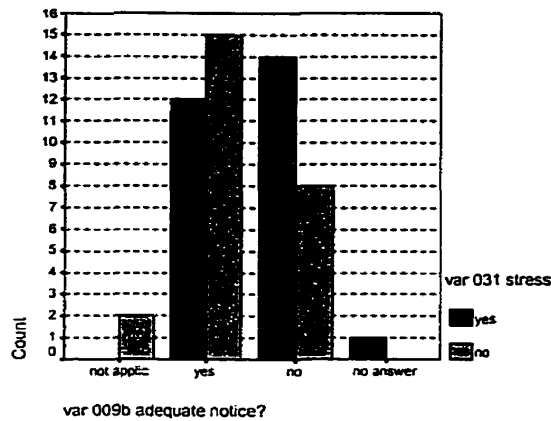


Figure 5.6— adequate notice by stress since flood

It is difficult in this complex situation to consider what factors may be influencing either level of stress among respondents or their recall of the flood. For instance, since they were asked retrospectively if they felt they had adequate notice, could those who were more stressed with regard to their post-flood situation report more negatively about the adequacy of notice? Or did those who had more damages and therefore post-flood stress indeed have less notice? What is evident is that the *adequacy of notice* is an important factor in planning for floods and respondents' perception of adequacy of warning in 1997 appears to somehow be related to stress response during and post-flood.

The issue of the role of an *evacuation alert* as provided by officials to potential flood victims is an interesting one. Answers were difficult to ascertain. Some victims were unsure if they had received one at all, or were unsure what the question referred to (i.e. exactly what *was* the alert document?) and looked during the interview to see if they could find an "alert" around the home. In addition, answers to the question of whether an alert was received, and how far in advance of the flood, brought a wide range of answers even within the same community. Clearly, there is a difficulty here. Homeowners within a floodplain need to understand what an "alert" is, and it should be immediately clear what it is and what it means to the homeowner. Several respondents reported receiving their alert notice once they had evacuated which raises further questions about the timing and consistency of the "alert" system.

With regard to the number of moves a respondent's family was required to make during evacuation, higher levels of stress were evident in those with more than one move - almost 30% more of those with multiple moves reported *high* levels of stress after the flood compared to those who did not move more than once.

Summary:

Information gained from respondents points to a need for increased clarity about what constitutes an "evacuation alert", what mechanisms are used to disseminate one, and what can be expected from the time an alert is received.

At a practical level this study points to a need to provide additional supports to evacuees out of their homes for longer periods of time, particularly over a month. This may possibly prevent the substantial increase in stress level that was experienced in this sample and attendant problems that arise simultaneously (such as conflict with persons both within and outside the family). Care should also be taken to better prepare families and communities for evacuation so that a minimum number of moves are required for individual households.

Several respondents noted that they would probably not evacuate again in the event of another flood. Instead, they would refuse, remain on their property and not rely on government agents to protect their homes. However, this is a reaction to perceived government failures during the flood and is a flawed solution to property damage because it may ultimately increase personal injuries during future floods.

5.2.3.3 *Economic Issues*

This dimension was examined by asking respondents if they had any lost household income related to the flood, to give estimates of any lost income, and note the cause of the economic loss. To summarize results, looking at total household losses, the following number of respondents gave the indicated answer:

- no losses of income 12
- under \$5000 in lost income 9
- \$5,000-\$10,000 in lost income 7
- \$10,000-\$50,000 in lost income 9
- \$50,000-\$100,000 in lost income 3
- over \$100,000 in lost income 3
- no answer 6
- don't know 3

Looking further at some of the qualitative data gathered as to the *cause* of the lost income of respondents or their households, several comments can be made from review of answers to open-ended questions. Namely, three respondents lost their job, 19 of the respondents (or their spouses) were forced to be absent from work, and 21 respondents (or spouses) lost business activity that generated revenue for the family.

It is evident that estimates of lost household income were significant, clearly a secondary impact of the flood. Several respondents felt that the government's neglect to mitigate the broader issue of income impacts was a problem in the recovery stage post-flood. Some respondents had businesses that were interrupted by the flood, some on property directly impacted by water. Several also had substantial difficulty with their employers where they worked. These employers were perceived to be insensitive to both the trauma and practical difficulties faced by those who had sustained damage to their homes/properties. This problem was exacerbated over time, probably once the "altruism effect" seen in the literature was diminished i.e. where non-victims of a disaster rally to support victims but there is diminishing support as the time following the disaster increases.

With regard to loss of household income and health impacts, a decrease in general health when comparing before the flood and after the flood was much more common among those respondents who had reported lost household income related to the flood.

Looking at loss of household income and stress impacts after the flood showed that 13% more of the respondents who had lost household income (versus those who didn't) had

increased stress after the flood as compared to before. They were also slightly more apt to seek counseling if they had lost household income.

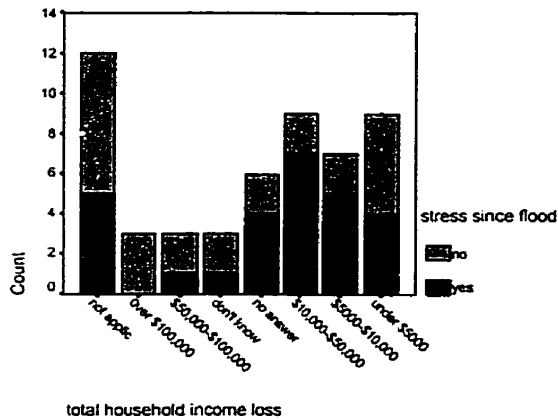


Figure 5.7—total household loss of income by stress since flood

Summary:

Sizeable floods in the Red River valley cause not only damages to property but also substantial income loss in some families. More at risk for increased stress and decline in health in this sample were those persons who lost household income and who did not receive emotional and practical support from their workplace environment and employers. Certainly there may be a role in government and community in promoting support (including financial) for flood victims not only in the immediate aftermath but also over the longer term given that, for some, recovery will be months or even years.

5.2.3.4 Family Issues

A notable number (i.e. twenty-one) of the victims of the 1997 flood who were interviewed reported that there was increased conflict in general in their family which they thought was due to the flood; twenty-seven said this was not the case. In the sample of flood victims interviewed it is also evident that those who reported increased

family conflict also had increased stress post-flood at a much higher rate than those who did not report increased family conflict (see figure below). As evident from Graph 17, about 58% of those who sought counseling also reported increased family conflict, while only 37% of those who did not seek counseling had an increase in family conflict. Overall, just under 25% of the entire sample sought counseling after the flood, excluding those who had only brief counseling intervention at the time of evacuation.

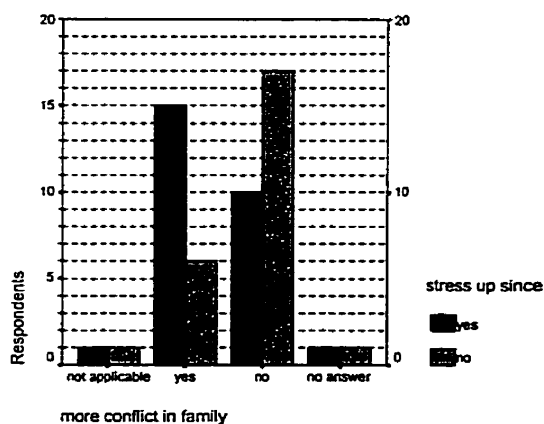


Figure 5.8—family conflict by stress since flood

An increase in arguments/disagreements *within* the family was reported by 58% of respondents and, of these, 1/3 sought counseling. And 43% of those with arguments within the family reported increased *irritability* since the flood while 32% of those not reporting increased arguments *within* the family had increased *irritability*.

With regard to arguments/disagreements with people *outside* the family, 39% of respondents (of those who answered this question) reported an increase, and 44% of these sought counseling. Those who did were more than three times as likely to report that they sought counseling post-flood than those who did not see an increase in arguments outside the family. The primary people with whom respondents claimed to have conflict were *authorities, neighbors, and friends*. Arguments were found to be primarily related to others' perceptions of the flood and flood victims. Several respondents noted that with time other people who were not flood victims became impatient with victims' complaints, including sometimes even extended family members. The next greatest source of

argument was related to delays in processing compensation claims for damages. The third highest source of arguments with people outside the family related to billet problems during evacuation, followed by general flood-proofing conflicts such as getting sandbags or conflict over how to build dikes.

Interestingly, there was also evidence in this sample of a slight increase in arguments outside the family among respondents who also had more *damages* (in dollars). Data analysis of respondents' surveys showed that many respondents (about 50%) who had arguments outside the family also reported more *irritability* since the flood

The perception by interviewees that there were, in fact, positive outcomes from going through the flood experience did not show any evident association with stress post-flood. However, 79% of flood victims did report positive outcomes of some type.

Examining comments to open-ended questions made by respondents with regard to positive outcomes reveals that the six most often mentioned positive outcomes for their families were the following: *family brought closer together* (10 or more respondents mentioned this); *closer community* (10 or more respondents); *closer to neighbors* (5 or more respondents); *gained a sense of competence or of being able to cope* (5 or more respondents); *some benefit to children (particularly young adults) as a result of the experience [often related to personal growth]* (5 or more respondents); *clarified "priorities" of respondent or their family* (5 or more respondents).

Summary:

The survey results show that among this sample of Red River Basin residents, the impacts to families were significant. For instance, this study pointed to the likelihood of increased family conflict post-flood, arguments and disagreements within the family, and with people outside the family. Counseling was one type of support to families, which was accessed by 25% of survey respondents to help in coping with flood related problems and

conflicts. It is important to note that the type of counseling sought in the group who did seek counseling was not defined as brief crisis counseling. Provision of services like counseling may be important if negative impacts to individuals and families are to be reduced and response to victims' needs improved.

5.2.3.5 Community Impacts

5.2.3.5.1 Support

This dimension was examined by asking respondents about their degree of involvement in their community prior to the flood, and then specifically about involvement related to problems or concerns that arose due to the flood. Approximately the same proportion (48%) of those with or without post-flood stress engaged in community activism post-flood. There was a slight increase in those who had not been previously active in their community and now were specifically involved in a flood-related issue --- specifically among those who were *not* stressed post-flood.

However, 54% of those who had water damage from the flood were also involved in community activism, while only 36% of those with no damages (i.e. 5/14) got involved in working on a flood-related community problem. Therefore, in this sample, having damages seemed associated with community activism.

Some community work was in the form of services to victims. Other residents formed or joined local committees to look at the events of the 1997 flood and/or the recovery process.

The Community Impacts dimension was also examined by looking at levels of support perceived by victims, namely levels of support by the *provincial government* and the *community* in general. Overall respondents felt quite supported by their communities, with a total of 71% reporting *some* or *a lot* of support (58% choosing *a lot*) from their community. In contrast, only 44% felt *some* or *a lot* of support from government, with only 16% perceiving *a lot* of support. See the figure below. Three communities particularly did not feel much support from government, namely Grande Pointe, Ste.

Agathe, and St. Adolphe. This may be partly explained by the fact that they experienced the most community-level damages.

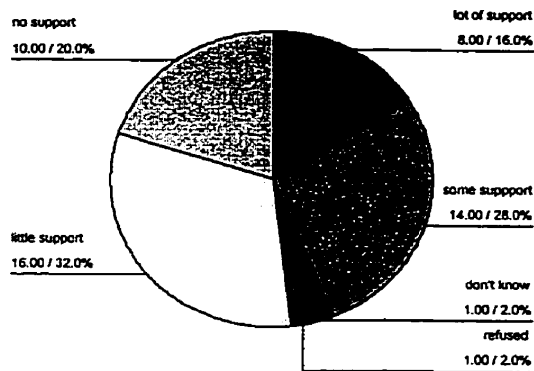


Figure 5.9—perceived support of government

With regard to respondents' perception of support offered by their communities, only Grande Pointe had a high percentage of respondents reporting that they felt *little* or *no* support from their community. This does raise a question about why Grande Pointe residents felt such lack of support, and what variables may have contributed to those perceptions — was it severity of flood damages in the area, lack of warning, demographic variables?

There was no evident difference in the respondents' answers about perceived support from government or community and the amount of damages (in dollars) sustained to their homes and property.

5.2.3.5.2 *Social life impacts*

Just over 50% of respondents reported that they experienced social life impacts from the flood. Some were of a positive nature through expanding friendships (e.g. with neighbors); others were negative social life impacts due to people being displaced, or too busy with recovery to socialize as before.

Summary:

The primary factor which may have positively affected individuals' involvement in flood-related community activism among these respondents was having experienced damages from the flood.

This sample of flood victims also showed that most communities felt a strong sense of support from community members in general, with Grande Pointe being a notable exception. The government received mixed reviews in terms of support but it is evident that there was a more negative perception of government support in those communities which sustained the most overall losses. In the cases of Ste. Agathe and Grande Pointe, particularly, comments by respondents to open-ended questions with regard to government focused on authorities' errors in prediction of water levels, lack of notice about the risk, lack of preparation of municipal authorities in responding to the flood, and frustrations related to the disaster financial assistance program.

Overall, the amount in dollars in damages that an individual respondent sustained in the flood did not appear to influence perception of government so much as perhaps community level concerns (e.g. sufficiency of official warning, access to diking resources). One half of survey respondents experienced social life impacts, both positive and negative.

5.2.3.6 Future Plans

In looking at the future plans of flood victims, a question about their *property values* was posed. Some respondents in all sampled communities were expressing concern about property values; there was a slightly increased tendency for the respondents in rural communities to express concern than those in the urban communities. This may have been due to the fact that infrastructure works often better protect the urban communities.

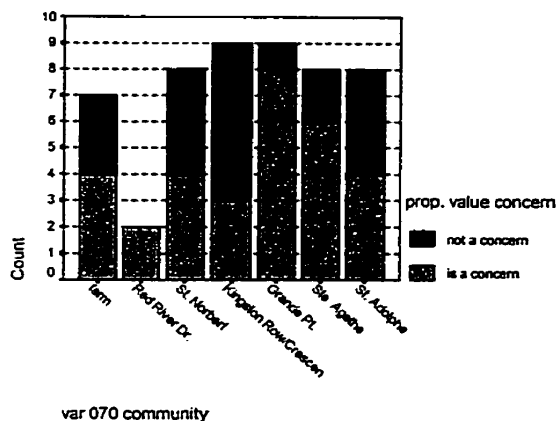


Figure 5.10—property value concern by community

In fact, when *property value* concerns are compared to amount of *damages*, high numbers of those with some type of damages (over 70%) were concerned while just over 30% of those who did not sustain *any* damages in 1997 were concerned about property values. Those residents who had no damages, such as some in St. Norbert or those along Kingston Crescent/Row, were concerned about their ability to ever sell their homes because of the flood threat even though they had not personally had water in their homes. One respondent said that although they had wanted and planned to move prior to the flood, and sustained only some minor damage related to primary dike works adjacent to their property, they now felt they must remain because they would not recoup the value of the home because of the flood risk.

The Future Plans dimension also sought information about whether respondents were *considering/planning a move* away from their community because of the flood. Over 50% of respondents had or were considering or planning a move from the community because of the flood of 1997. However, substantially more of the respondents who were also experiencing *post-flood stress* at the time of interviews said they were considering/planning to move (see figure below). It would be valuable to further examine this in a longitudinal study of the effects of the flood—more specifically, it would be interesting to investigate how many of the flood victims who were considering or planning to move actually decided to remain in the community when/if their stress level abated.

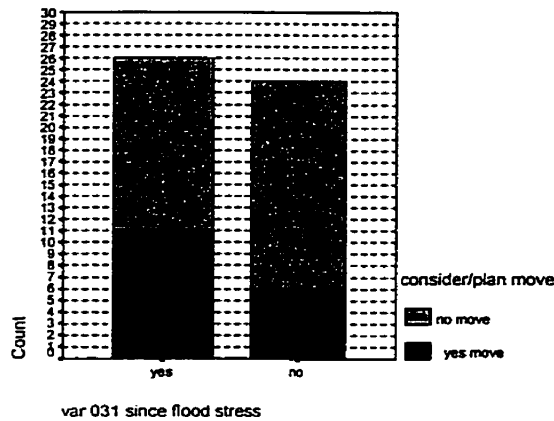


Figure 5.11—considering move by stress since flood

In the study, twenty respondents reported that they owned business property that was impacted by the flood, but only two actually planned to *relocate/close down/sell* their business as a result of the flood. They were both farmers.

Summary:

Property values were a concern across all communities studied. However, the respondents from rural communities with no infrastructure protection were more concerned than those with protection. Kingston Row/Crescent residents had the least report of concerns (less than 50% of respondents). If a respondent had received damages during the flood the more likely they were to report concern about property value.

With over 50% of respondents reporting that they were at least considering, if not planning, to move out of their home, it would be perhaps informative to follow-up and confirm which respondents actually took such action especially once/if stress levels were reduced. In this sample stress was positively related to considering/planning a move.

It is clearly advisable for authorities, both municipal and provincial, to work with communities to better prepare for future floods, to help prevent large-scale damage, and

to come up with practical solutions to help individual families and communities to cope with the stress and uncertainty related to flood events occurring.

5.2.3.7 Knowledge Dimension

The Knowledge Dimension is intended to look at which respondents had *prior experience* with floods and whether the prior experience helped them to cope in 1997. In this sample almost half of respondents did have prior experience and of these many felt it helped them to cope with the flood event (80%). Interestingly, this group with *prior experience*, many of whom felt it helped them to cope (when asked directly), actually had a slightly higher report of increased stress during the flood as compared to before the flood than did other respondents who had no prior experience. They were also more likely to report a *high* level rather than *moderate* or *low*.

These facts raise the question of why so many of the respondents with prior experience felt it helped them to cope even though their reported levels of stress were actually high. The reasons may be highly complex if other variables mediated the perception of stress. For example did this group have prior experience because their property was actually at much higher risk and they therefore had much more damage which thus increased their stress? Or did they use prior experience as a means of reassuring themselves of their ability to cope, and thus reported feeling that it actually helped them although their stress levels were high?

Respondents were also asked about their ability to *cope with problems* that arose during and after the flood. Slightly *less* respondents with prior experience (29% versus 39%), reported *more* problems coping than usual during the flood. However, post-flood ten percent *more* of those with prior experience reporting trouble coping than those without prior experience.

A related variable considered under the Knowledge Dimension was *awareness of risk*. Respondents were asked if prior to this flood they were aware that their property was at

risk. Interestingly, while many had *prior experience* with floods, most denied being aware of their risk in 1997. Well over 50% in most communities denied awareness, with Ste. Adolphe residents and Red River Drive residents being exceptions.

It should be noted as well that many respondents who were unaware of the risk, when responding to stress related questions, had *higher* levels of reported stress *post-flood* than those *in the same communities* who claimed to be aware of the risk.

Summary:

Residents of the Red River Basin that were interviewed who had prior flood experience said they felt it helped them to cope in 1997. They were less apt to report that they had *trouble coping with problems* that arose during the flood, yet at the same time they were more likely to have higher *stress* levels *during* the flood than those residents with no prior experience. Among this sample, a key benefit of prior experience may be in perception of ability to cope during a flood. This would be an interesting avenue for further research, particularly to understand the subtle differences between *perception of* versus *actual* enhanced ability to cope.

Because respondents who claimed to have been *unaware* of the risk of their property from flooding had more report of elevated stress post-flood, there are outstanding issues crucial to improved flood emergency response which are related to awareness of risk, and how *level* of risk is interpreted at an individual and household level.

Entire communities may benefit from better acknowledgement of and planning for the likelihood of flood. What must be better defined, perhaps, in further research, is just what constitutes “awareness of risk” because, while many respondents in this study said they had prior experience with floods, most denied being aware of the risk. This apparent contradiction warrants further investigation. Most importantly for the generation of social criteria for use in flood management, it points to the need for a working definition of “risk” which residents of the basin can use to assess their own ongoing vulnerability to floods.

5.2.3.8 Risk Communication and Warning

Related to Prior Knowledge is the dimension of Risk Communication and Warning. However, this dimension focuses on the dissemination of information and its adequacy. The respondents to the survey showed a wide range of responses to the question of *how much warning* (in days) they felt they had that their property was at risk from the flood even among respondents from the same community. In the communities of Ste. Agathe, Grande Pointe and among farmers, most respondents reported that they had less than one week warning about the imminent flood. This may suggest further attention to uncertainty in prediction and just how much information about the levels of uncertainty should be conveyed to residents.

Among this sample there was no clear difference in response regarding experience of stress during or post-flood and amount of warning (in days or weeks from any source) that the respondents felt they had received.

According to Graph 133 most respondents (65%), when asked directly, felt that receiving a warning of the flood risk in 1997 had increased their stress; only 6% felt it had decreased it at the time just prior to and during the flood. The rest felt it made no difference or did not answer the question.

Data provided in Graph 141 shows that in Ste. Agathe, St. Adolphe, and Grande Pointe 30% or less of respondents said that they had *official notification* of the flood risk in 1997. In sharp contrast are St. Norbert and Kingston Row/Crescent, the most urban communities, in which 100% of interviewees said they received *official notification*. Among Red River Drive residents and farmers, 50% and 43% respectively reported receiving *official notification*.

Summary:

The issue of warning requires attention in flood management. Clarification of what constitutes a “warning”, the implications of an “official” warning, and what actions should follow the receipt of a warning all need to be reviewed.

Given that 40% of respondents said that they received no official warning at all in 1997, it is necessary in future flood planning to ensure communication from officials is timely, appropriate, and helpful in prompting actions that will minimize losses, injuries, and stress.

A large number of respondents felt that receiving a “ warning” of the flood from any source that they considered reliable (whether it be observing the snow storm in April, observing Grand Forks flooding on the television, or official notification) increased their stress prior to and during the flood. This pre-event stress can be positively used to prepare for a natural disaster. For the most effective response to a warning, the communication mechanism (and the warning “source”) must be considered credible. The literature warns that otherwise valuable preparation time is lost as people ignore early warnings.

In 1997, some survey respondents asserted that in future they would not rely on government, and they want their communities and community-level authorities to be more proactive in risk assessment during flood threats. This is a goal that may be well worth pursuing from a societal point of view; heavy reliance on government to assess risk and protect may have been a major contributing factor to not only damages, but post-flood disillusionment and anguish. However, government must be willing to empower communities and provide resources for a more community-based and proactive approach to flood preparation, flood fighting, and recovery.

5.2.3.9 Behavior Dimension

This dimension included looking at respondents' social behavior during and since the flood, their individual coping (includes counseling), and if residents took measures to protect their property from flood damage.

5.2.3.9.1 Social behavior

When respondents were asked about the amount of contact that they had with their usual support networks within their communities during evacuation there was a wide range of answers in most communities- including *much* contact, *some*, *little*. And some individuals did not have a support network in their communities. Only the urban communities of St. Norbert and Kingston Row/Crescent had a high proportion of respondents who had *lots* or *some* contact with their support network.

In open-ended questions some respondents reported that a lack of support from their usual support network did pose a problem for them in terms of their own ability to cope. In some instances being "too busy", or neighbors/friends being "too busy" because of the flood was seen as the main reason for diminished social contact. In other cases, during evacuation and for those unable to return to their homes for protracted periods of time, residents were in accommodations far from other community members.

Other respondents felt that the flood had expanded their social network in the community because they had developed closer ties to neighbors through the disaster. In fact, Graph 122 shows that almost 70% of respondents actually felt that they had expanded their support network in the community because of the flood.

As per data discussed in Graphs 60 and 61, in this sample, over 65% of those respondents who claimed to have *lots* of contact with their support network reported that they had *not* experienced a rise in stress after the flood regardless of their community, while those with less contact had a proportionally higher incidence of stress.

5.2.3.9.2 Individual Coping Behavior

Residents were asked several questions related to coping with the flood event and its aftermath. First, they were asked if they had more trouble coping with problems that arose during the flood; this was asked again for the time period after the flood event (the flood event was considered to be over when the water stopped rising at their property).

During the flood, 36% of respondents reported more trouble coping with problems that arose; after the flood that number dropped to 24%. Some respondents did say in open-ended questions that very shortly after the flood event, their ability to cope returned to normal. What was most difficult for many residents (in this sample) post-flood, was the huge number of new and unfamiliar problems with which they now had to cope related to getting their lives back to normal. This, not their ability per say, was the problem.

Respondents in this sample who had more arguments *within* the family during or since the flood also showed a higher report of *trouble coping with problems* since the flood (almost double). There was no difference between respondents who had arguments *outside* the family and those who didn't with regard to ability to cope with problems that arose *since* the flood. This finding may emphasize the need to offer families emotional and psychological supports during and after a flood to help them adapt the post-flood situation.

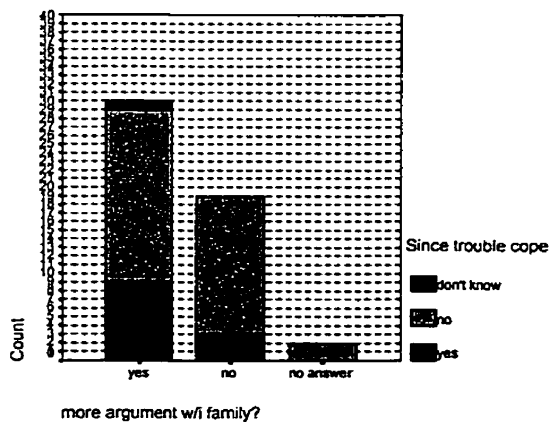


Figure 5.12–trouble coping with problems since flood by arguments within family

Among those respondents who had at least one family member (including self), that sought counseling, there were proportionally more respondents who did see positive outcomes from the flood than those who did not, and more who had injuries occur to some immediate family member as a result of the flood than those who had no family member injured.

As discussed earlier under Family Dimension counseling was sought almost twice as often by those residents who had increased family conflict than by those who didn't. Again this points to the need for support to flooded families, particularly in the months post flood to which this question pertained.

5.2.3.9.3 *Protection of Property*

Respondents were asked to indicate if they took action to protect their properties from the flood in 1997. All but one respondent had taken some type of action specific to protecting against the 1997 flood including, for example, building earth dikes on property, building sandbag dikes on property, pumping water away from home, moving articles/furniture off property, moving furniture/articles to higher ground.

Summary:

Seventy percent of flood victims that were interviewed felt they had expanded their social network in their community as a result of the flood experience, offering opportunity for strengthening community ties and cooperative community initiatives related to flood-proofing, planning, and response.

Also, while 98% of respondents engaged in behaviors to protect their property from flood damage, additional comments by residents showed that a lack of warning about their risk, lack of available resources such as volunteers to help dike or sandbag, and a lack of sandbags or trucks to haul sand were just some of the major barriers to effective action against the flood threat. These problems were a great source of frustration during and post-flood, and a source of dissension between citizens and officials.

Finally, comments by residents revealed that much of their difficulty in coping with flood-related problems was due to the number of and unfamiliarity of the problems to which they were exposed. Better future planning could anticipate the needs of flooded residents in the Red River Basin and offer improved and more timely solutions.

5.2.3.10 Dependent Variables

As shown in Table 3.2, there are several categories of variables proposed as dependent variables in this research. They will now be considered with observations on the information related to these variables that was collected in the surveys.

5.2.3.10.1 Stress and Stress Symptoms

While a multitude of symptoms may be considered signs of stress, in this study, stress symptoms are operationalized through several variables or characteristics. The following feelings/perceptions experienced by respondents during or since the flood were compared with their experience of these feelings/perceptions in the period prior to the flood: perceiving *more* stress, perceived *level* of stress, perceiving more trouble coping with problems, feeling more irritable, and feeling more depressed /unhappy.

In Graphs 13, 14 and 80 levels of reported stress for all respondents and in all communities are described. A vast majority of respondents had stress during the flood more than normal (92%); this was reduced post-flood to about half of respondents reporting increased stress levels (52%). Post-flood the highest levels of stress were in Ste. Agathe and Grande Pointe where half or more of respondents who had elevated stress were reporting *high* stress versus *moderate* or *low*. Interestingly, while many more respondents reported that they felt more stress during the flood (see Graphs 3 and 4) when compared to after the flood, the mix of stress *levels* was almost identical. That is, just over 60% of those with stress above pre-flood levels had *high* levels, about 24% had *moderate* levels, and roughly 14% had *low* levels—both during and post flood. The spread across the group of stressed residents was the same.

In considering possible independent variables impacting upon stress, the following was found in this sample. As noted earlier under Severity of Flooding, *during* the flood, the percentage of respondents that reported high levels of stress seemed to vary slightly with the level of water in the home. There was more report of *high* stress among those with first floor water than with water in the basement and even less among those with no water during the flood. Level of water among this sample of flood victims did appear to impact level of stress *during* the flood.

While after the flood, as noted above, less respondents still had increased stress, of those who did, over half of the ones that got water in the house reported levels of *high* or *moderate* even at the time of the interviews. And only 28% of those who had no water in their home still *had* stress above pre-flood levels 3-6 months post-flood, while 62% of those with basement water and 63% of those with first floor water still had stress levels above pre-flood levels. Water in the home did appear to result in ongoing stress *post-flood* in this sample as compared to no water in the home (with mostly reports of *moderate* and *high* levels of stress).

Perceived stress and level of stress were also considered relative to personal loss and more specifically *loss of irreplaceable items*. Stress was high for most respondents during the flood; it was elevated for 88% of those respondents that did not lose irreplaceable items and 93% of those who lost irreplaceable items. However, post-flood, only 22% of those with no losses of personal items had elevated stress while about 54% of those with losses of some type had stress. As noted earlier, type of loss (replaceable or not) did not appear to affect stress so much as losing personal items of some type.

Seventy-one percent of those respondents who reported increased conflict in their family since the flood (that they believed was due to the flood) also reported increased stress post-flood, while only 37% of those without conflict had increased stress post-flood.

Having clean-up to do post-flood was also considered relative to stress. The numbers of respondents without clean-up was extremely small, namely only 4/52 or 8%. At the time of interviews 31/52 were still cleaning up. And of this group, 66% reported post-flood stress continuing. Among those who had completed clean-up at the time of interviews, post-flood stress was occurring in less than half of this group.

Fifty-two percent of respondents felt they had adequate notice of the need to evacuate; 42% said they did not, and 6% didn't answer the question. While over 90% had higher stress during the flood, 75% of respondents who claimed to have increased stress of a high level *during* the flood did not feel they had adequate notice. Only 52% with high levels during the flood felt they had had adequate notice. As noted elsewhere, those respondents who felt they did not have adequate notice had more *post-flood* stress and were more apt (by over 15%) to have *high* levels of stress versus *moderate* or *low*.

Over 25% *more* respondents from families that made *more than one move* during evacuation had post-flood stress levels reported as *high* versus *moderate* or *low*. Those evacuated longer than 1 month were also more likely to indicate that they had increased stress post-flood compared to those evacuated for less time.

Data in Graph/Crosstabulation 30 shows those people who were stressed post-flood were equally likely to engage in community activism as those who were not stressed post-flood. Those who had not previously been involved in community activism and were not stressed post-flood showed a very slightly higher likelihood to engage in post-flood activism. Per Graph 36, Ste. Agathe had the highest proportion of respondents (7/8 or 88%) involved in addressing a community problem. Provision of services to victims/volunteers was the most common community activity noted by the entire sample, followed by membership in a generic resident committee to look at flood-related issues.

While 46% of all respondents who answered the question said they did not feel heightened stress post-flood, of these 25% were still *considering or planning to move*. Of those 52% with increased stress post-flood, 42% were planning/considering a move.

Stress was slightly higher during the flood among those respondents for whom it was not the first flood than for those for whom it was a first flood. And the former also had more report of *high* versus *moderate* or *low* levels of stress during the flood.

When answers to questions related to respondents' contact with their support networks within their community were reviewed, those with less contact did have more incidence of stress occurring but the *level* of stress (high, moderate or low) did not obviously vary by amount of contact with the support network.

Trouble coping with problems that arose was considered under Stress and Stress Impacts. During the flood, 35% of respondents said that they were having trouble with problems that arose. After the flood 23% reported problems coping with problems that arose. Respondents with previous flood experience reported slightly better coping *during* the flood than those without previous experience but slightly less better coping with problems *post-flood*. Trouble coping with problems was also reported more frequently in families who were also reporting more arguments within the family.

Irritability (considered as a stress symptom) in the period post-flood was examined. Thirty-eight percent of respondents said that they had post-flood irritability more than prior to the flood, and 62% did not have increased irritability. As noted earlier 43% of those with more *irritability* also had more *arguments within the family* during or since the flood. And 50% of them had more *arguments outside the family* than prior to the flood.

Feelings of depression/unhappiness were considered as a symptom of stress. However, the question was somewhat problematic. During interviews it was found that several respondents felt uncomfortable with the word "depressed" and refused to answer the question, or were willing to respond to the word "unhappy" with an affirmative answer but not the word "depressed". In all cases it was male respondents that had this difficulty. Thus this question was omitted from further analysis except to note that of those respondents who answered the question, thirty-seven percent of respondents said yes to

depression and unhappiness post-flood above pre-flood levels; 62% said no. Of those with losses of some type during the flood, 43% had post-flood depression while only 10% of those who did not sustain losses had increased depression post-flood as compared to prior to the flood.

Concluding Remarks Related to Stress and Stress Symptoms:

Most respondents, (over 90%), had experienced elevated stress during the flood and over 52% post-flood (see figures below). Many expressed concerns about the impact of stress on their families, on children, and on other members of their extended family or community.

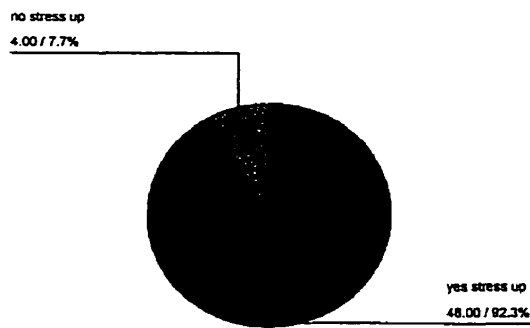


Figure 5.13-- respondents reporting stress above pre-flood levels during flood

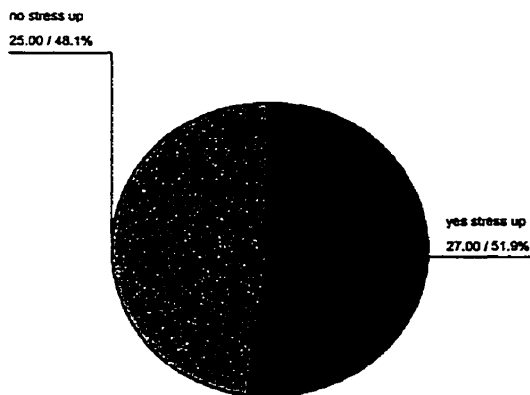


Figure 5.14- respondents reporting stress above pre-flood levels post-flood

It is evident that information about stress gathered from this sample of flood victims gives clues to important considerations for decision-makers to be aware of if they desire to reduce negative impacts from future floods. Not surprisingly, in the sample of residents surveyed, higher water levels meant higher levels of stress during the flood. Once the event was past, only those who were exempt from damage or losses had very low incidence of post-flood stress. Information from this sample also suggested that stress may have been experienced more by those who ultimately lost personal items (and not only a home). More effective planning for protection of personal items may be warranted for people living in a floodplain.

While about half of respondents felt that they had adequate notice of the impending flood, those who did not had higher *levels* of increased stress during the flood and post-flood. Overall, number of days of warning was less related to stress in this sample than was the perception that *adequate warning* had or had not been received. During survey administration, it was left to the respondent to interpret what was or was not “adequate notice”. Because the questionnaire was done post-flood and so requiring the respondent to think retroactively about the adequacy of warning, there may be multiple other variables biasing the results such as amount of damage sustained or their feelings about their municipal authorities etc.

Most respondents did some type of clean-up post-flood; however, those who had continuing clean-up at the time of interviews were twice as likely to report stress post-flood pointing to the impact that a protracted clean-up period has on flood victims. Respondents also reported that a huge additional stress was health concerns such as those related to black mold; these fears were enhanced when EMO was slow to make decisions about whether the resident must rebuild or tear down his/her home. In some cases, families started to rebuild at considerable expense only to find that there were mold problems which required tearing down their new construction. Others had family members, particularly children and newborns, about whom there were concerns related to allergies or asthma due to mold / toxins left from the flood. Some families employed

clean-up companies who were endorsed by their municipal authorities to do disinfecting of their homes, only to find later that it had been improperly done and needed to be repeated at considerable inconvenience and expense.

With regard to considering or planning to move from their home, many more with post-flood stress answered affirmatively to this question, and even 25% of those with no post-flood stress were considering/planning a move. There is no doubt that the flood experience, even for those with minimal damage or stress, affected people's desire to stay in a home or community. Those residents whose properties flooded in 1997 were then twice as likely to be concerned about future property values than non-flooded residents.

As noted elsewhere the arguments outside the family were often with people whom victims felt had misconceptions about their circumstances or with EMO regarding compensation. Government clearly can have a role to play in the portrayal of victims' plight to the non-impacted public, and in streamlining the damage claims process and the provision of recovery services such as counseling, respite, or clean-up assistance.

Irritability as a symptom of stress was seen in 38% of respondents even post-flood. High numbers of those reporting more irritability post-flood than prior to the flood also had arguments both *within* the family and *outside* the family. Thirty-seven percent of respondents also had post-flood depression/unhappiness, and there was a much higher proportion of residents with depression/unhappiness post-flood among those who sustained losses. There was also more report of stress post-flood in individuals who reported more family conflict.

While many respondents were aware that their properties could not be "saved" from damage in 1997, they did feel that the recovery process could have been greatly improved to lessen stress. In fact, some respondents maintained that the flood was in some respects easier to cope with than the poorly executed disaster recovery process.

Overall, there was evidently a wide range of negative impacts to individuals and families after the 1997 flood. This reiterates the need for a victim-friendly disaster recovery process, one that is well conceived and executed, and meets victims' needs.

5.2.3.10.2 *Psychosocial Symptoms of Distress*

This category of dependent variables contained responses to questions about feelings/beliefs related to *sense of control over one's life*, *confusion*, *fear*, *sense of dependency on others*, and *anger*. Respondents were asked if they experienced those feelings and to what degree. They were asked to reflect on these feelings at the peak of the flood, and were asked separately how they were feeling at the time of the interview.

With regard to sense of *control over one's life*, as noted in Graphs 101 and 106, there was a wide variety of responses from respondents ranging from *none* to *extremely strong* sense of control, both during and after the flood (considered in two separate questions). What was evident in this sample was that the proportion of respondents reporting that they felt *no* control *during* the flood was lower when compared to *after* the flood, and there were 10% more with extreme sense of control post-flood. Interestingly, several respondents indicated that they felt even less control *after* the flood than during because of the need to rely on EMO to provide compensation, and uncertainty about the outcome of that process. These were people that found the compensation program very difficult and stressful to access. For some of them, reliance on others, particularly for compensation or special social services (such as grocery money) was also difficult.

Responses to the question about feeling *sense of dependency on others* were also reviewed. Overall more feelings of dependency existed at the peak of the flood than at the time of the interviews (three to six months post-flood) (see Graphs 104 and 107). Feelings of dependency did, however, remain quite high after the flood. As evident in Graph 113, it also seemed that those respondents with damage to home or property gave more report of feeling dependent than those who did not receive damage after the flood. Comments by respondents would tend to confirm this observation; several felt that

waiting for EMO to respond to their damage claims, particularly if they could not begin to rebuild without EMO's approval, made them feel highly dependent.

Further information related to feelings of *dependency* gleaned from respondents included comments that they felt that the processes set up for accessing help fostered dependency, through excessive slowness and inappropriateness. For example, one woman reported that when she legitimately needed available grocery money over a protracted period of time, every time she went to get assistance (with her children), she had to review their whole situation again including the flood damage they sustained, what was happening in terms of disaster assistance, and justify her need for the grocery money. Going to get grocery money, she reported, was so stressful that she felt re-traumatized.

Related to this were comments to the effect that area residents that had not sustained any, or much, damage used the emergency social services system inappropriately; that is, they took more than their fair share of support services and free goods. The result was that those that truly needed the help had to excessively justify their need especially as over time there was more general suspicion that some people were 'milking the system'. Some respondents spoke of feeling "embarrassed" and "humiliated" not only because they were dependent and needed the help, but also because they felt under suspicion.

With regard to feelings of *confusion*, one quarter of respondents had *extreme* feelings of confusion at the peak of the flood, a third had *no* feelings of confusion and the rest ranged in between. Post-flood, at the time of interviews, confusion had dropped considerably with almost half reporting *none* and only 12% reporting *extreme* confusion. Again, the respondents with *extreme* confusion were primarily those who were engaged in dealing extensively with EMO, trying to get confirmation of their disaster compensation or, in some cases, trying to find out if their homes would be salvageable or would need to be torn down and rebuilt.

Feelings of *fear* were prevalent among respondents both at the peak of the flood and afterwards. The numbers of respondents reporting *extreme, quite a bit* or *some* fear during

the peak was 50%; after the flood it was 34%, with the biggest decline in numbers being in the *extreme* category. Much of the *fear* post-flood, according to respondents, was due to the losses they sustained and fears that they would not be adequately compensated or be able to have their lives return to normal in the near future.

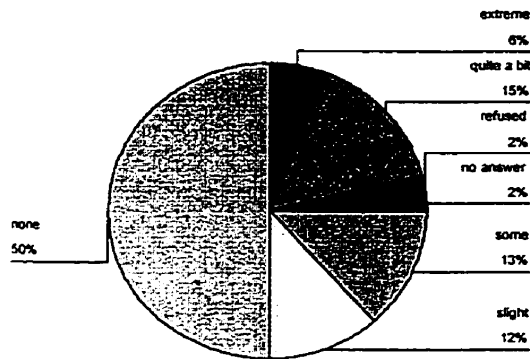


Figure 5.15- respondents' "fear" at time of interview

Anger was a prevalent emotion presented during the interviews. When respondents were asked about their experience of angry feelings both during and post-flood, there was no great difference in the overall numbers reporting anger in general. It was about 45% who stated that they felt anger both *before* and *after*. While "extreme" feelings of anger were twice as common during the peak as after, it is noteworthy that 19% of respondents still were experiencing *extreme* feelings of anger up to six months post-flood. Much of that, some of them claimed, was due to the protracted, difficult, contradictory and unfair compensation process that they had to endure. In answers to open-ended questions, respondents shared that their anger was related to a multitude of factors ranging from not only the EMO process, but also concerns about the cause of the high water levels (were they higher than natural levels because of the operation of the floodway?), perceived insensitive comments by government officials and poor management of resources for flood fighting.

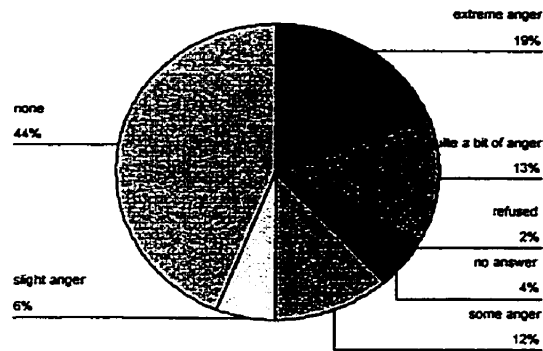


Figure 5.16- respondents' "anger" at time of interview

Some expressed a need and desire for counseling for themselves or other family members but were uncertain about how to pursue it, and what to expect. Some were so overwhelmed by their feelings and the symptoms of distress that they were experiencing that they didn't know to whom to turn. They believed that they had asked so much already of personal friends and extended family that they simply could no longer continue to ask for help. During the interviews there were several reports of feelings of hopelessness, lost tempers, increased alcohol consumption, troublesome behaviors in adolescents and children (although these questions were not formally asked). Many families interviewed appeared loath to have the interview end. Several families were given numbers to call for emergency crisis intervention or mental health counseling. Later some families let the interviewer know that they had in fact called and received assistance.

5.2.3.10.3 *Physical Health Impacts*

It is evident through the graphs below that survey respondents overall had a decline in *general health* status when comparing before the flood with after the flood. This is however based on their self-report with associated bias, particularly to trying to recall their health prior to the flood. Overall, 31% (16/52) of respondents reported a decline and 4% (2/52) an increase. Health was ranked using "excellent", "good", "fair", and "poor" as

the major categories. The greatest changes in health report was a decline in the number of respondents saying their health was “excellent”, and a large increase in respondents stating their health was “fair”. Approximately one third of those who were in “excellent” health fell to a lower category and about one third of those with “good” health fell to lower categories. See figures below. Decline in health was more prevalent in respondents with *damage* versus no damage but not necessarily in those with higher levels of damage in dollars (Graph/Crosstab 27), or those with longer clean-up periods (Graph/Crosstab 28).

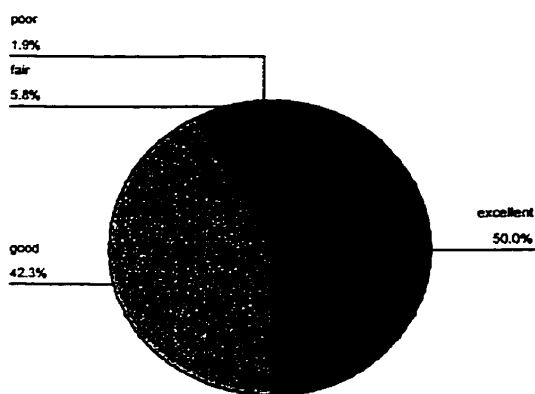


Figure 5.17- general health before flood

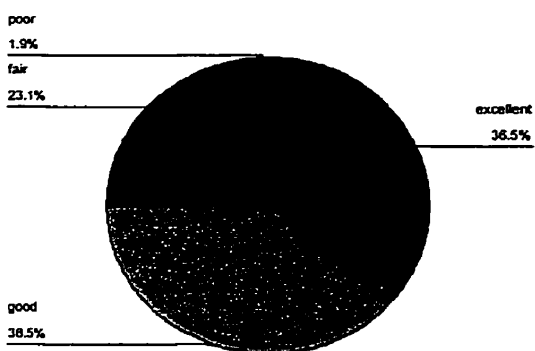


Figure 5.18- general health since flood

However, in this sample, 48% of those who reported a “*loss of household income*” –for example through lost business activity or wages- did report a decline in health from

before the flood to after the flood, compared with the 31% of the entire sample who had a decline in health. This is consistent with comments about the enormity of stress from income related losses from the flood. This issue may be one that should be further examined in assessing the impacts of a flood on families.

When looking at *general health* relative to the *loss of personal items*, those nine respondents who had no losses whatsoever also reported no decline in health after the flood i.e. 100%. Of those with losses which were not irreplaceable (i.e. not of high sentimental value) 33% had a decline in health and 7% an increase, and of those with loss of irreplaceable items 44% had a decrease in physical health and none an increase in health. Overall, those respondents who had actually sustained losses, and most particularly those who had sustained losses of *personal items*, had higher reports of physical health symptoms. Those with more *severity of damage* as measured by dollar amount of damage did not show any increase in physical health symptoms.

When change in *general health* was considered relative to length of *evacuation*, there was no evident difference in those respondents with shorter versus longer lengths of evacuation.

As shown in Graph 123, a Crosstabulation (of health before and after the flood by stress since the flood) shows that 11/27 or 41% of those who indicated that they had increased stress post-flood (as opposed to before the flood) had declining health, while only 16% of those with no stress increase post-flood had a decline in health comparing before and after the flood.

Data was also collected on a wide range of physical health symptoms. A range of respondents from between 76% and 17% had an increase in all of the six physical symptoms/ailments studied – namely, chest pain, dizziness/lightheadedness, tingling/numbness in extremities, change in appetite, excessive tiredness, digestion problems - as compared to before the flood. They were experienced either during or since the flood (“during” and “since” the flood were not separated in this question). Excessive

tiredness was the number one symptom, with 76% reporting it, followed by appetite change, dizziness and digestion problems. Next were tingling/numbness in extremities and finally chest pain, the latter at 17% of respondents.

Given the large numbers of physical symptoms among respondents, it is not surprising perhaps that when respondents were asked if there were family members physically “injured” in the flood, 32% said yes. Respondents were left to interpret the question broadly if they chose. The types of injuries reported in the open-ended question on injuries were varied, ranging from muscle strain, chest pain, to anxiety symptoms . In this sample a greater number of respondents who had someone in their families (i.e. not necessarily themselves) *injured* in the flood reported that their own stress level post-flood was higher than prior to the flood, as compared to respondents who did not have a family member injured.

Two independent variables were considered relative to some of the specific physical health variables (loss of irreplaceable items and damages). For instance, when looking at loss of irreplaceable items, (thought to perhaps increase stress and stress-related symptoms in some individuals), it was seen that dizziness was experienced much more in those respondents who had not only lost personal effects, but was even higher among those who had lost *irreplaceable* items (when compared to those who sustained no losses). Also, more than double the number of respondents who had lost irreplaceable items also reported tingling / numbness to the extremities when compared to those with no losses. Digestion problems were seen most in those respondents reporting loss of irreplaceable items, somewhat in those with loss of replaceable items, and least in those with no losses.

Excessive tiredness was seen across all categories of respondents. When looked at relative to damages, there was no difference in the response of interviewees to the question of tiredness based on amount of damages; in fact, those with no damages to home and property were reporting similar levels of tiredness during and post-flood as those with damages.

In fact, when all six physical health symptoms were examined relative to damages there was no evident difference in the responses of interviewees related to the dollar amount of damages they sustained or if they sustained none. Of the 13 respondents who had no damages at all, one or more of them had each of the physical health symptoms, and in roughly the same percentage as many of the groups with varying levels of damages.

5.2.4 Qualitative Data Analysis

An extensive presentation of all of the qualitative data collected is beyond the scope of this study. However, several issues were raised by a number of respondents that reveal much about their experiences in 1997 and the problems that they faced. Those mentioned here should be of relevance to decision-makers as flood management plans evolve in the region.

There was a lack of resources needed to prepare for the flood waters. This issue was mentioned by over 1/3 of respondents. Most lacking were sandbags, sand for bags, and the labor required to build dikes on private property. Coordinating resources (e.g. labor and sandbags simultaneously) was often impossible and contributed greatly to frustration. A few residents made mention of being told they were not a priority for resources such as sandbags, yet by waiting they ended up with significant damages. Some who built dikes did not know how to do them properly; in some areas arguments broke out between neighbors about the proper way to construct them.

A purchase order system to distribute sandbags where individuals were given numbers and stood in line was seen as a failure by over 10 respondents, and there were accusations of preferential treatment for some (i.e. some got resources without waiting in line), mention of the “sandbag wars” which divided communities, and poor organization.

Certainly lack of leadership, foresight, and planning was seen as a prevalent problem both at the municipal and provincial levels of government. A frustrated resident claimed that

he had “over-estimated EMO’s (and the Natural Resources Department’s) ability to gather information and to decision-make”. In addition, getting information about risk and how to prepare for the flood was difficult, and some respondents felt that they received conflicting information from different sources, and were suspicious that some information about what was transpiring may have been deliberately suppressed by some agencies/departments. One person claimed that “we kept being assured that we would not flood; even when we were evacuated we were told our properties would not flood”. But flood they did.

There was also confusion about which department or agency had most authority during the flood (e.g. Water Resources Branch, EMO, or military personnel). Five respondents claimed either the Water Resources Branch of Manitoba Conservation or EMO misjudged the flood situation or gave out erroneous information. One expressed frustration as he recounted that he had got into a disagreement on the telephone with one employee of a government agency when he was telling them of the three feet of water against his dike. The person on the other end of the phone insisted there was *no* water against his dike. They only believed him when they arrived at the property and saw it for themselves.

A number of respondents to the survey described feeling abandoned or betrayed by the provincial government, particularly as time passed. Then-premier Gary Filmon made a comment that offended no less than 10 respondents, a comment in which they felt he was blaming them for choosing to live outside the floodway in an area at risk for flooding. One respondent accused Gary Filmon of a “blame the victim mentality”. The comment by Mr. Filmon was described by a series of interviewees as “callous and insensitive”; “despicable”; “lacking in respect for constituents”, and as “ridiculous”.

The prevalent belief that some of the people living outside the city had moved there merely to achieve lower taxes was mentioned by several indignant respondents who forcefully claimed they live in their communities because of the enhanced lifestyle and not to save tax dollars.

In some communities respondents felt that there was not enough warning of the imminent flood, and four people commented that if they had not personally been proactive in demanding answers regarding their risk they would have had even greater losses. Some respondents to the survey felt that there was also not sufficient notice of the need for evacuation. Five respondents went on to say that in another flood either they or others in their neighborhood would not evacuate (even when told by authorities that they must) because they felt that their homes may not have flooded in 1997 if they had been allowed to remain to protect them. One angry resident expressed this view by saying that he had evacuated because he thought it was “mandatory and enforced”-- only to find out that it was not enforced, and that some who defied the evacuation order managed to save their homes through their personal efforts.

Another issue raised by seven respondents was a belief that the flood was not entirely a “natural” event. One respondent said it was “man-assisted”. A sentiment existed that the actions of humans were contributing to flooding in some areas- actions such as cutting roads, opening culverts, or overall changes to natural drainage patterns over the landscape. Resentment that some activities resulted in rural communities being sacrificed because their waters rose disproportionately as a result of activities to save the city was mentioned by 10% of respondents. One interviewee claimed that “Gary Filmon didn’t care as long as the city was protected”.

Feelings about the army’s help were mixed and seemed to vary by community. Six respondents were disappointed in the role of the army, feeling they were deployed too late, were restricted in the help they were willing to offer, and played mainly a policing role.

Several respondents also raised the issue of “checkpoint” conflicts. Residents who wanted to return to check on their properties after the area had been evacuated often ran into problems and were denied access, which they felt was unwarranted. There was a feeling that protocol for re-entry into flooded communities was inconsistently applied and

unpredictable. People often wanted to participate in property patrols but had difficulty convincing authorities to allow them. One respondent observed that once city department workers become exhausted they were more apt to allow residents to help. People resented being excluded when it was *their* homes at risk.

Childcare was a problem for six respondents either while preparing for the flood or in needing help or respite post-flood. Six others encountered either billeting or flood voucher problems during their period of evacuation. Seven were concerned about excessive abuses of the free services to victims, and that those providing social services were not diligent enough about assessing eligibility and then ensuring the most needy had easy and low-stress access to necessary services.

The media was heavily criticized by 10% of respondents. Their role was of potentially great importance in communicating vital information to a broad audience. People felt they could have been better used to help not only with the emergency phase of the flood event but also with recovery. Concerns related to the media included that they promoted the political agenda and failed to provide the “whole picture” regarding the flood of 1997. They were also criticized for focusing on the City of Winnipeg in their reporting and minimizing rural concerns. One respondent said the media relied on “sensationalism, didn’t tell the whole story, or clarify the total numbers of people impacted”. Another claimed “ the media was used by the government to sway public opinion, and to blame (rural) communities for their flooding”.

During recovery, residents of the flooded communities faced a number of challenges. A few found that concerns about health issues (such as if their homes were contaminated by mold, or that fuel spills made the home permanently unlivable) contributed enormously to stress. Fears for their family’s safety were very real. Delays as Public Health and EMO had to coordinate their assessments of the home were difficult to accept.

Some respondents had to deal with very unsympathetic employers, and lost their jobs or were demoted when required to take time from work to deal with the demands of the flood.

Life disruption of all types was prevalent and very difficult for residents; this was compounded by the enormous financial strain placed on many families who suffered significant damages. The flood event and its impact was summed up by one family—“we will never totally recover---there will always be holes in our life and lost time...irreplaceable time and irreplaceable items lost”.

Finally, a great challenge for flooded families was in dealing with EMO. More respondents noted problems with EMO than any other single issue that was raised. There were several areas of concern. The first area was related to how respondents felt they were treated in dealing with EMO. There were complaints about the assessors' lack of training and unpleasant attitudes, and dissatisfaction with having individual files moved from person to person so that it was difficult to get consistency and to get answers to questions. Some people perceived that EMO employees were afraid to offer assurances to flood victims about coverage because they were fearful of getting into trouble, so there was a feeling that the department lacked a sense of commitment to those needing their assistance. It was perceived that the whole process was very impersonal.

There were problems at a practical level- such as confusion with the often changing eligibility requirements and specifics of coverage, and much frustration and increased stress with the long delays in processing. People perceived EMO as ill-prepared, lacking organization, inconsistent, and at times baffling in their policies. EMO's approach to assisting flood victims was summed up this way by one resident—“EMO's follow-the-book attitude was not appropriate in crisis circumstances, causing extensive delays”.

There is no doubt that the flood of 1997 taxed both practical and human resources in Manitoba, and provided an opportunity to promote either cohesiveness or (conversely) divisiveness among Manitobans. By applying lessons learned in 1997 to future flood

management planning, preparation and mobilization of resources could be greatly enhanced and the needs of residents better addressed.

5.3 Conclusion

The exploratory data on psychosocial impacts reviewed here has highlighted the fact that impacted residents experienced stress symptoms, psychosocial symptoms of distress, and physical health impacts in 1997. To minimize negative impacts on residents in the future, decision-makers considering flood management alternatives should be aware of the general nature of these impacts, what factors appear to contribute to them, and what resources might mitigate them. The following chapter identifies factors of social significance when considering flood management alternatives, and organizes the wide range of reported impacts in the survey into major themes, which are of particular importance to making effective decisions. Six social criteria are then provided for use by decision-makers.

CHAPTER 6: SUMMARY, RECOMMENDATIONS AND CONCLUSION

6.1 Summary

This study was initiated to generate social criteria for use in making flood management decisions. A survey of residents within and south of the city of Winnipeg on the psychosocial impacts of the 1997 flood provided the primary data used to determine the social criteria. The data was considered in the context of information gathered on flooding and flood management in Manitoba, and information specific to the 1997 flood (as reviewed in Chapter 4). The information that ultimately was most critical to the selection of social criteria for use in decision-making appears below organized under the Objective to which it relates. The six social criteria are then presented and discussed, followed by a brief presentation of some other empirical findings, recommendations for further research, and a final conclusion.

Objective 1 was to overview the characteristics of flooding along the Red River in Manitoba and the flood control system. In fulfillment of this objective, seven factors of social significance emerged which were considered important when deriving social criteria for use in flood management decision-making.

1. Large magnitude floods are likely to continue to occur in the Red River Basin and communities must prepare.
2. Floods in this region are slow moving which allows for preparation provided that the institutional and infrastructure supports are available to residents/communities.
3. There are numerous authorities and various institutional arrangements at different levels of government, all of which are important to flood planning, management, and recovery. There is a resulting decision-making process which is complex, inefficient, potentially inconsistent, and which reduces accountability.

4. Government permitting ongoing development in flood prone areas, and heavy reliance on structural flood control measures in southern Manitoba has contributed to citizens' denial of flood risk.
5. Non-structural measures like zoning and land use regulation and enforcement, flood-proofing programs, and warning systems have been under-utilized to date.
6. Uncertainties in prediction of flood events continue to exist.
7. Traditional benefit/cost analyses have been and continue to be used as the primary tool in flood management decision-making.

Objective 2 was to describe the 1997 flood including flood management activities during the event. It revealed several important social considerations for use in future decision-making.

1. Structural measures have technical limitations that must be prepared for in assessment of flood risk.
2. Evacuation, while stressful and problematic, is an essential step in ensuring human safety during a flood.
3. Monetary damages from successive floods continue to climb.
4. Understanding of flood "risk" and communication of "warning" of an imminent flood are key issues to be addressed.
5. Decisions made by some local municipalities in 1997 were contrary to emergency preparedness practices, partly due to lack of knowledge, training, or experience of local decision-makers.
6. Three years post-flood there are still some outstanding flood recovery issues for some families, and outstanding disaster claims settlements.
7. Three years post-flood, several at-risk communities are still without completion of planned community defense systems.
8. Residents south of the city remain concerned that their properties may be *sacrificed* to save the City of Winnipeg in future floods without any type of consultation occurring.

Objective 3 was to overview psychosocial impacts of the 1997 flood on victims in selected communities using the survey results obtained from residents interviewed. The following crucial observations, related to reducing negative psychosocial impacts, were made evident in analyzing the data from the survey.

1. Psychosocial impacts of the flood, as manifest by reports of increased stress, psychosocial symptoms of distress, and physical health impacts continued among victims into the period 3-6 months post-flood.
2. By three to six months post-flood, some individuals and families felt abandoned by non-victims, authorities, and others.
3. Many residents want to remain in their communities provided there are appropriate supports to manage their personal and community flood risk.
4. Ninety-two percent of all respondents had stress above pre-flood levels during the flood, and 52% had increased stress levels post-flood. Among the survey sample, the following appeared to be associated with increased stress (i.e. above pre-flood levels), or with a higher reported *level* of stress either during or post-flood:
 - a) water in the home
 - b) higher levels of water
 - c) sustaining damages
 - d) lengthier clean-up period post-flood (especially 2+ months)
 - e) personal losses (i.e. of personal items) of some type
 - f) longer evacuation periods (particularly beyond 1 month duration)
 - g) more than one move during evacuation
 - h) loss of household income due to flood
 - i) injury to someone in immediate family directly attributable to flood
 - j) prior experience with floods
 - k) lack of awareness of risk
 - l) less contact with usual support network within the community
 - m) increased conflict in family believed to be due to the flood
 - n) respondent feeling they did not have “adequate notice”

5. Specific Stress Impacts (trouble coping with problems; irritability; depression/unhappiness) seemed to be related to the following factors in this sample of flood victims :
- a) *Trouble coping with problems* since the flood associated with an increase in:
 - arguments within family
 - b) *Irritability* associated with
 - arguments within family
 - arguments outside family
 - c) *depression / unhappiness* associated with
 - loss of personal items
6. Specific Psychosocial Symptoms of Distress (sense of control over one's life; sense of dependency on others; confusion; fear; anger) were considered and the following observations made from responses in this sample:
- a) lack of sense of control over one's life
 - increased for some post-flood, identified problem was compensation and formal recovery process
 - b) sense of dependency on others
 - levels of dependency were high during and post-flood, declining somewhat post-flood
 - sense of dependency was higher among those with damage to home/property
 - compensation/recovery processes exacerbated feelings of dependency post-flood
 - c) confusion
 - dropped significantly post-flood, except where problems existed with compensation or other recovery activity (particularly activities under EMO direction)
 - d) fear

- common during and post flood, with the latter due to fear of not being adequately compensated and able to re-establish “normal life”

e) anger

- prevalent during and post-flood although less report of “extreme” anger post-flood
- main causes of anger were EMO process, perceived lack of warning, questions about why water levels exceeded “natural” levels in some areas, insensitive comments by others, and lack of available resources when needed during flood

7. Thirty-one percent of respondents to the survey had a decline in general health status pre-flood to post-flood. It was noted that :

a) The report of decreased health was higher among respondents also experiencing

- loss of household income
- loss of personal items

b) Decline in general health and increased stress post-flood often were reported simultaneously

8. A range of respondents, from 17% -76%, had an increase in all of the physical health symptoms considered (chest pain, tingling in the extremities, digestion problems, dizziness, appetite change, and excessive tiredness). Symptoms did not appear to be related to amount of damages incurred (in dollars).

9. Final observations related to survey data:

- Perceived ability to cope with problems during flood (but not post-flood) was enhanced by prior flood experience.
- Community activism related to flood was more evident in those who sustained damages.
- There was a wide range of responses within each community as to how much warning (in days/weeks) individuals received about the flood.

- Many people had experienced floods previous to 1997 yet said they were unaware in 1997 that their property was at risk, an inexplicable contradiction.
- Counseling was sought by at least one immediate family member in 25% of respondents' families and was more common in families experiencing an increase in general family conflict, arguments within the family, and arguments with people outside the family.
- Respondents generally felt more support from their communities than from provincial government, and those in Grande Pointe, Ste. Agathe and St. Adolphe felt appreciably less support from government than other communities.
- In Ste. Agathe, Grande Pointe, and among farmers many respondents reported less than one week warning of the flood.
- *High* post-flood stress level (versus *moderate* or *low*) was seen proportionally more among respondents in Ste. Agathe and Grande Pointe (more than 50% reported *high* stress).
- Ste. Agathe had the most post-flood activism (in the form of addressing community concerns related to the flood).
- Planning/considering a move was more prevalent among those with post-flood stress.
- Respondents reported they were generally unaware of flood risk in all communities except St. Adolphe and Red River Drive.
- Although 20 respondents had businesses directly impacted by the flood, only two (farmers) intended to relocate/close/sell their business.
- Those who had at least one family member "injured" in the flood were less likely to report positive outcomes from the flood experience.

6.2 Social Criteria

Objective 4 was to develop a list of social criteria applicable to Multi-Criteria Decision Analysis for use in evaluating alternative flood management strategies. Determination of a set of social criteria to be used in decision-making required that the nature of psychosocial impacts, and ways of potentially mitigating them, be carefully considered in light of information and understandings attained through flood victim interviews in 1997. Recurrent and/or highly relevant concerns were identified and will be

noted under the selected social criteria intended to address the concerns and reduce future hardship. The number of social criteria was kept to a minimum in hopes of concisely presenting a set of criteria which, if used in MCDA, could significantly reduce negative psychosocial impacts when used in evaluation of flood management alternatives. Noted under each criteria are the three stages of flood management, with asterisks to show the degree to which the criteria has implications at that specific stage in planning (* - low applicability, ** - moderate applicability, *** - high applicability).

6.2.1 Criteria 1

Maximize community level involvement in all stages of flood management planning

Applicable to the following stages of flood management:

- Planning ***
- Emergency Response *
- Recovery **

This criterion is designed to address a number of themes that emerged throughout this study. The first theme was the existence of social and institutional barriers to residents and communities taking responsibility for their flood preparation and response. Prior to and since the 1997 flood, the provincial government as an institution continues to take leadership in flood preparation and response, largely to the exclusion of communities and residents. Public consultation has consisted primarily of forums, where government recommendations are reviewed rather than creatively and jointly derived with communities. As was seen in 1997, government assuming responsibility for future flood management planning implies to some flooded residents that government should be held accountable for failures or inadequacies in planning that may have contributed to heavy losses. Three years after the 1997 flood this is still a contentious issue for some residents, and contributes to ill-feeling towards government.

Another issue that exists is that of government's heavy reliance on structural measures in flood management and use of traditional cost-benefit analysis. A more holistic approach to flood management could allow for adoption of more creative solutions to flood risk including use of nonstructural measures. It could mean inclusion of less tangible cost and benefits in determining the best course of action in flood protection through broader stakeholder involvement. Community level involvement in flood management can better allow for these, as well as promote a broader set of adaptations to living with the threat of flood. Community level planning may also reduce the danger of creating a false sense of security as evident in the past through excessive reliance on government and upon structural solutions. When considering this in the context of information from respondents to the survey, residents impacted by the 1997 flood felt that they were not truly aware of the risk to their property, were not adequately warned of the impending flood, did not understand the implications of some government communications and actions in relation to the flood, and felt that they, their communities, and local governments were ill-prepared for a flood. They also felt at the mercy of bureaucratic inefficiencies and errors both during and post-flood.

Community level involvement in flood planning would allow for both formal and informal learning (including inter-generational) about flood events and those variables influencing flood outcomes, clarify uncertainties in prediction, and allow for individuals and communities to manage their own risk in making decisions both at times when there is no imminent flood, and in a flood crisis. It allows those with prior flood experience in communities to offer their expertise and provide an impetus for future preparations.

Community level flood management, especially in the planning stage, would allow for consideration of the "what if" scenarios which abound during a large, often unpredictable, natural disaster. Residents could look at equity issues such as the one that arose in 1997 over "saving" Winnipeg at the expense of some communities south of the city. Such difficult circumstances and difficult decisions may sometimes be anticipated in planning, and a response prepared.

A community that is involved in an ongoing appraisal of flood readiness is also capable of faster and more effective response to a flood emergency and can have a range of plans to access the needed resources to prepare for the flood. In 1997 the lack of available resources such as sand, sandbags, trucks, and volunteers was a source of great stress, anger, and confusion for residents as they tried to prepare. Community level planning could ultimately reduce the overall damages because of the improved response time, and also because community members have an intimate knowledge of the community. Community members better understand the needs of local people, any unique problems which must be addressed, and have a vested interest in seeking the best solutions to anticipated or actual problems in a flood emergency.

“Buy-in” to emergency response plans will be more evident in community conceived and endorsed plans; this may be crucial to reduction of damages or prevention of loss of life during a flood. For example, some victims of the 1997 flood said that they would not evacuate in a future flood; therefore, it is important to involve them in developing evacuation plans and procedures to solicit local support for evacuation plans when required.

Community level planning as it relates to recovery is very important to the reduction of some of the negative impacts of disasters. Communities can anticipate post-flood needs of their citizens much more effectively than non-local agencies, and help citizens with the formalities of disaster assistance, streamline provision of necessary services, and advocate for necessary assistance.

To summarize, this social criteria - to maximize community level involvement in all stages of flood management planning - will facilitate more timely and comprehensive emergency operations and recovery in individual communities. It will encourage “buy-in” to flood management plans as developed by the community in consultation with authorities, maximize local leadership and responsibility for floodplain management and flood planning, reduce sense of dependency on others, and enhance feelings of control related to flood planning, operations, and recovery. It will also ensure ongoing

information and technology exchange related to flood damage mitigation, and encourage intergenerational awareness of risk and the need for preparation (even when there are extended periods in which no flood occurs).

6.2.2 Criteria 2

Maximize effective communication regarding flood risk and planning

Applicable to:

- Planning **
- Emergency response ***
- Recovery **

This criterion is essential in evaluating potential flood management strategies at all three phases of flood management. Because flood management decisions and the ensuing activities are interventions into social systems, “communication” is of immense importance to promote government actions that respond to the needs of residents and to ensure that residents and communities take necessary action to best protect life and property. Some of the criticism directed at government in 1997 had to do with poor information flow to communities and a general lack of clarity about the roles (and authority) of different levels of government or different agencies.

In the *planning* stage of flood management communities should be actively involved. This requires establishment of a communication network between residents and all levels of government. Communication of community knowledge and concerns can result in planning that is more comprehensive and more likely to be endorsed by communities.

During the *emergency* stage of a flood disaster, it is particularly important that communication is consistent, clear, and timely if damages and injuries are to be minimized. In 1997 there was a high level of confusion among residents in the sample about what they perceived to be warning of an imminent flood, about what constituted official warning, and about whether they had received an “alert notice” of evacuation. Members of the same community, when interviewed, often had very different responses to the questions related to communication of risk, and the number of days of warning

regarding evacuation that they had. Such inconsistencies emphasize a need to improve communication both between authorities and communities, and within each community.

Communication mechanisms and procedures should be put into place to clarify what types of warning will be provided in the event of an imminent flood, how far in advance, and what it will mean to individual families. This is essential to reducing stress related to inadequate warning or countering a lack of knowledge concerning risk. The information must come from a source that is considered reliable by the message recipients, and must be consistently distributed and therefore verifiable by community members.

During the *recovery* phase following the 1997 flood, communication was at the crux of much of the stress experienced by victims. Those who were involved with EMO, Public Health, or other authorities had many questions related to disaster assistance and general recovery processes, many of which went unanswered for long periods of time (or the answers changed over time). This contributed not only to post-flood stress levels but also to feelings of abandonment and anger. Conflict, in the form of arguments and disagreements were often the result of this confusion. Better communication mechanisms, better informed government personnel, and accurate and informative paperwork for dissemination post-flood are essential to improved post-flood response and reduced negative impacts on victims.

6.2.3 Criteria 3

Maximize appropriateness and responsiveness of services to individual families

Applicable to:

- Planning *
- Emergency Response ***
- Recovery **

This is a broad criterion which is intended to address a number of concerns which resulted in increased stress, conflict, trouble coping with problems that arose during and post-flood, and decreased health among flood victims interviewed.

During the initial stages of the 1997 flood, as water encroached on residents' properties, many of them needed services such as dependable and accessible information, evacuation assistance, flood-proofing guidance and help, and assistance in protecting personal and business affects. It was clear that many residents surveyed found that the services that they required were not available for various reasons. People who suffered losses, in retrospect, had difficulty understanding that their needs had not been better satisfied, and had not been anticipated by authorities. Many people who managed to save their property had utilized their own personal financial and other resources to obtain the services that they had needed. This is certainly not socially equitable.

One problem residents faced was that flood management was already into *emergency* operations by the time that many individual families began their own preparations and responses to the flood. Most of them were unsure about what was needed and when. Authorities by this time had a wide range of concerns to deal with, including problems of wider scope than the flood preparations of individual families.

Consequently, types and amounts of flood preparation services required for individual families and communities must be identified prior to a flood event, with 'what-if' scenarios in mind. This must be done during the *planning* phase while time for a thorough assessment of need and resource availability can be done. Any flood management planning that does not consider services necessary to prepare families for possible inundation is relying heavily on government to either take action to provide total protection or to later compensate victims. And when government fails in these tasks, as seen in 1997, there is a public outcry. At an individual and family level the impacts are often profound, resulting in a range of stress related impacts as seen in 1997.

During the *recovery* phase of flood management, flood victims' need for services remains high, as seen in 1997. Some interviewed residents were enormously frustrated and embittered by the lack of services available to meet their post-flood needs. Delays in getting needed services were seen as major contributors to stress. Some of the most

common needs were, for example, long-term housing, sanitization services, respite child-care, clean-up assistance, and services of a wide variety of construction trades-people. Costs for some services also escalated as the demand rose, adding additional financial burden. Particularly frustrating were the processes set up to provide assessment of damages, compensation for damages, and assessment for required flood-proofing.

Counseling became widely sought by flood victims to deal with stress and uncertainty, and at the time of interviews up to six months post-flood there were still respondents who were feeling the need to seek emotional and psychological support services to deal with flood-related problems.

Overall the process for recovery set up by the government was seen by many as impersonal and inefficient; many feared that their lives would never get back to “normal” and that they never again feel secure. Some survey respondents felt that they were (and would be) excessively beholden to friends, extended family, or financial institutions due to the financial, emotional and other support they needed in the wake of the flood.

Following the 1997 flood is an excellent time to evaluate what support services are reasonable and necessary during and post-flood using recent experience and the input of flooded residents. Support services should be anticipated and planned for in the planning phase of flood management, be capable of being quickly executed as necessary during the emergency phase, and be adapted quickly to post-flood circumstances of individual families and communities. Only then can many of the negative psychosocial impacts of a flood be reduced.

6.2.4 Criteria 4

Minimize personal economic losses of residents

Applicable to:

- Planning ***
- Emergency Response *
- Recovery **

This criteria is intended to address the personal economic costs of a large-magnitude flood to its victims. In 1997 some flooded residents felt that government should have been (and was not) supplying sufficient monies for them to restore their properties/homes and ultimately restore their quality of life. There were concerns for some residents that retirement plans would need to be altered because retirement savings were being depleted to rebuild their homes/businesses post-flood. Some respondents to the questionnaire felt that their economic circumstances would be negatively impacted far into the future partly because of government failures to provide for their needs.

A few respondents felt for various reasons that government should be fully liable for the full amount of their damages, including that government failed to provide sufficient warning, and failed to plan adequately for the flood. In 1997, the post-flood revelation that operating guidelines for the Red River Floodway had not been followed, and water levels were kept one foot below the operating maximum in Winnipeg during the flood (as an extra precaution for the city) fueled feelings of resentment against government. Some believed that the water levels on some properties south of the city would have been less if the water levels in Winnipeg had been allowed to rise up to the operating standard. Clearly, following 1997, there are reasons for government decision-makers to consider thoroughly the possible impacts (including economic ones) of their decisions on residents south of the city as well as within Winnipeg, and the rationale for their ultimate decisions.

It is most difficult to thoughtfully consider courses of action (and their economic impacts) during the *emergency* stage of a flood. Actions must sometimes be quickly taken without complete forethought. Ideally, then, it is during the *planning* stage that decision-makers should give careful consideration of the possible economic costs to individual homeowners and communities of potential courses of action in the event of a flood, and prepare to minimize financial losses through damages. It should be clear what priorities government has in terms of prevention of damage (e.g. Winnipeg versus the southern townships). And, failing avoidance of damage through flood management, decision-makers should have a comprehensive and timely plan of financial compensation (with the

assumption that compensation exists). This includes making the public clearly aware in advance of flood events of what government is and is not prepared to financially compensate for in a flood disaster.

This criteria also compels decision-makers to consider if planning alternatives will have excessive negative ramifications on those with businesses that are at risk from flood. It also requires some consideration of the diverse types of lost income that may result in families affected by the flood and the consequences. One common source of lost income in 1997 was the result of flood victims being unable to attend work because of the urgency of matters requiring attention at home. For many, this ranged over not only weeks but over months. Several respondents had trouble with insensitive employers who failed to give sufficient allowance for the flood recovery period, therefore putting additional pressure on individuals and families that were already under immense stress. Ideally, in the *planning* and *recovery* stages of flood management, authorities can consider and implement ways to prevent application of undue pressure upon flooded employees.

Finally, economic losses are also related to delays. The longer time a family is evacuated, (or living in temporary arrangements), or the longer a premise goes without sanitization or reconstruction, or the longer an employee is off work engaged in flood related activities, the greater the economic burden to the household in question, and the greater the negative impacts to family members.

6.2.5 Criteria 5

Minimization of life disruption

Applicable to:

- Planning *
- Emergency response ***
- Recovery ***

This criterion was selected because the issue of life disruption was a prominent theme throughout the interviews with flood victims in 1997. Many of the victims interviewed were still having increased stress and stress symptoms, psychosocial symptoms of distress, and health impacts up to six months post-flood. Some had lives sufficiently disrupted that they sought counseling to help them cope with the instability.

Residents who suffered damages were waiting for decisions to be made on their claims by EMO, and many could not proceed to rebuild or even complete clean-up until EMO's decisions were rendered on their financial entitlement, and payment made. Others were waiting for Public Health to confirm that they did (or did not) need to tear down their original dwelling due to a health risk (like black mold) and that it was safe to move back in. Many had to wait long periods for trades people to be available to assist them in rebuilding because the demand was so high for building trades in the area. In some cases respondents shared that some of their fear, anger, sense of dependency and feeling of lack of control over their lives was largely a result of the seemingly endless life disruption.

In the analysis of survey data, life disruption in the form of lengthy evacuation periods also seemed linked in this sample with increased stress. Some respondents also shared that they were observing unusual and worrisome behaviors in their children which they partly attributed to disruptions in their normal routine.

If decision-makers give consideration to the degree of life disruption likely when selecting among different flood management plans it may help decrease some of the negative impacts on residents. It is important to consider this prior to a flood event, namely during the *planning* stage in preparing response plans. Ultimately, however, it is in *emergency* response and *recovery* stages that minimization of life disruption would be realized. There must be a concerted effort to minimize life disruption through efficient organization during the emergency response stage particularly. This should be followed by restoring people's lives as thoroughly and as quickly as possible in order to avoid longer-term negative impacts.

6.2.6 Criteria 6

Minimize stress and stress impacts (including physical health impacts)

Applicable to:

- Planning *
- Emergency response ***
- Recovery ***

This final criterion flows from the experiences of residents in 1997, revealed particularly in the survey interviews. While previous literature had confirmed that stress and stress-related impacts are often a consequence of flood disasters, this study confirmed that among the sample of victims in Manitoba there was report of heightened levels of stress both during and post-flood, in many cases continuing for months. Other stress related symptoms such as trouble coping with problems, irritability, depression/unhappiness and symptoms of distress such as fear, anger, sense of dependency on others, and lack of sense of control were also evident. Finally, among this sample there was clearly a reduction in general health status and an increase in specific health complaints following the flood.

With such confirmation of the stress impacts upon residents from the flood it was necessary to provide minimization of these symptoms as a criterion to guide decision-making. The range of factors that contribute to stress and related symptoms are so numerous and varied that only a criterion which requires decision-makers to consciously think about the potential for stress impacts, and use this proposed criterion as one basis for their judgements, offers sufficient protection to the social well-being of Manitobans.

This criterion applies most directly to the emergency operations and recovery aspects of flood management planning. This is when residents clearly experience heightened stress and related symptoms. Actions taken at these times should most reflect concerns for stress impacts. However, because of time and planning limitations during the emergency phase, this criterion must be given consideration in the planning stage when time is available to properly consider the implications of actions on the social wellbeing of

residents. This study provides many clues to factors (variables) that, if not adequately planned for, will contribute to stress. It is also during the planning stage that input directly from residents can be sought to enhance the basis for decision-makers' judgements.

6.3 Discussion of Social Criteria

The six social criteria presented are suitable for use in MCDA where multiple judgement criteria are used in trying to choose among flood management alternatives. MCDA can find the set of feasible flood management solutions which will provide the best trade-offs among all the various criteria, including the social criteria. Ultimately the importance of each of the different criteria (objectives) to the overall goal in MCDA is decided by appointed decision-makers and they weight the relative importance of each criterion to the overall goal which they are trying to achieve (using their best judgement at that point in time). The provision here of social criteria for use in flood management will require that decision-makers be absolutely conscious of how much relative importance they attach to each social criteria, as compared to economic or other criteria.

The six selected social criteria were presented in terms of the direction in which it is being proposed that the criteria should be measured. In other words, *are we seeking to minimize or maximize the criteria?* They were also presented with reference to the three stages of flood management, and the applicability of that criteria to the activities performed during each stage.

Ideally, per the literature, criteria used in MCDA should not overlap. This was certainly a strong consideration in selection of the criteria. However, achievement of any and all "social" criteria or objectives are essentially dependent on complex human social systems, social interactions, and the vagaries of human cognitive processes and responses. Thus achievement of one goal may involve overlap in some respects with another goal.

One example is the potential overlap between Criteria 1 and 2, *maximization of community level planning* and *maximization of communication* respectively. Logic would imply that successful community level planning must involve development and refinement of communication networks both within and outside the community. Yet improvement in communication is but one small part of community level planning. Similarly, the need for improved communication as outlined in the discussion of Criteria 2 specifically notes that role clarification between various government departments is important; however, this may or may not be overlooked in *community* level planning depending upon who is doing the planning. In the final analysis, some overlap is deemed acceptable and perhaps unavoidable; in fact, if and when some overlap occurs, it will merely reinforce that there are some variables/issues/items that must be given extra weight in order to ultimately reduce negative impacts of flooding on residents of the Red River Basin.

6.4 Other Empirical Findings

While the six social criteria offered provide important considerations to decision-makers if minimizing negative psychosocial impacts are an objective in flood management planning, the wealth of empirical data from the survey questionnaire offered additional insights that should be noted. They are presented in the form of the following additional planning recommendations:

- Coordination of necessary resources and information during an imminent flood is essential, and clarity regarding roles and responsibility for various aspects of flood preparation and response.
- Local communities and local authorities must have an adaptive floodplain management plan that accurately reflects both short and long-term local development goals and local residents' needs. Local authorities also need to be familiar with the provincial emergency response plans (including contingency plans) in order to accurately anticipate possible impacts to their locality.

- EMO processes for handling damage claims (including both the assessment and compensation processes) need to be redesigned and improved to better meet flood victims' needs.
- Evacuation policy, including the attendant rationale behind policy, needs to be understood and perhaps debated by members of the public prior to a crisis event to help maximize compliance with evacuation orders and minimize injury or loss of life. Efforts should be made now to reduce the likelihood that numbers of flood victims will refuse to evacuate in future; in 1997 a number of residents voiced the sentiment that they will never again leave their property to the mercy of a flood.
- Evacuation and recovery services for flood victims could be improved through adoption of computer technology to ensure the appropriate people receive the appropriate service and to minimize abuses of the social system in place.
- The role of the media as an important source of information should be enhanced to better meet the needs of citizens both during and post-flood. The appropriateness and depth of media coverage of flood events should be carefully evaluated to optimize the use of this resource to promote a safe, timely response to a flood and a speedy recovery for communities and individuals.
- Flood risk appears to often be minimized in Manitoba and inadequately incorporated in individual, community, and government decision-making. Development of a disaster subculture in which everyone is aware of the vulnerability of the region to flood, and this knowledge reflected in planning, would ultimately reduce flood damages and hardship.

6.5 Recommendations for Research

This study has ventured into an area where there has been little research to date. Understandably, there is much work yet to be done to enhance flood management decision-making through consideration of social objectives. There are two obvious areas that will be mentioned briefly here.

- The generation of social criteria is a starting point for including broad social objectives (such as to minimize negative psychosocial impacts) in flood management. The next step is to determine how to best *measure* the degree to which proposed flood management alternatives meet the social criteria proposed. Selection and testing of such measures is an important area for further research.
- The use of social criteria (among others) in decision-making in flood management needs to be tested for its suitability. The advantage of an expanded decision-making model (such as MCDA) must be shown through actual application and implementation. Such studies ought to be longitudinal if the success of a decision-making approach which includes social criteria is to be confirmed because of the complex and cyclic nature of flood events. One option would be to pilot a flood management model which uses social criteria within an at-risk community and evaluate its effectiveness in meeting established social and other objectives.

6.6 Conclusion

This study has provided a wealth of information on the psychosocial impacts of the flood of 1997 with the intent of using this information to develop social criteria for use in flood management. It was assumed that an appropriate broad social goal was (and is) to minimize negative psychosocial impacts on residents, and for decision-makers to attempt to select strategies which will not excessively detract from the quality of life of residents in at-risk communities. Thus the identification of key areas of psychosocial impact in 1997 was done and six relevant social criteria selected that would minimize negative impacts if given careful consideration by water resources managers.

In other words, the six social criteria give to decision-makers socially relevant evaluation criteria to use in project selection, thus potentially eliminating less socially desirable alternatives (or solutions) to flood management problems. There is no doubt from the results of the survey on psychosocial impacts that residents suffered as the result of their experiences in 1997, and that there are lessons to be learned and applied in future decision-making.

As a final comment, it is perhaps imperative to state that the results of the survey of flooded residents showed that they experienced high degrees of stress and stress-related symptoms in 1997, much disillusionment with authorities and with those institutions whose role it is to defend the public good, and some feelings of abandonment by fellow citizens. It raises the question of whether this is not perhaps the cost of living in a society that fails to promote public acknowledgement of the high flood risk, shuns proactive flood management planning, and fails to encourage development of a disaster subculture ~ that is, a culture where responsibility for prevention, reduction, and mitigation of harm from flood rests with each individual as well as with those to whom we grant decision-making authority over us.

REFERENCES

- Ad Hoc Task Force on Flood Mitigation Projects.
Report on Manitoba Flood Mitigation Projects. Dec. 1980.
- Appley, Mortimer and R. Trumbull.
"On the Concept of Psychological Stress". Stress and Coping: An Anthology. Columbia University Press. 1977.
- Barlshen, F.
The Annual Report of the Diking Commissioner (1996) . Water Resources Branch. Manitoba Natural Resources. 1997.
- Bhattacharyya, N.N. and A.K. Bora
"Floods of the Brahmaputra River in India". Water International, Vol.22 No.4, December, 1997.
- Bulmer, Martin (Ed.).
"Social Measures and Social Indicators". Contemporary Social Research Papers. 1981.
- Bumsted, J.M.
Floods of the Centuries.
Great Plains Publications: Winnipeg, 1997.
- Carley, Michael.
Issues of Policy and Theory. Contemporary Social Research. George Allen and Unwin: Boston. 1981.
- Carley, Michael and Anna Walkey
"Exploring some Key Elements in SIA". Social Impact Assessment: Theory, Method and Practice. University of Calgary. 1981.
- Cook , Alicia S. , and Daniel J. Weigel.
"Relocation and Crisis: Perceived Sources of Support". Family Relations . December, 1984.
- Cooper, Guy.
"Red River '97 Flood – Construction of Brunkild "Z" Dyke". Canadian Water Resources Association Flood Symposium. October, 1997.

- Creswell. John W.
Research Design: Qualitative and Quantitative Approaches.
 Sage Publications, Incorporated: California. 1994
- De Man, Anton, Paul Simpson-Housley, and Fred Curtis.
 “Assignment of Responsibility and Flood Hazard in Catahoula County, Louisiana “. Environment and Behavior, Vol. 17 No. 3 May, 1985.
- Doering, J.C..
 “The Task Force” Canadian Water Resources Association Flood Symposium.
 October, 1997.
- Dunn, James R., S. Martin Taylor, Susand J. Elliott, and Stephen D. Walter.
 “Psychosocial Effects of PCB Contamination and Remediation: The Case of Smithville, Ontario”. Social Science and Medicine, Vol. 39. No. 8. 1994.
- Dynes, Russell R.
 “Disaster Reduction: The Importance of Adequate Assumptions About Social Organization.”
Sociological Spectrum Vol. 13 –175-192, 1993.
- Elliott, Susan J., S. Martin Taylor, Stephen Walter, David Stieb, John Frank, and John Eyles.
 “Modelling Psychosocial Effects of Exposure to Solid Waster Facilities”. Social Science and Medicine, Vol. 37. No. 6. 1993.
- Environment Canada: Economics and Conservation Branch.
Flooding. Supply and Services Canada: Ottawa, 1993.
- Figley, C.R. and McCubbin, H.I.
 “Stress and the Family, Vol. II: Coping with Catastrophe”.
Handbook of Stress: Theoretical and Clinical Aspects. Brunner/Mazel Publishers: New York, 1982.
- Fitzpatrick, Colleen , and Dennis S. Mileti.
Public Risk Communication. 1992.
- Australian Emergency Management
 “Flood Warning: an Australian Guide”. Australian Emergency Management Institute,
 Mount Macedon. 1995.

Flynn, Brian.

"Fighting the Red River Flood of 1997- The Canadian Forces Participation". Canadian Water Resources Association Flood Symposium. October, 1997.

Frankfort-Nachmias, Chava , and David Nachmias

Research Methods in the Social Sciences –5th edition.

St. Martin's Press: New York, 1996.

Forrest, Thomas R.

"Disaster Anniversary: A Social Reconstruction of Time". Sociological Inquiry, Vol. 63, No. 4. 1993.

Giel, R.

"Psychosocial Processes in Disasters". International Journal of Mental Health, Vol. 19.No.1 1990.

Goicoechea, Ambrose, Don R. Hansen, and Lucien Duckstein.

Multiobjective Decision Analysis with Engineering and Business Applications. John Wiley and Sons : Toronto, 1982.

Goldberger, Leo and Shlomo Breznitz (Eds)

Handbook of Stress: Theoretical and Clinical Aspects. 1982

Government of Canada and Manitoba Natural Resources

Manitoba Flood Protection Projects Agreement-1990-1991 Annual Report. Oct. 1991.

Green, C.H., S.M. Tunstall, and M.H. Fordham.

"The Risks from Flooding: Which Risks and Whose Perception?" Disasters Vol. 15 No. 3, 1991.

Hamel, Jacques, Stephanie Dufour, and Dominic Fortin.

"Case Study Methods". Qualitative Research Methods Series. Sage Publications:California. 1993.

Hannigan, John A., and Rodney M. Kueneman.

"Anticipating Flood Emergencies: A Case Study a Canadian Disaster Subculture". In Disasters: Theory and Research. Sage Publishing: Beverly Hills. 1978.

Hansson, Robert O., Dianne noulles, and Steven J. Bellovich.

"Knowledge, Warning, and Stress: A Study of Comparative Roles in an Urban Floodplain". Environment and Behavior, Vol. 14 No. 2, March 1982.

- Henerson, M.,L. Morris, and C. Fitz-Gibbon.
How to Measure Attitude. Sage Publishing : California. 1987.
- Holroyd, Kenneth A. and Richard S. Lazarus.
"Stress, Coping and Somatic Adaptation". Handbook of Stress: Theoretical and Clinical Aspects. Brunner/Mazel Publishers: New York, 1982.
- Hutchins, Gerald L., and Fran H. Norris.
"Life Change in the Disaster Recovery Period". Environment and Behavior ,Vol. 21 No. 1, January, 1989.
- International Joint Commission
Interim Report on Red River Flooding : Short-Term Measures. Dec. 1997.
- Krebs, Dagmar and Peter Schmidt (Eds).
New Directions in Attitude Measurement. Walter de Gruyer and Co. : Boston. 1993.
- Keeney , Ralph L., and Howard Raiffa.
Decisions with Multiple Objectives: Preferences and Value Tradeoffs.
Cambridge University Press: New York, 1993.
- Krenz,Gene, and Jay Leitch.
A River Runs North: Managing an International River. Red River Water Resources Council. 1993.
- Laska, Shirley B.
"Homeowner Adaptation to Flooding: An Application of the General Hazards Coping Theory". Environment and Behavior, Vol. 22 No. 3. May 1990.
- Lazarus, Richard S.
"Cognitive and Coping Processes in Emotion." Stress and Coping: An Anthology. 1977.
- Locke, Lawrence F., Waneen Wyrick Spirduso, Stephen J. Silverman.
Proposals the Work, 3rd edition. Sage Publications Incorporated: California, 1993.
- Manitoba Government Information Services.
News Release. Feb. 20, Feb. 24, 1998.
- Manitoba Natural Resources: Sustainability Canada
Land Drainage Review. Un-dated.

Manitoba Natural Resources.

Manitoba Submission to the Manitoba Water Commission. Oct. 1997.

Manitoba Natural Resources.

“The Water Commission Act”. Manitoba Submission to the Manitoba Water Commission- Appendices Oct. 1997.

May, Tim.

Social Research : Issues, Methods and Process.
Open University Press:Philadelphia, 1993.

McBean, Edward A., Jack Gorrie, Michael Fortin, John Ding, and Ralph Moulton.

“Adjustment Factors for Flood Damage Curves”. Journal of Water Resources Planning and Management. Vol. 114(6) , 635-646, 1988.

McGrath, Joseph E.

“Settings, Measures and Themes: An Integrative Review of Some Research on Social-Psychological Factors in Stress”. Stress and Coping: An Anthology. 1977.

McNeil, Doug, and Barry MacBride

“The City of Winnipeg Flood Planning , Preparations and Operations”. Canadian Water Resources Flood Symposium. October, 1997.

Monat E, and R. Lazarus.

Stress and Coping-Some Current Issues and Controversies. Columbia University Press:
New York. 1977.

Montz, Burrell E., and Graham A. Tobin.

A Proposal: The Effectiveness of Flood Mitigation Measures: The 1997 Upper Midwest Floods. 1997.

Mudry, N., P.J. Reynolds, and H.B. Rosenberg.

“Post-Project Evaluation of the Red and Assiniboine River Flood Control Projects in the Province of Manitoba, Canada ”. International Commission on Irrigation and Drainage. Grenoble, 1981.

Naik, Hasu.

“Evaluation of Social Intangibles with Special Reference to Floodplain Management”.
Social Impact Assessment: Theory, Method and Practice. University of Calgary, 1981.

- Nijkamp, P., P.Rietveld, and H. Voogd.
“Multicriteria Evaluation in Physical Planning” Contributions to Economic Analysis.
Elsevier Science Publishers: Netherlands. 1990
- Phifer, James F., and Fran H. Norris.
“Psychological Symptoms in Older Adults Following Natural Disaster : Nature, Timing,
Duration, and Course”. Journal of Gerontology: Social Sciences, Vol. 44 No.6 1989.
- Platt, Rutherford R.
“Intergovernmental Coordination: An Uncertain Factor in American Water Resources
Management”. Canadian Water Resources Journal. pgs.21-30. 1987
- Quarantelli, E.L.
“Ten Criteria for Evaluating the Management of Community Disasters”. Disasters
Vol.21(1), 1997.
- Quarantelli, E.L., and Russell R. Dynes.
“Response to Social Crisis and Disaster”. Annual Reviews in Sociology, 1977.
- Rahman, Matiur.
“Of Water and Water Fighters: Peoples Response to Flood 1997 in the Red River
Valley, Manitoba: A Research Agenda ” Canadian Water Resources Association Flood
Symposium. October , 1997.
- Rannie, W.F.
“The Red River Flood Control System and Recent Flood Events.” Water Resources
Bulletin. Vol 16(2). April 1980.
- Riad, Jasmin K., and Fran H. Norris.
“The Influence of Relocation on the Environmental, Social, and Psychological Stress
Experienced by Disaster Victims.” Environment and Behavior. Vol.28. No.2 , March
1996.
- Rochford Jr., E. Burke, and T. Jean Blocker.
“Coping with “Natural” Hazards as Stressors: The Predictors of Activism in a Flood
Disaster”. Environment and Behavior. March, 1991.
- Sampson, Edward E.
Social Psychology and Contemporary Society. 2nd Ed. John Wiley and
Sons:Illinois,1976.

Selye, Hans.

"Selections from the Stress of Life". Stress and Coping: An Anthology. Columbia University Press: New York.1977.

Simonovic, Slobodan P.

"Criteria for Social Evaluation of Flood Management Decisions". Unpublished Draft Paper. April, 1998.

Simonovic, Slobodan P.

"Multi-Objective Decision Analysis for Water Resources Planning and Management". Short Course: Department of Civil Engineering , University of Manitoba. 1993.

Simonovic, Slobodan P., Donald H. Burn, and Barbara J. Lence.

"Practical Sustainability Criteria for Decision-Making". International Journal of Sustainable Development and World Ecology Vol. 4, 1997.

Simonovic, Slobodan P.

"Social Criteria for Evaluation of Flood Management Decisions: Winnipeg Case Study". Urban Water, Vol.1, No.2, 167-175.1999.

Taylor, S. Martin.

"Psychosocial Impacts of Exposure to Environmental Contaminants : Final Questionnaire for Stage One Epidemiologic Survey". Unpublished. Mc Master University, Hamilton, Ontario.

Taylor, S. Martin, Susan Elliott, John Eyles, John Frank, Muray Haight, David Streiner, Stephen Walter, Norman White and Dennis Willms.

"Psychosocial Impacts in Populations Exposed To Solid Waste Facilities". Social Science and Medicine. Vol.33, No. 4. 1991.

Tobin, Graham A., and Jane C. Ollenburger.

"Predicting Levels of Postdisaster Stress in Adults Following the 1993 Floods in the Upper Midwest ". Environment and Behavior, Vol. 28 No.3, May 1996.

Tripodi, Tony, Phillip Fellin and Henry J. Meyer.

The Assessment of Social Research. F.E. Peacock Publishers, Inc: Illinois, 1983.

Warkentin, A.A.

An Overview of the Causes, Predictions, Characteristics and Effects of the Red River Flood of the Century. Water Resources Branch. Manitoba Natural Resources. July, 1997.

Wruck, Gus.

“Agricultural Flood Preparation”. Canadian Water Resources Association Flood Symposium. October, 1997.

Zegans, Leonard S.

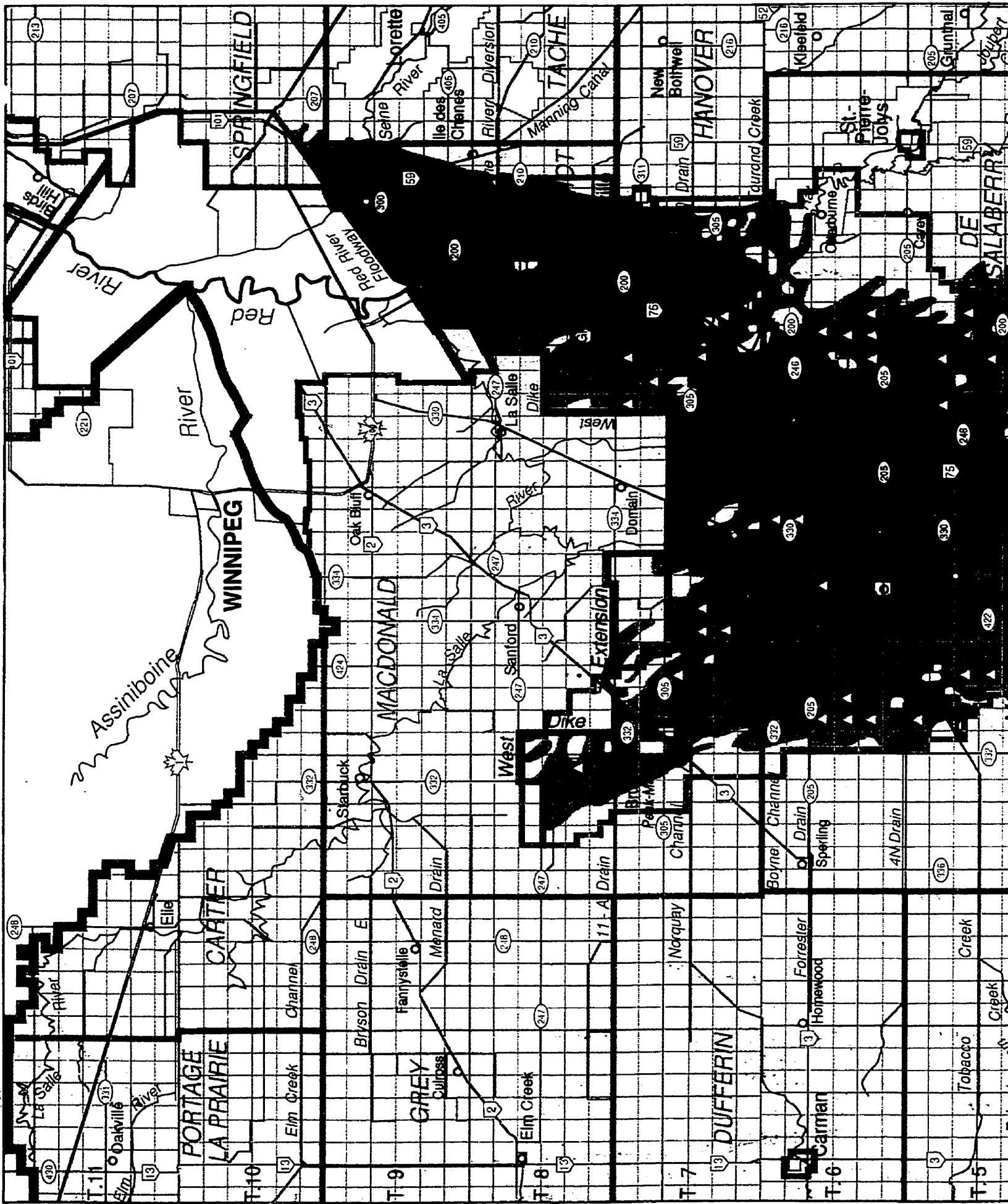
“Stress and Development of Somatic Disorders”. Handbook of Stress: Theoretical and Clinical Aspects. Brunner/Mazel Publishers: New York, 1982.

Zeleny, Milan.

Multiple Criteria Decision-Making. McGraw- Hill Inc.: Boston. 1982.

APPENDIX 1: MAP

Map of Red River Valley Designated Flood Area - 1997





R. 5W. R. 4W. R. 3W. R. 2W. R. 1W. R. 1E. R. 2E. Emerson Peak-Apr. 27 R. 3E. R. 4E. R. 5E.
 NORTH DAKOTA UNITED STATES

RED RIVER VALLEY

DESIGNATED FLOOD AREA

RED RIVER MAXIMUM FLOODED AREA FOR 1997

Based on Radarsat Imagery from April 27, May 1, May 4 & May 8 1997,
 and on aerial photography from April 29, May 1 and May 2, 1997.

- █ Islands one or more this section (2 Ac.- 30 Ac.).
- Road
- Road Flooded



July 17, 1997

APPENDIX 2: SURVEY AND COVER LETTER

SURVEY COVER LETTER

This survey is entitled **PSYCHOSOCIAL IMPACTS OF THE 1997 RED RIVER VALLEY FLOOD**. It is being conducted by Ms. Toni Morris-Oswald, a graduate student at the Natural Resources Institute at the University of Manitoba. The purpose of the study is to identify how individuals and families in the Red River Valley were affected or impacted by the flood. It is being sponsored by the National Science and Research Council of Canada.

The survey will be done through in-person interviews with affected people who volunteer to share their experiences. Volunteers will be asked questions from the survey and Ms. Morris-Oswald will record the answers. The interview will take approximately one hour.

The personal information of all participants will be kept totally confidential. Participants who begin the interview can end it at any time, and their information will not be included. Participants can also refuse to answer any questions at any time without explanation.

A summary of the overall findings of the study will be made available to any participant who requests it. This request can be made during the interview, or afterwards by contacting Dr. John Sinclair of the Natural Resources Institute at 474-8373. Any other questions or concerns can be directed to Dr. Sinclair at this number.

Thank you very much for taking the time to help with this study.

SURVEY

Psychosocial Impacts of the 1997 Red River Valley Flood

Date: _____ Time: _____

Interviewer: _____

Respondent (s): _____

Address: _____

Telephone Number: _____

Community: _____

Results Requested Y N

Card Left Y N

Interview Number in community _____

Interview Number (of total) _____

I'D LIKE TO ASK YOU SOME QUESTIONS ABOUT HOW YOUR LIFE WAS DISRUPTED BY THE FLOOD. FIRST I'D LIKE TO ASK SOME QUESTIONS ABOUT THE DAMAGE TO YOUR HOME AND PROPERTY.

1. Do you own or rent your home? A) rent B) own C) other (describe)

2. Do you own property that was impacted by the flood ?
A) yes B) no C) don't know D) refused

If yes, what type of property? (check as many as apply)

a) personal property including home

b) business property
what type of business? _____

c) other property (please describe) _____

3. Were you told by officials(during the flood) that your home was at risk from the flood (i.e. official notification)?

A) yes B) no C) don't know D) refused

If yes, how were you told? _____

4. Did you have water damage to your home? A) yes B) no C) don't know D) refused

(If no, go to question # 5 if business property, otherwise #6)

If yes, what depth of water was in your home (highest level)?

- a) water in basement
- b) water in first floor
- c) water in second floor
- d) water up to the roof

Can you briefly describe what type of damage your dwelling had? _____

(INTERVIEWER TO CHECK) A1) Lost home (irreparable)
B1) Have reparable damage to

home

What is YOUR ESTIMATE of the total cost of the damage to your home? (in dollars)

- a) over 250,000
- b) between 100,000 and 250,000
- c) between 50,000 and 100,000
- d) between 10,000 and 50,000
- e) between 5000 and 10,000
- f) below 5000

don't know

refused

Have you had the damage assessed by a claims person?

A) yes B) no C) don't know D) refused

If yes, by whom? _____

Any comments about the result? _____

NOW I WILL ASK A FEW QUESTIONS ABOUT DAMAGE TO YOUR FARM OR BUSINESS IF APPLICABLE (IF NOT APPLICABLE MOVE TO QUESTION #18)

5. What type of damages or losses impacted on your business activity? _____

What is YOUR ESTIMATE of physical damages from the flood affecting this business activity (only) ?(in dollars)

- a) over 250,000
- b) between 100,000-250,000
- c) between 50,000-100,000
- d) between 10,000-50,000
- e) between 5000-10,000
- f) under 5000

g) don't know

h) refused

What is YOUR ESTIMATE of lost revenue from this business activity (only) due to the flood?(in dollars)

a) over 250,000

b) between 100,000-250,000

c) between 50,000-100,000

d) between 10,000-50,000

e) between 5000-10,000

f) under 5000

g) don't know

h) refused

I'D LIKE TO LOOK AT WHAT MEASURES YOU TOOK TO PROTECT YOUR HOME OR BUSINESS IF ANY...

6. Were measures taken to protect your personal residence or business property?

A) yes B) no C) don't know D) refused

If yes, what measures?

.....such as ... (CHECK AS MANY AS APPLY)

PERSONAL PROPERTY

- a) built earth dike on property
- b) built sandbag dike around buildings
- c) built earth dike elsewhere
- d) built sandbag dike elsewhere
- e) pumped water away from or out of home
- f) moved articles or furniture to higher ground
- g) moved furniture/ articles off property
- h) other (explain)

BUSINESS PROPERTY

- a) built earth dike on property
- b) built sandbag dike around buildings
- c) built earth dike elsewhere
- d) built sandbag dike elsewhere

- e) pumped water away from or out of home
- f) moved articles or furniture to higher ground
- g) moved furniture/machinery/livestock/articles off property
- h) other (explain)

I'D LIKE TO ASK ABOUT HOW THE FLOOD AFFECTED YOUR LIVELIHOOD, IF AT ALL...

7. **Due to the flood**, did you lose income from your job or livelihood?
 A) yes B) no C) don't know D) refused

If yes, your income loss was due to (check all that apply)

- a) lost job (permanent)
- b) forced absenteeism from work _____days
- c)lost business activity
- d)other (please describe)

How much income do YOU ESTIMATE that you lost to date
 (all sources of livelihood activity)? (in dollars)

- a) Over 100000
- b) 50000-100000
- c) 10000-50000
- d) 5000-10000
- e) under5000
- f) Don't Know

Indicate 'household' income loss with ''*

IF YOU RECEIVED AN EVACUATION ALERT OR WERE EVACUATED I WOULD LIKE TO ASK YOU SEVERAL QUESTIONS ABOUT THAT EXPERIENCE...
 (OTHER RESPONDENTS MOVE ON TO QUESTION # 18)

8. Did your *immediate* family receive an evacuation alert notice?
 A) yes B) no C) don't know D) refused

If yes, how long were you on alert? _____days

9. Was your *immediate* family evacuated?
A) yes B) no C) don't know D) refused

IF NO, MOVE TO QUESTION #18

If yes, for how many days?

Did you have adequate notice in your opinion?

- a) yes b) no c) don't know d) refused

To *where* were you initially evacuated? _____

How good did you feel the accommodation was?

- a) excellent
b) good
c) poor

Did you have to split up your family?

- A) yes B) no C) don't know D) refused

Did you have to move more than once?

- a) yes b)no c) don't know d) refused

If yes, list other types of accommodation?

10. How **adequate** was communication about evacuation procedures in your experience? Please describe...

11. Can you tell me who you usually turn to for support and help in **your community** i.e. your support network?

(check as many as apply)

- a) friends
b) extended family
c) neighbors
d) local professionals
e) usual support network not in community
f) other (please describe)

While evacuated, how much contact did you have with your usual support network in your community?

- a) lots of contact
- b) some contact
- c) little contact
- d) no contact
- e) usual support network not in community
- f) don't know
- g) refused

During or since the flood, do you feel you have expanded your support network within your community?

- A)yes B)no C)don't know D) refused

REGARDING SCHOOL...

12. Do you have children in school?

- A) yes B) no C) don't know D) refused

(IF NO, EVACUATED BUSINESSES MOVE TO QUESTION #14, OTHER RESPONDENTS TO QUESTION # 18)

If yes, how many? _____ Their ages? _____

How much school time did they miss while evacuated?
(EACH CHECK MARK TO REPRESENT 1 CHILD)

- a) none
- b) 1 day
- c) 1 week
- d) 1-2 weeks
- e) 2 weeks - 1 month
- f) over 1 month

What arrangements, if any, were made to have them attend school while you were evacuated?

13. Can you briefly describe the major problems you had to deal with during the evacuation?
(transportation issues, daycare, childcare, pets care, moving, accessing sandbags, finding labour, etc...)

NOW I'D LIKE TO DISCUSS EVACUATION OF YOUR FARM OR BUSINESS (IF NOT APPLICABLE MOVE TO QUESTION# 18)

14. Are your personal property and business property the same?
A) yes B) no C) don't know D) refused

How long was your *business property* evacuated?
_____ days

15. Is your business activity "farming" ?
A) yes B) no C) don't know D) refused

16. Did you need to relocate any equipment?
A) yes B) no C) don't know D) refused

If yes, what type?

What problems, if any, had to be overcome to relocate your equipment? _____

17. Did you need to relocate any livestock?
A) yes B) no C) don't know D) refused

If yes, what type (s)? _____ What number (s)? _____

What problems, if any, had to be overcome to relocate your livestock?

NOW I'D LIKE TO ASK YOU A FEW QUESTIONS ABOUT HOW YOU ADAPTED TO THE FLOOD SITUATION

18. Was this the first flood you ever experienced first- hand?
 A) yes B) no C) don't know D) refused

If no, do you feel the previous experience helped you to cope?
 a)yes b)no c) don't know d) refused

19. Prior to this flood were you aware that your property was at risk for flooding?
 A) yes B) no C) refused D) don't know

20. How much warning (from whatever source) did you have that your property was at serious risk?
 _____ days

21. Do you feel that having this warning ...
 A) increased your stress?
 B) decreased your stress?
 C) had no impact on your stress?

22. Please indicate how much you felt/experienced each of these *emotions* at the **peak** of the flood event by RANKING HOW STRONGLY YOU EXPERIENCED THE EMOTION ,IF AT ALL--- RANK THE FEELINGS FROM 0 TO 4 WHERE 0 MEANS YOU DID NOT EXPERIENCE THE EMOTION AT ALL , 1 MEANS SLIGHTLY, 2 MEANS SOME ,3 MEANS QUITE A BIT AND 4 MEANS THE FEELING WAS EXTREMELY STRONG

A) sense of control over life	4	3	2	1	0
B) confusion	4	3	2	1	0
C) fear	4	3	2	1	0
D) sense of dependency on others	4	3	2	1	0
E) anger	4	3	2	1	0

Any comments about these feelings? _____

During the **peak** of the flood, how did you cope with your fears and worries? (such as keeping busy, talking to others, ignoring feelings, counselling...) _____

Now rank the same *emotions* according to how you are feeling **now** in relation to the flood

A) sense of control	4	3	2	1	0
B) confusion	4	3	2	1	0
C) fear	4	3	2	1	0
D) sense of dependency on others	4	3	2	1	0
E) anger	4	3	2	1	0

Any comments about these feelings? _____

Since the flood, how have you coped with your fears and worries? (such as keeping busy, talking to others, ignoring feelings, counseling...) _____

FOR THOSE WHO WERE EVACUATED ONLY

23. Were any crisis related services made available to your family at your place of relocation?
 A) yes B) no C) don't know D) refused

If yes, did you use any service(s)?
 a) yes b) no c) don't know d) refuse

Which ones? (1) _____
 (2) _____
 (3) _____

Who provided it? (1) _____
 (2) _____
 (3) _____

How satisfied were you with the service (s)? (NUMBER DESIGNATING A PARTICULAR SERVICE TO BE PLACED NEXT TO CORRESPONDING SATISFACTION RATING)

- a1) very satisfied
- b1) somewhat satisfied
- c1) slightly satisfied
- d1) not satisfied
- e1) don't know
- f1) refused

ALL RESPONDENTS TO ANSWER

24. Other than crisis counseling for evacuees, have you or any family members sought counseling during or since the flood?
 A) yes B) no C) don't know D) refused

If yes, from whom (circle all that apply)?

- a) social services
- b) local health professional
- c) non local health professional
- d) mental health
- e) guidance counselor
- f) pastor
- g) volunteer with Red Cross
- h) volunteer with Salvation Army
- i) Other (describe)

Can you share the main reason (s) for the counseling (if willing)? _____

I WOULD LIKE TO ASK YOU A FEW QUESTIONS TO HELP ME UNDERSTAND THE IMPACT THE FLOOD HAS HAD ON YOUR FAMILY LIFE

25. Were there more disagreements/ arguments **within the family** during/since the flood than before the flood?

- A)yes B)no C)don't know D) refused

If yes, what were the disagreements about (if willing)?

26. Were there more disagreements/ arguments **with people outside the family** during/since the flood than before the flood?

- A)yes B)no C)don't know D) refused

If yes, with whom (if willing)? _____

What were the arguments about (if willing)? _____

27. Since the flood , do you feel there has been increased conflict *in general* in your family that is due to the flood?

- A) yes B) no C) don't know D) refused

If yes, what have you seen/experienced within the family that makes you think the conflict has increased (if willing) ?

What do you think are the causes of the family conflict (if willing) ? _____

28. Has any person(s) in the family seemed particularly under stress?
A) yes B) no C) don't know D) refused
If yes, whom? _____

Any comments on why that might be? _____

29. Do you feel there were any positive outcomes for your family from going through the flood experience?
A) yes B) no C) don't know D) refused
If yes, please explain the positive outcome(s)?

I WOULD LIKE TO ASK YOU TO CONSIDER THE IMPACT YOU FEEL THE FLOOD EXPERIENCE HAS HAD ON YOUR (RESPONDENT ONLY) OVERALL HEALTH. I'D LIKE TO BEGIN WITH QUESTIONS RELATED TO STRESS....

30. During the flood did you feel more under stress than before the flood?
A) yes B) no C) don't know D) refused

If yes, was it a
a) general feeling of anxiety (i.e. free-floating)
b) related to particular aspects of your situation (i.e. stressors)
c) both
d) don't know
e) refused

What were the signs that you were under stress i.e. that were/are indicators to you...? _____

What do you believe were the main sources /triggers of stress to you during the flood?_____

Overall , how would you classify your level of stress during the flood ?

- a) high
- b) moderate - high
- c) moderate
- d) low

31. Since the flood has been over, do you feel more stress than before the flood?

- A) yes B) no C) don't know D) refused

If yes, is it a

- a) general feeling of anxiety (i.e. free-floating)
- b) related to particular aspects of your situation (i.e. stressors)
- c) both
- d) don't know
- e) refused

What are the signs that you are under stress i.e. that were/are indicators to you...?_____

What are the main sources/ triggers of stress since the flood?

Overall,, how would you classify your stress since the flood?

- a) high
- b) moderate
- c) low

32. During the flood did you get less sleep?

- A) yes B) no C) don't know D) refused

If yes, would you like to make any comment on why this might be? _____

Since the flood, have you gotten less sleep?

A)yes B)no C)don't know D)refused

If yes, would you like to make any comment on why this might be? _____

33. **During** the flood did you feel **more** depressed and / or unhappy than before the flood?

A) yes B) no C) don't know D) refused

If yes, would you like to make any comment on why this might be? _____

Since the flood, have you felt more depressed/unhappy than before the flood?

A) yes B) no C) don't know D) refused

If yes, would you like to make any comment on why this might be? _____

34. **During** the flood, did you have more trouble than usual coping with problems that arise?

A) yes B) no C) don't know D) refused

If yes, would you like to make any comment on why this might be? _____

Since the flood have you had more trouble than usual coping with problems that arise?

A) yes B) no C) don't know D) refused

If yes, would you like to make any comment on why this might be? _____

35. **During** the flood did you feel **more** irritable than before the flood?

A) yes B) no C) don't know D) refused

If yes, would you like to make any comment on why this might be? _____

Since the flood, have you felt **more** irritable?

A) yes B) no C) don't know D) refused

If yes, would you like to make any comment on why this might be? _____

THESE NEXT FEW QUESTIONS WILL FOCUS ON YOUR PHYSICAL HEALTH

36. **Before the flood**, how would *you* describe your *general* health ?

- A)excellent
- B) good
- C) fair
- D)poor
- E)don't know
- F)refused

Since the flood, how would *you* describe your *general* health?

- A)excellent
- B)good
- C)fair
- D)poor
- E)don't know
- F)refused

37. Were you or an immediate family member physically / emotionally injured in the flood?

- A)yes B) no C)don't know D) refused

If yes, who? Respondent or _____

Did you/ they require medical treatment?

- a)Yes b) no c)don't know d) refused

Did you/ they require hospitalization?

- a)Yes b) no c) don't know d) refused

38. At any time **during or** since the flood , have **you** had ...

- | | | | | |
|--|-----|----|------------|---------|
| A) more chest pain than prior to the flood ? | yes | no | don't know | refused |
| B) more lightheadedness or dizziness? | yes | no | don't know | refused |
| C)more tingling/numbness | yes | no | don't know | refused |
| D)less / more appetite? | yes | no | don't know | refused |
| E) excessive tiredness? | yes | no | don't know | refused |
| F) more digestion problems? | yes | no | don't know | refused |

39. Are there any health complaints/ problems you had during or since the flood that you would like us to know about?

yes no don't know refused

If yes, please describe _____

NOW I'D LIKE TO ASK YOU SOME QUESTIONS ABOUT THE AREA YOU LIVE IN AND THE IMPACT THE FLOOD HAS HAD ON YOU AND YOUR COMMUNITY

40. **Prior to** the flood how often would you visit with neighbors? (choose the best description)

- A) never
- B) seldom (once a year)
- C) 1-2 times a month
- D) 1-2 times a week
- E) very often (daily)
- F) don't know
- G) refused

Since the flood how often do you visit with neighbors?

- A) never
- B) seldom (once a year)
- C) 1-2 times a month
- D) 1-2 times a week
- E) very often (daily)
- F) don't know
- G) refused

41. **Prior to** the flood how often did you frequent local businesses? (choose the best description)

- A) never
- B) seldom (once a year)
- C) 1-2 times a month
- D) 1-2 times a week

E) very often (daily)

F) don't know

G) refused

H) not applicable

Since the flood how often do you frequent local businesses?

A) never

B) seldom (once a year)

C) 1-2 times a month

D) 1-2 times a week

E) very often (daily)

F) don't know

G) refused

H) not applicable

42. Was your social life in the community impacted by the flood?

A) yes B) no C) don't know D) refused

If yes, in what way? _____

43. Prior to the flood, had you ever worked with others or joined a group/organization in your community to do something about some community problem?

A) yes B) no C) don't know D) refused

During or since the flood have you worked with others or joined a group/organization to do something about a community problem related to the flood?

A) yes B) no C) don't know D) refused

If yes, what problem? _____

44. Prior to the flood, how involved were you in community events, including public meetings?

A) very involved

- B) somewhat involved
- C) slightly involved
- D) not at all involved
- E) don't know
- F) refused

During or since the flood ,how involved were/ are you in community events, including public meetings?

- A)very involved
- B) somewhat involved
- C) slightly involved
- D) not at all involved
- E) don't know
- F) refused

45. Who did you turn to for support and help during the flood?
(check as many as apply)

- A)neighbors
- B) family
- C) local businesses
- D) non-local businesses
- E) local community groups
- F) medical professionals
- G) mental health professionals
- H) Salvation Army
- I) Red Cross
- J) community church
- K) Mennonite Disaster Committee
- L) provincial government (explain)
- M) municipal government
- N) other (explain)
- O) friends

46. Which services or institutions did you need during and after the flood?
(check as many as apply)

- A) social services
- B) mental health
- C) bank
- D) insurance company
- E) crop insurance
- F) Emergency Measures Organization Claims Department
- G) pastoral

- H) Salvation Army
- I) construction trade (plumber, electrician etc.)
- J) Red Cross
- K) other (please describe)

47. How much support in general did /do you feel from other **community** members including local businesses?

- A) a lot of support
- B) some support
- C) a little support
- D)no support

48. How much support in general did/do you feel from the **provincial government**?

- A) a lot of support
- B) some support
- C) a little support
- D)no support

I'D LIKE TO ASK YOU A FEW GENERAL QUESTIONS ABOUT RECOVERY AND CLEAN-UP AFTER THE FLOOD

49. Did you have clean-up to do on your personal property ?

- A)yes B) no C) don't know D) refused

If no, go to question #61

If yes, how long did clean-up take?

- a)1-6 days
- b)1-4weeks
- c)1-2 months
- d)still continuing

anticipated end?_____

What clean-up problems/ hazards had to be dealt with , if any?

NONE or _____

Which of these problems/hazards remain?
NONE or _____

IF YOU HAVE BUSINESS PROPERTY IMPACTED BY THE FLOOD...

50. Did you have clean-up to do on your business property ?

- A) yes B) no C) don't know D) refused

If no, go to question # 51

If yes, how long did clean-up take?

- a) 1-6 days
- b) 1-4 weeks
- c) 1-2 months
- d) still continuing
anticipated end? _____

What clean-up problems/ hazards had to be dealt with ?

NONE or _____

Which of these problems/hazards remain?
NONE or _____

Are you considering or planning to A) relocate B) close down C) sell your business or farm as a result of the flood? (CIRCLE AS MANY AS APPLY)

- A) yes B) no C) don't know d) refused

B) what you feel are your priorities in life 4 3 2 1 0

Please explain _____

C) your view of your community 4 3 2 1 0

Please explain _____

D) your sense of financial security 4 3 2 1 0

Please explain _____

55. Do you have any final comments you'd like to make about the flood and its impact on you , your family or community? _____

56. Do you have any comments about the survey? _____

APPENDIX 3: GRAPHS & CROSS TABULATIONS

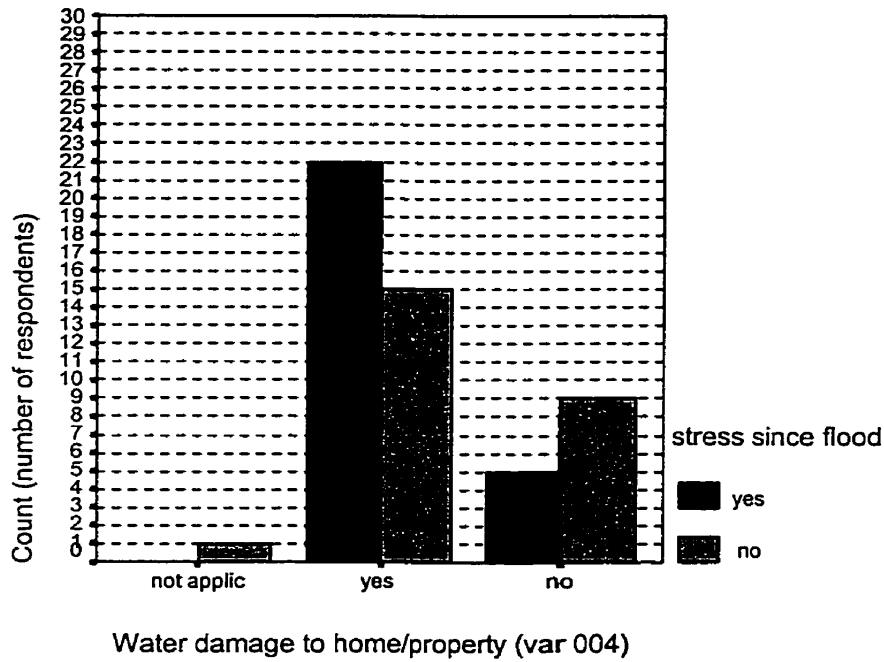
List of Graphs

Graph 1: Water damage to home by stress since flood	5
Graph 2: Water damage by stress during flood	5
Graph 3: Shows perceived stress level for those feeling increased stress during flood.....	6
Graph 4: Level of stress by those reporting stress since flood	6
Graph 5: Social impacts (Y/N) by Community	7
Graph 6: Adequate notice (Y/N) by stress experience during flood.....	7
Graph 7: Adequate notice by level of stress during flood	8
Graph 8: Adequate notice by stress since flood	8
Graph 9: Adequate notice by level of stress since flood	9
Graph 10: 1+ moves (evacuation) by stress since flood.....	9
Graph 11: 1+ moves (evacuation) by level of stress since flood.....	10
Graph 12: Increase in stress since flood by increased family conflict.....	10
Graph 13: Respondents reporting stress during flood above pre-flood levels.....	11
Graph 14: Respondents reporting stress above pre-flood levels post-flood	11
Graph 15: Loss of irreplaceable items by community.....	12
Graph 16: Stress level during flood by irreplaceable items lost.....	12
Graph 17: Sought counseling since flood by family conflict	13
Graph 18: Sought counseling by arguments outside family	13
Graph 19: Sought counseling by amount of respondent's lost income	14
Graph 20: Amount of household income lost by family member sought counseling.....	14
Graph 21: Sought counseling by damage to home	15
Graph 22: Stress since flood by perceived support from community.....	15
Graph 23: Stress since flood by perceived support by government (provincial).....	16
Graph 24: Damage to home by support from government (provincial)	16
Graph 25: General health before flood.....	17
Graph 26: General health since flood.....	17
Graph 27: Crosstabulation comparing health before and after flood by estimate of damage (\$)	18
Graph 28: Crosstabulation of health before and after by length of cleanup period	19
Graph 29: Crosstabulation of health before and after flood by loss of household income	20
Graph 30: Crosstabulation of activism (worked with prior community problem / worked with flood related problem in 1997) by stress level since flood	21
Graph 31: Type of community problem worked on after flood by community	22
Graph 32: Work on community problem after flood by sense of control after flood	22
Graph 33: Work re community problem post-flood by depression during flood	23
Graph 34: Work re community flood problem by depression after flood	23
Graph 35: Work on community problem (post-flood) by trouble coping during flood.....	24
Graph 36: Trouble coping since flood by first flood experience.....	24
Graph 37: Prior flood experience by trouble coping during flood	25
Graph 38: Trouble coping with problems since flood by arguments in family	25
Graph 39: Trouble coping by arguments outside family	26
Graph 40: Pie graph of causes of arguments outside family	26
Graph 41: Family members injured (Y/N) by level of stress since flood.....	27
Graph 42: Irritability since the flood by arguments within family	27
Graph 43: Irritability by arguments outside family	28
Graph 44: Loss of irreplaceable items by level of stress post-flood.....	28
Graph 45: Loss of irreplaceable items by depression since flood	29
Graph 46: Depression / unhappiness post-flood by loss of personal items (replaceable & irreplaceable)	29
Graph 47: Crosstabulation of health before and after flood and loss of irreplaceable items	30
Graph 48: Chest pain by loss of irreplaceable items	31
Graph 49: Loss of irreplaceable items by dizziness during / since flood	31
Graph 50: Loss of irreplaceable items by tingling in extremities.....	32
Graph 51: Loss of irreplaceable items and appetite change	32
Graph 52: Loss of irreplaceable items by tiredness.....	33

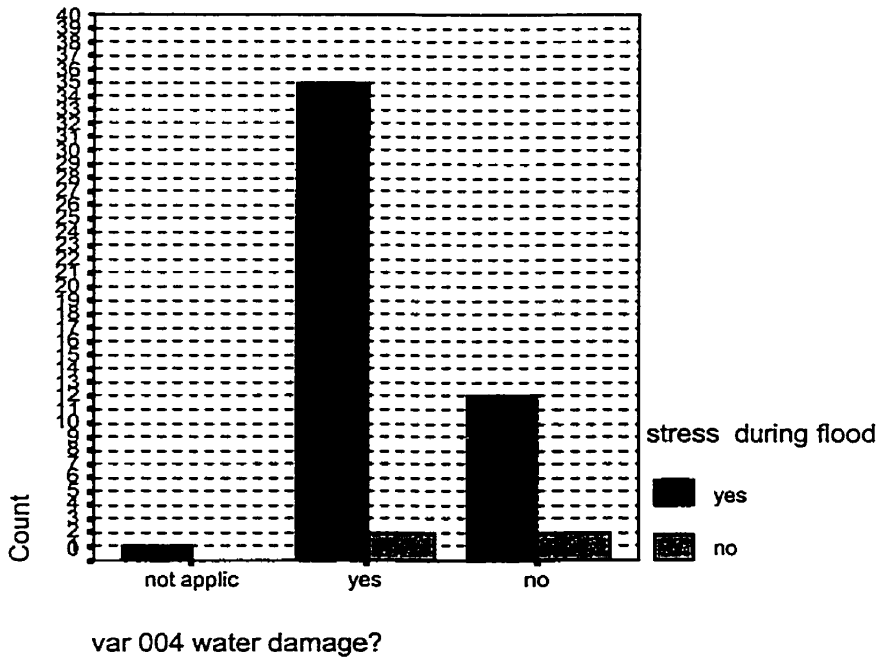
Graph 53: Loss of irreplaceable items by digestion problems	33
Graph 54: Estimate of damage by tiredness since / during flood	34
Graph 55: Depth of water in home by level of stress during flood	34
Graph 56: Depth of water by stress level since flood.....	35
Graph 57: Prior experience (first flood) by community	35
Graph 58: Prior experience helped with coping by community	36
Graph 59: Contact with support network by community	36
Graph 60: Contact with support network by stress level after flood	37
Graph 61: Contact with support network by level of stress during flood.....	37
Graph 62: Crosstabulation of health before and after flood and contact with support network	38
Graph 63: Previous flood experience by stress during flood.....	39
Graph 64: Previous experience by level of stress.....	39
Graph 65: Businesses planning to close / relocate / sell.....	40
Graph 66: Relocate / sell / close business by community	40
Graph 67: Property value concern by community.....	41
Graph 68: Property value concern by estimate damages (\$)	41
Graph 69: Concern re property value by prior experience	42
Graph 70: Considering move by stress since flood.....	42
Graph 71: Counseling sought by respondent or family member	43
Graph 72: Family member sought counseling by a family member injured	43
Graph 73: Perceived positive outcomes from flood by family member sought counseling	44
Graph 74: Length cleanup by stress post-flood (Y/N)	44
Graph 75: Cleanup by stress post-flood	45
Graph 76: Length of cleanup by stress level since flood.....	45
Graph 77: Positive outcomes for family by stress post-flood.....	46
Graph 78: Adequate notice by stress during flood	46
Graph 79: Crosstabulation of awareness of risk for flooding by community.....	47
Graph 80: Stress level post-flood by community	48
Graph 81: Pie chart of flood related community problems addressed by respondents.....	48
Graph 82: Perceived support of community.....	49
Graph 83: Perceived support of government.....	49
Graph 84: Perceived support from provincial government by community	50
Graph 85: Perceived support from community by community	50
Graph 86: Receipt alert notice by community.....	51
Graph 87: Adequate notice by experience increased stress during flood.....	51
Graph 88: Adequate notice of evacuation by level of stress during flood.....	52
Graph 89: How long on alert by community.....	52
Graph 90: Crosstabulation of awareness of risk by level of stress and by community	53
Graph 91: Warning respondents felt they had by community	54
Graph 92: Stress during flood and warning.....	54
Graph 93: Warning respondents felt they had by stress since flood.....	55
Graph 94: Warning respondents felt they had by stress level since flood	55
Graph 95: Damages sustained and family conflict.....	56
Graph 96: Damages and family arguments	56
Graph 97: Arguments outside family and damages.....	57
Graph 98: Respondents property types.....	57
Graph 99: Number of respondents who took measures to protect property	58
Graph 100: Number of respondents per communities surveyed	58
Graph 101: Pie chart of respondent's "sense of control over life" during peak of flood.....	59
Graph 102: Pie chart of respondent's "confusion" during peak of flood.....	59
Graph 103: Pie chart of respondent's "fear" at peak of flood.....	60
Graph 104: Pie chart of respondent's "sense of dependency on others" during the peak of the flood	60
Graph 105: Pie chart of respondent's "anger" during the peak of the flood.....	61
Graph 106: Pie chart of respondent's "sense of control" at time of interview.....	61
Graph 107: Pie chart of respondent's "confusion" at time of interview	62
Graph 108: Pie chart of respondent's "fear" at the time of the interview.....	62

Graph 109: Pie chart of respondent's "sense of dependency on others" at time of interview	63
Graph 110: Pie chart of respondent's "anger" at time of interview	63
Graph 111: Respondent's perception of "anger" feelings and plan / consider moving	64
Graph 112: Respondent's anger at time of interview and perception of support from government.....	64
Graph 113: Feelings of dependency on others at time of interview and amount of damage sustained	65
Graph 114: Pie chart of estimates of damage to home / property.....	65
Graph 115: Estimate of damages to stress since flood	66
Graph 116: Estimate of damage and stress level post-flood.....	66
Graph 117: Pie chart of personal losses - no losses, replaceable, and non-replaceable.....	67
Graph 118: Number of respondents evacuated.....	67
Graph 119: Crosstabulation of number of days evacuated and quality of accommodation	68
Graph 120: Estimate of total lost household income due to flood.....	69
Graph 121: Total household loss of income by stress since flood.....	69
Graph 122: Expanded support network (Y/N)	70
Graph 123: Crosstabulation of stress since flood by general health before and since flood	71
Graph 124: Crosstabulation of health before and since flood and length of evacuation	72
Graph 125: Gender of respondents (number and percentage)	73
Graph 126: Age break down of respondents	73
Graph 127: Highest education level attained by respondents.....	74
Graph 128: Years in current community	74
Graph 129: Years at current address	75
Graph 130: Ethnic group identified with, if any.....	75
Graph 131: Children under age 18	76
Graph 132: Respondents by community (number and percentage).....	76
Graph 133: Pie chart of how respondents felt that warning affected their stress level if at all.....	77
Graph 134: Pie chart of how respondents were told by officials that their home was at risk.....	77
Graph 135: Pie chart of respondent's experiencing more stress than before the flood during the flood...78	78
Graph 136: Pie chart of respondent's experiencing stress more than prior to flood after the flood	78
Graph 137: Pie chart of respondents with post-flood depression / unhappiness	79
Graph 138: Irreplaceable items lost by depression since flood	79
Graph 139: Arguments within the family by sought counseling	80
Graph 140: Work on flood related community problem by water damage	80
Graph 141: Community by official notification of risk.....	81
Graph 142: Lost income from job or livelihood (Y/N)	81
Graph 143: Perceived impact warning had on stress.....	82
Graph 144: Income Lost by Community.....	82
Graph 145: Community by lost business revenue.....	83
Graph 146: Number of days evacuated by stress since flood (Y/N)	83

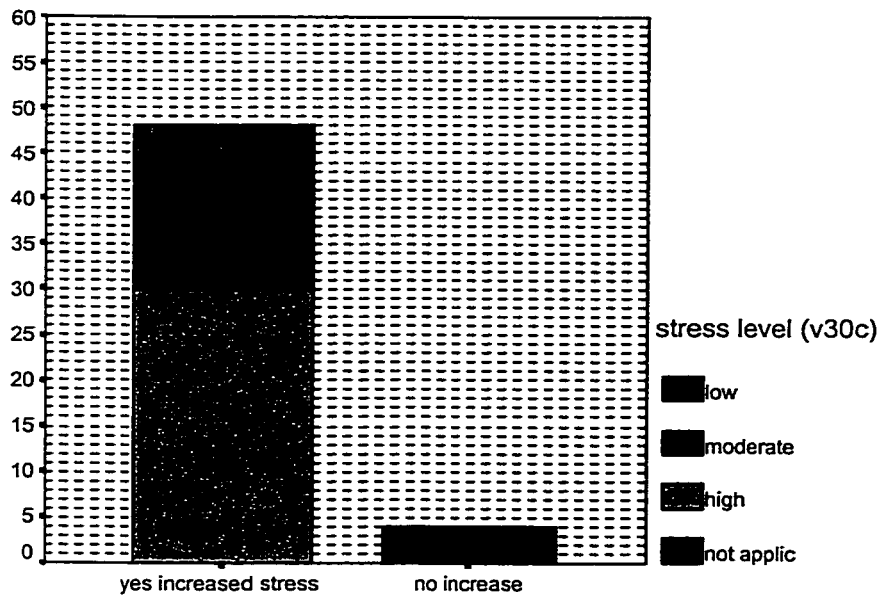
Graph 1: Water damage to home by stress since flood



Graph 2: Water damage by stress during flood

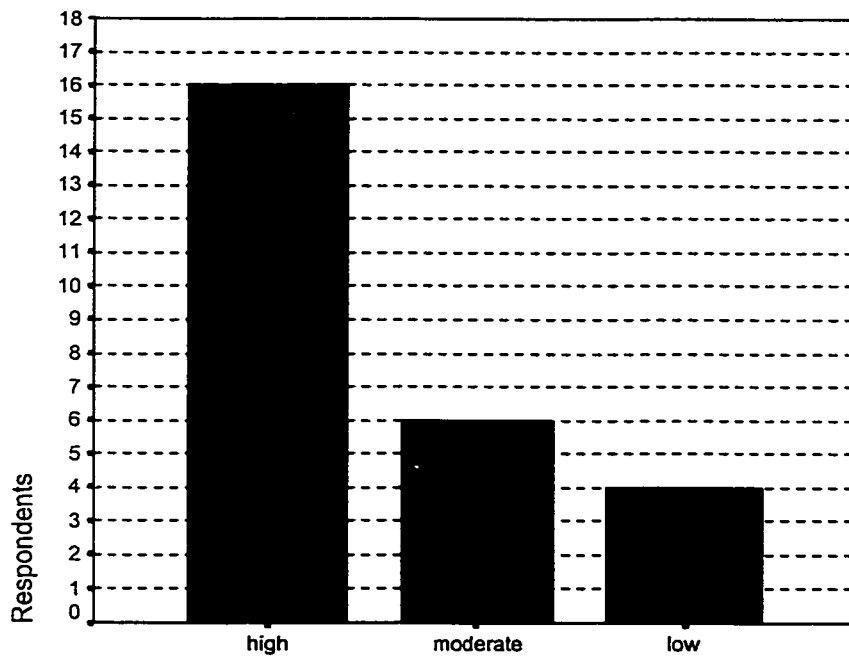


Graph 3: Shows perceived stress level for those feeling increased stress during flood

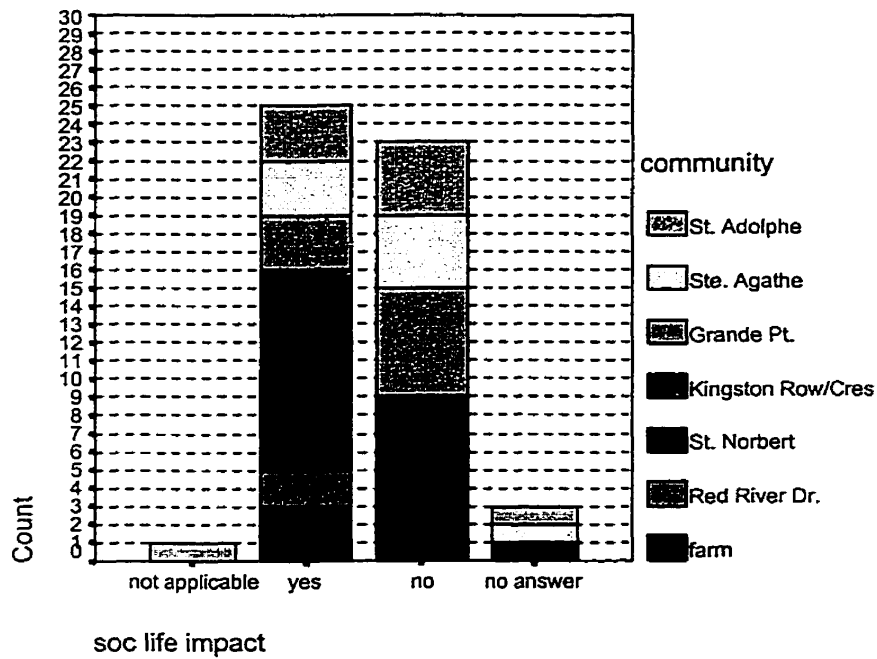


Increased stress during flood? (v30)

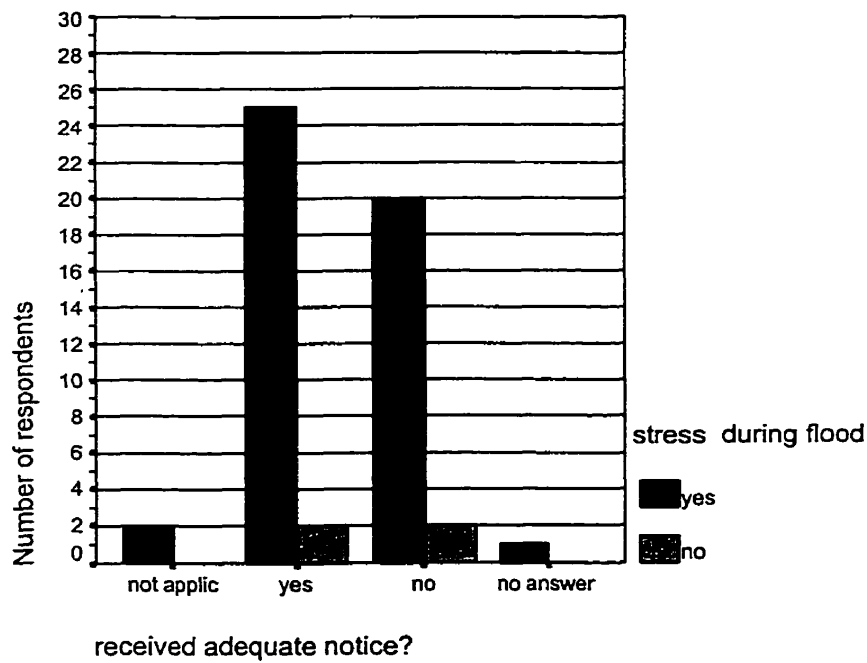
Graph 4: Level of stress by those reporting stress since flood



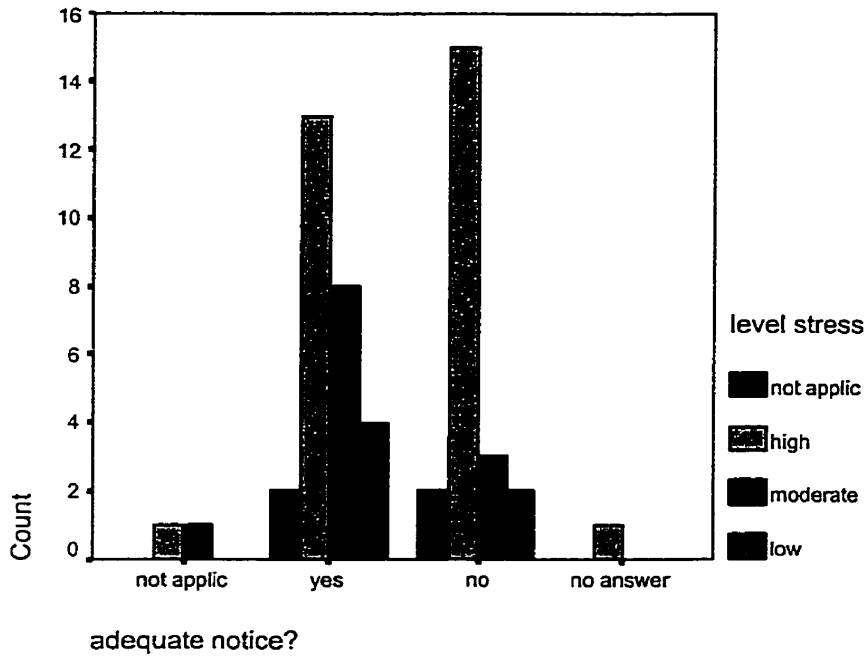
Graph 5: Social impacts (Y/N) by Community



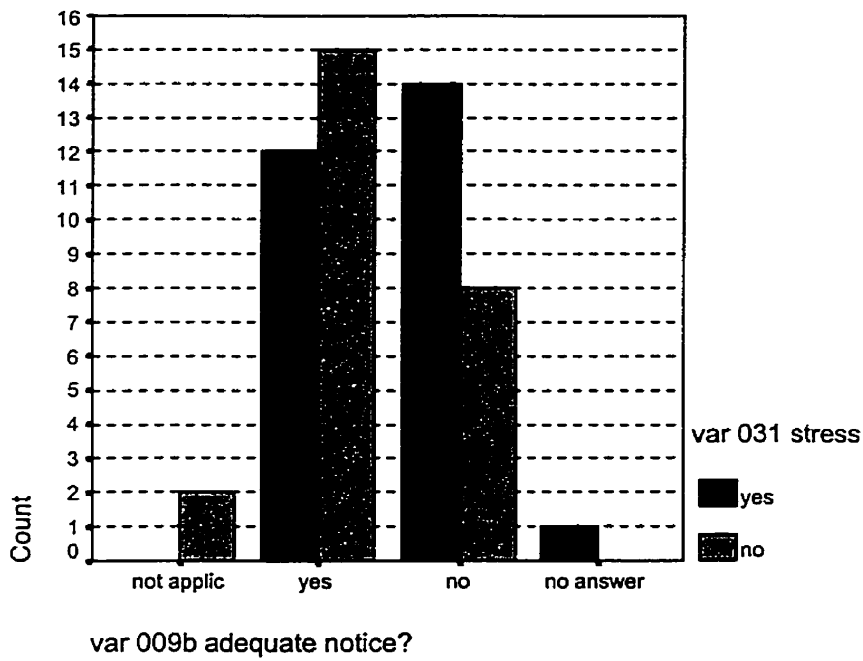
Graph 6: Adequate notice (Y/N) by stress experience during flood



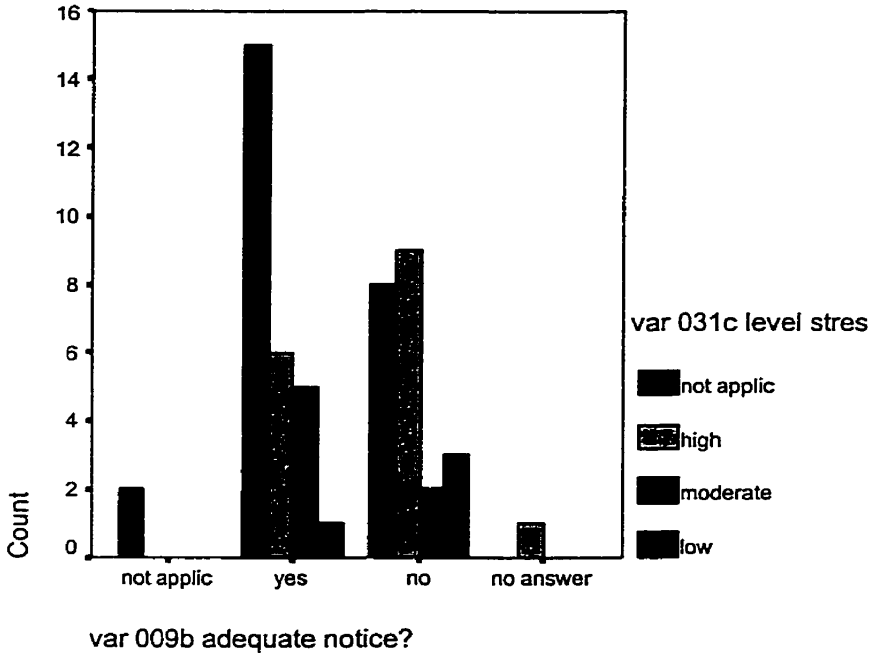
Graph 7: Adequate notice by level of stress during flood



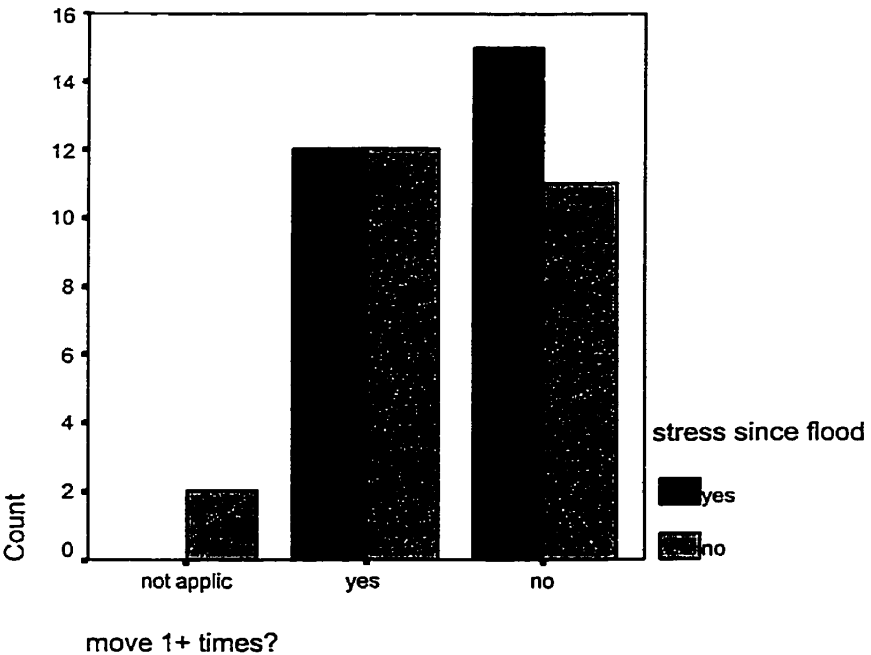
Graph 8: Adequate notice by stress since flood



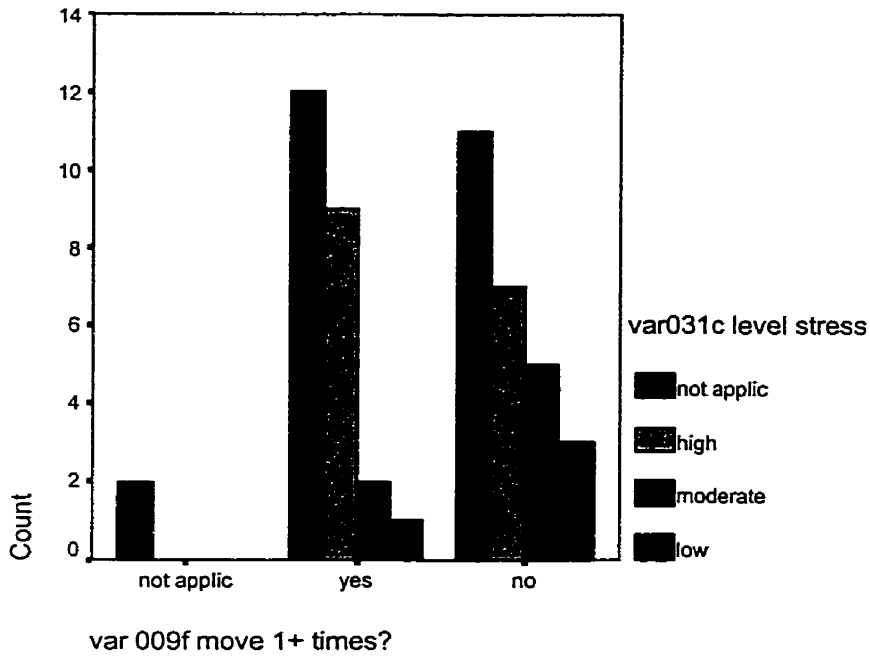
Graph 9: Adequate notice by level of stress since flood



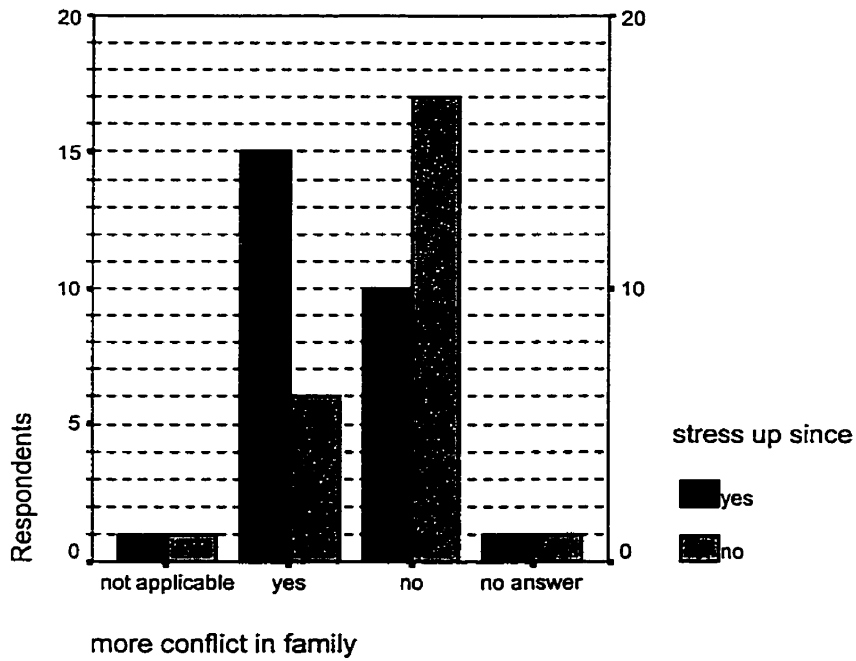
Graph 10: 1+ moves (evacuation) by stress since flood



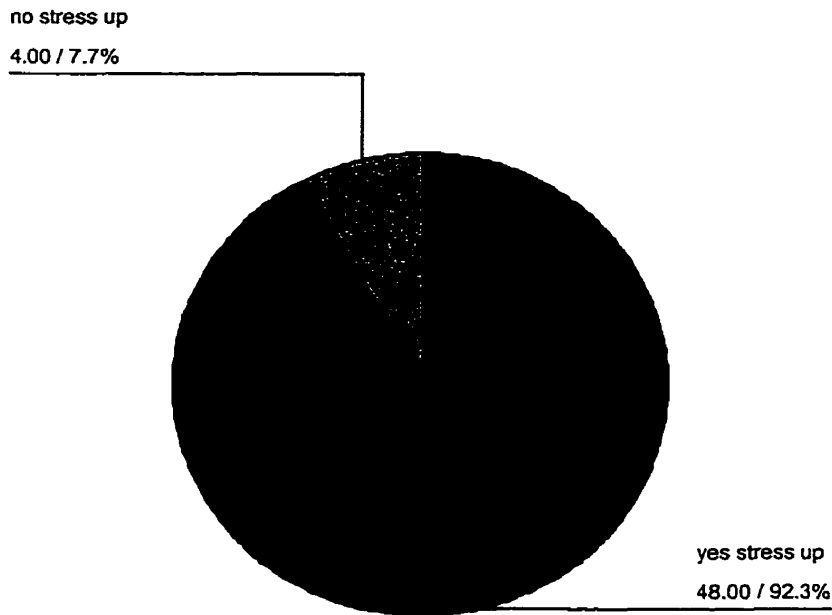
Graph 11: 1+ moves (evacuation) by level of stress since flood



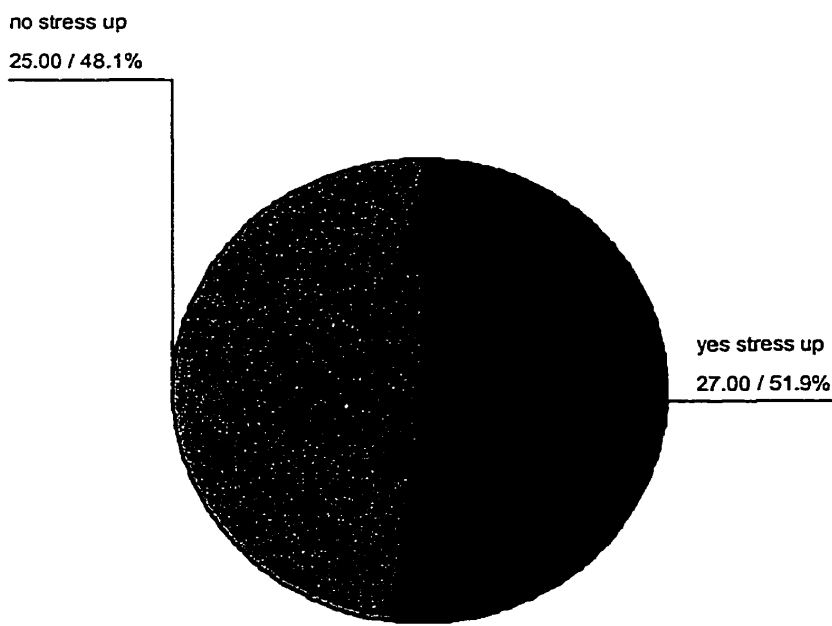
Graph 12: Increase in stress since flood by increased family conflict



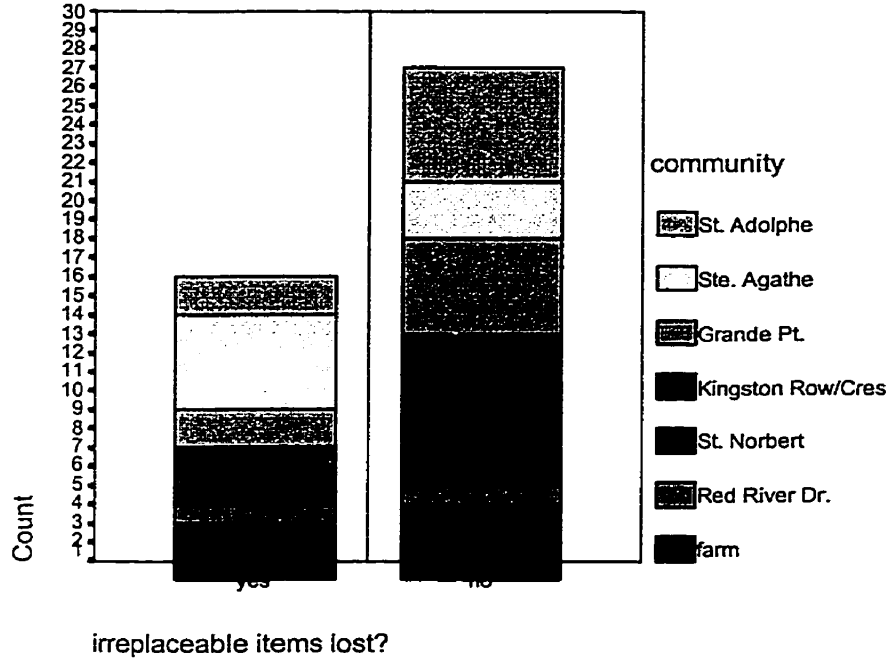
Graph 13: Respondents reporting stress during flood above pre-flood levels



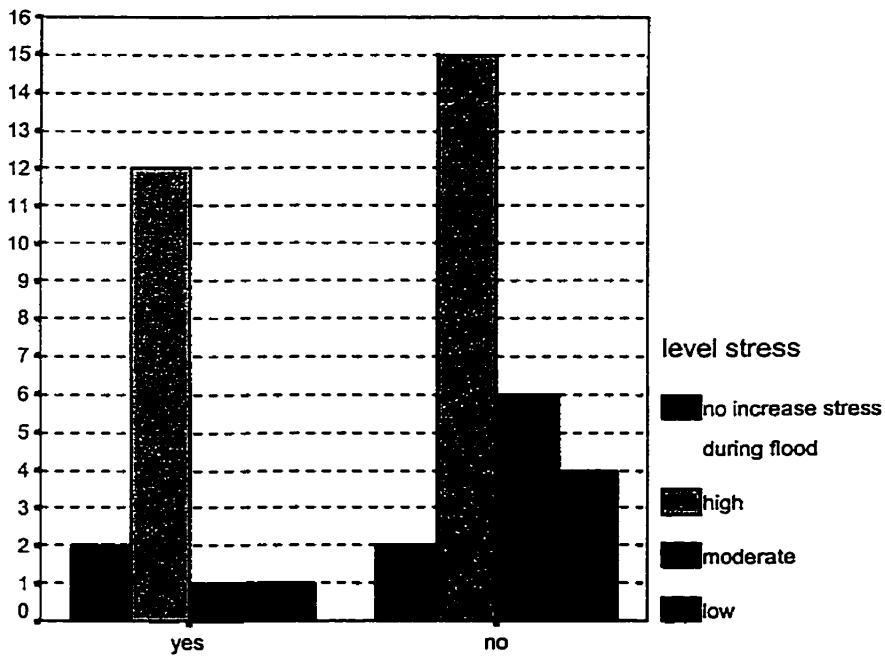
Graph 14: Respondents reporting stress above pre-flood levels post-flood



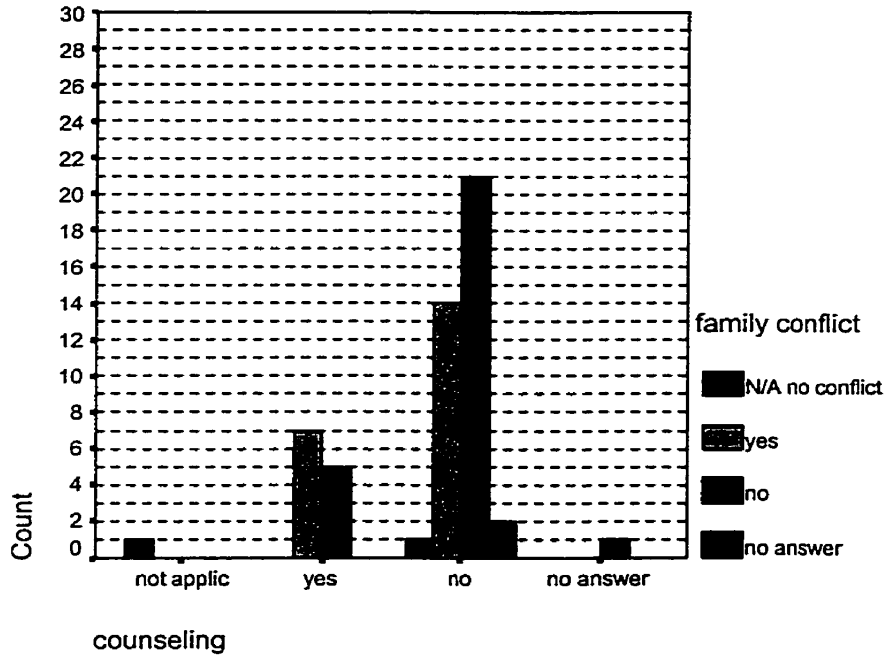
Graph 15: Loss of irreplaceable items by community



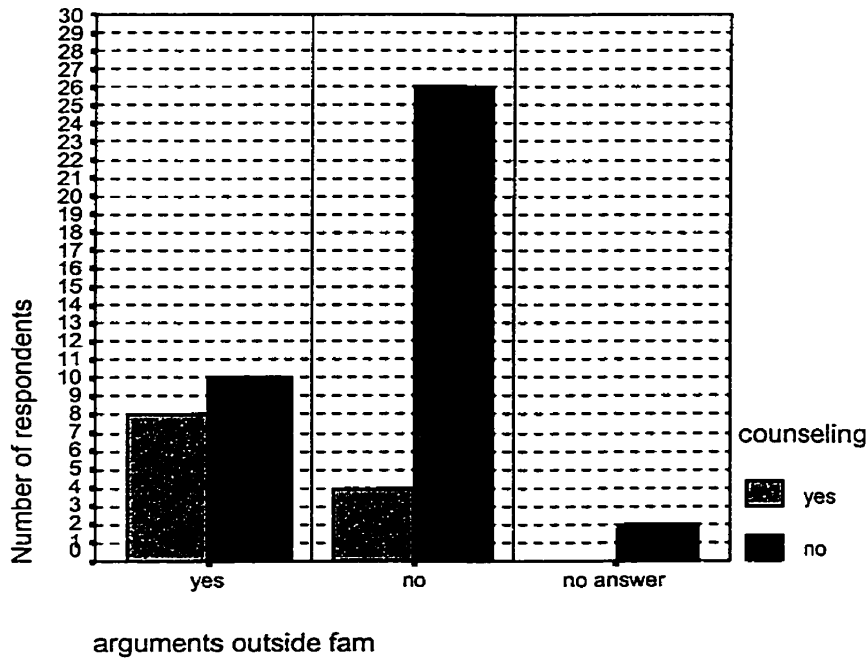
Graph 16: Stress level during flood by irreplaceable items lost



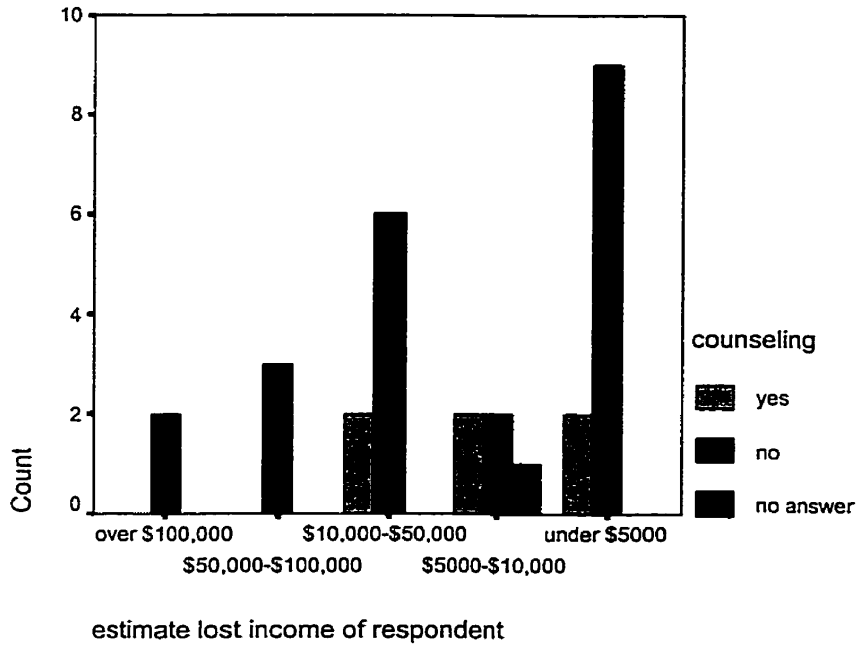
Graph 17: Sought counseling since flood by family conflict



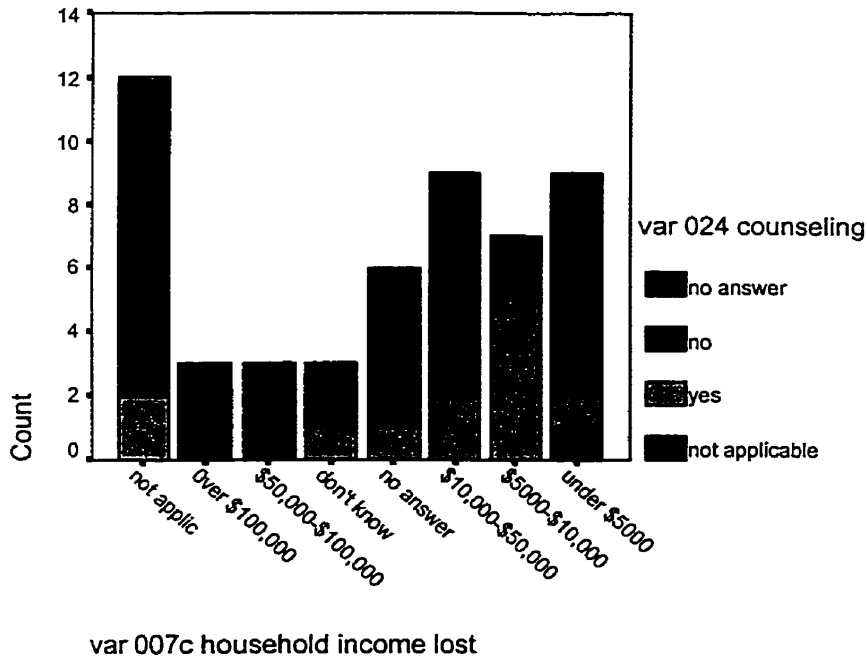
Graph 18: Sought counseling by arguments outside family



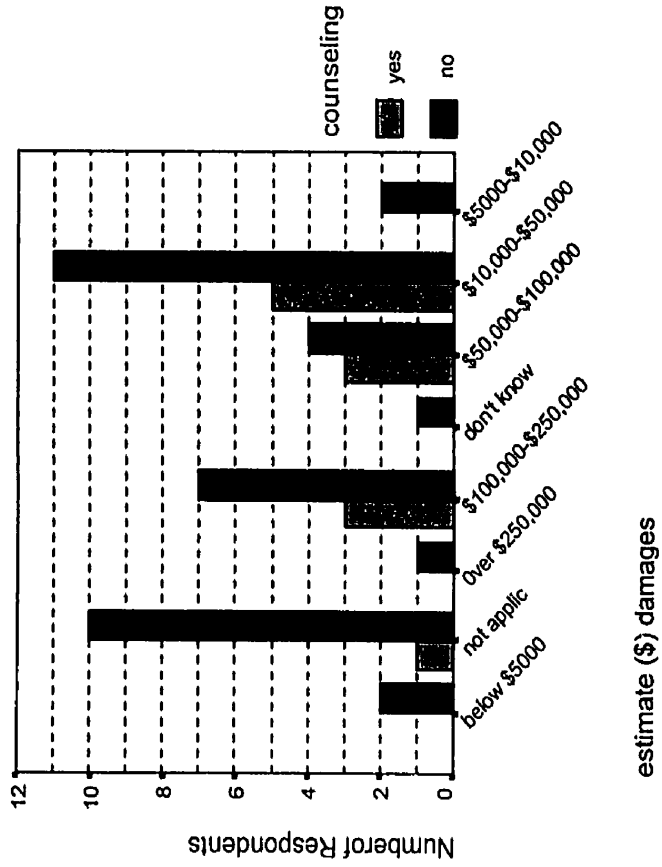
Graph 19: Sought counseling by amount of respondent's lost income



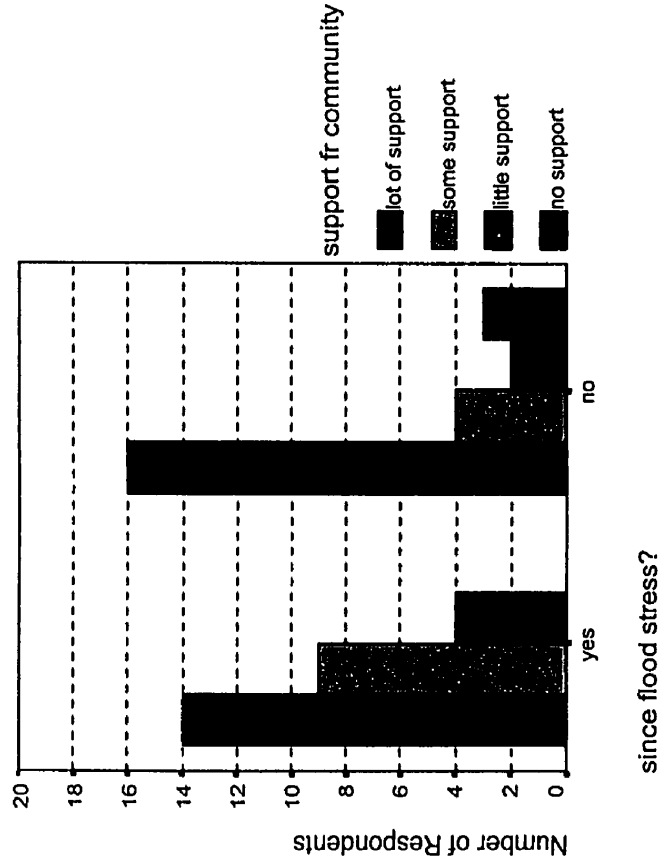
Graph 20: Amount of household income lost by family member sought counseling



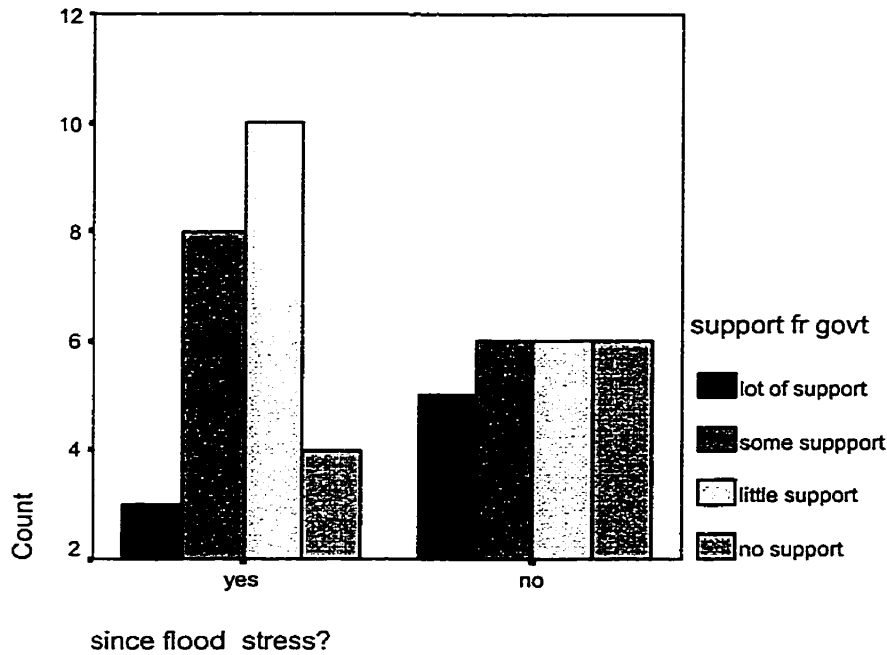
Graph 21: Sought counseling by damage to home



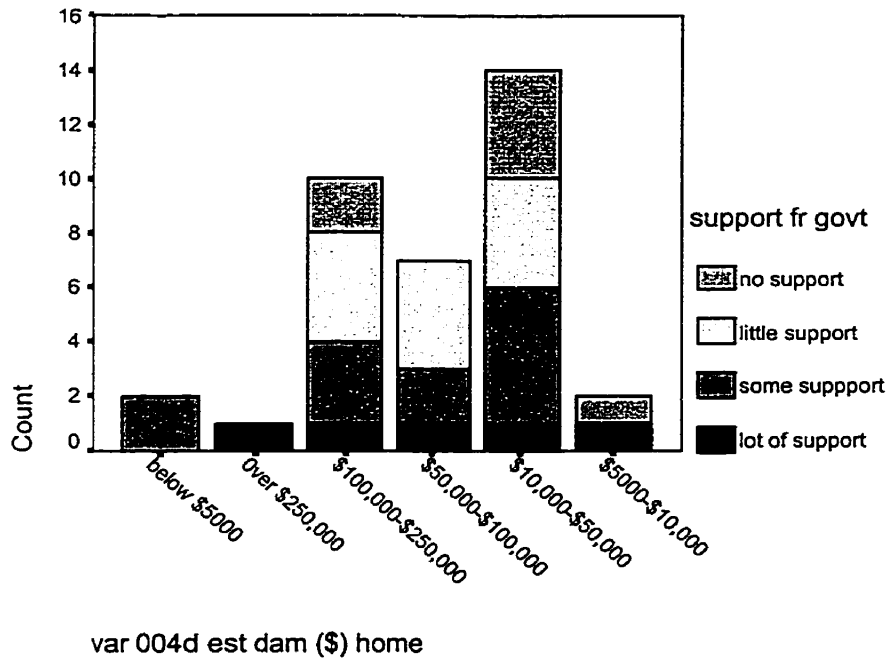
Graph 22: Stress since flood by perceived support from community



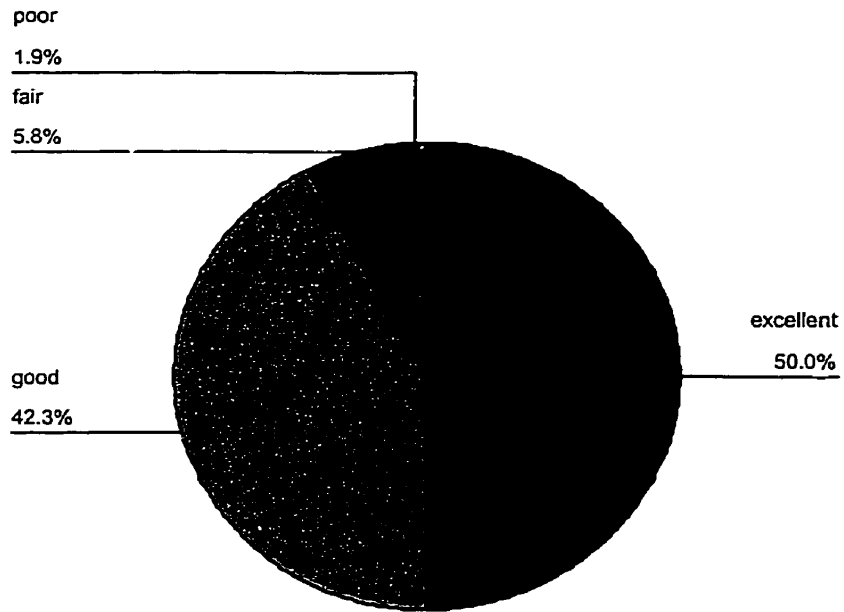
Graph 23: Stress since flood by perceived support by government (provincial)



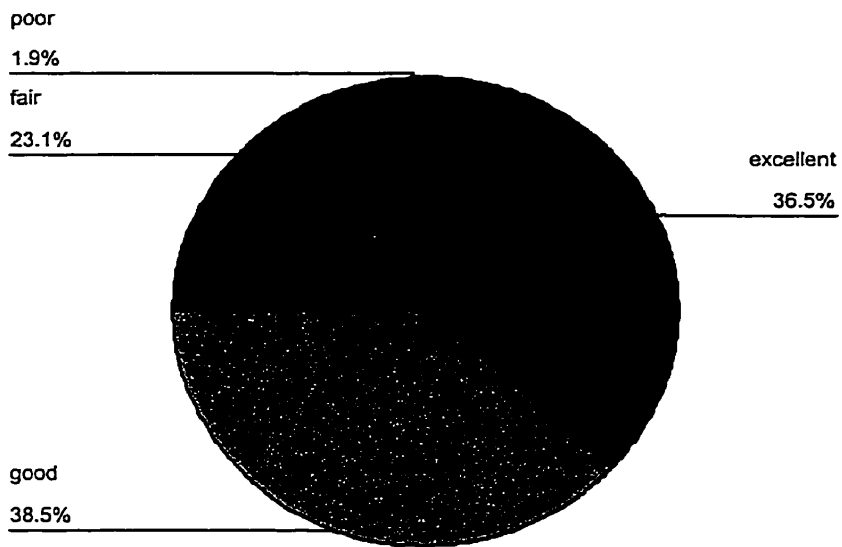
Graph 24: Damage to home by support from government (provincial)



Graph 25: General health before flood



Graph 26: General health since flood



Graph 27: Crosstabulation comparing health before and after flood by estimate of damage (\$)

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
var 004d est# dam home * var 036a health since * var 036 health before	52	100.0%	0	.0%	52	100.0%

var 004d est# dam home * var 036a health since * var 036 health before Crosstabulation

Count			var 036a health since				Total
var 036 health before			excellent	good	fair	poor	
excellent	var	below \$5000		1			1
	004d	not applic	7				7
	est#	Over \$250,000	1				1
	dam	\$100,000-\$250,000	1	3	1		5
	home	don't know	1				1
		\$50,000-\$100,000	3				3
		\$10,000-\$50,000	5		2	1	8
	Total		18	6	2		26
good	var	not applic		4	2		6
	004d	\$100,000-\$250,000		3	1		4
	est#	\$50,000-\$100,000		1	1	1	3
	dam	\$10,000-\$50,000		5	3		8
	home	\$5000-\$10,000		1			1
	Total			14	7	1	22
fair	var	\$100,000-\$250,000	1				1
	004d	\$50,000-\$100,000			1		1
	est#	dam			1		1
	home	\$5000-\$10,000			1		1
	Total		1		2		3
poor	var	below \$5000					
	004d				1		1
	est#	dam					
	home						
	Total				1		1

Graph 28: Crosstabulation of health before and after by length of cleanup period

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
var 036 health before * var 036a health since * var 049a how long take?	52	100.0%	0	.0%	52	100.0%

var 036 health before * var 036a health since * var 049a how long take? Crosstabulation

Count			var 036a health since				Total
var 049a how long take?	var 036 health before		excellent	good	fair	poor	
not applic	excellent		2				2
	good			1	1		2
	Total		2	1	1		4
1-6 days	excellent		4	2			6
	good			2	1		3
	poor				1		1
Total		4	4	2		10	
1-4 weeks	excellent		3				3
	good			2			2
	Total		3	2			5
1-2 months	excellent			1			1
	good			1			1
	Total			1			1
still continuuig	excellent		9	3	2		14
	good			9	5	1	15
	fair		1		2		3
	Total		10	12	9	1	32

Graph 29: Crosstabulation of health before and after flood by loss of household income

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
var 036 health before * var 036a health since * var 007c total household loss inc	52	100.0%	0	.0%	52	100.0%

var 036 health before * var 036a health since * var 007c total household loss inc Crosstabulation

Count			var 036a health since				Total
var 007c total household loss inc	var 036 health before		excellent	good	fair	poor	
not applic		excellent	6				6
		good		4	1		5
		fair	1				1
		Total	7	4	1		12
Over \$100,000		excellent	1				1
		fair			1		1
		poor			1		1
		Total	1		2		3
\$50,000-\$100,000		excellent	1	1			2
		good		1			1
		Total	1	2			3
	don't know		excellent	2			
		good		1			1
		Total	2	1			3
no answer			excellent	3			
		good		2	1		3
		Total	3	2	1		6
	\$10,000-\$50,000		excellent	2	1	1	
		good		2	2		4
		fair			1		1
		Total	2	3	4		9
\$5000-\$10,000		excellent		3	1		4
		good		1	1	1	3
		Total		4	2	1	7
	under \$5000		excellent	3	1		
		good		3	2		5
		Total	3	4	2		9

Graph 30: Crosstabulation of activism (worked with prior community problem / worked with flood related problem in 1997) by stress level since flood

Case Processing Summary

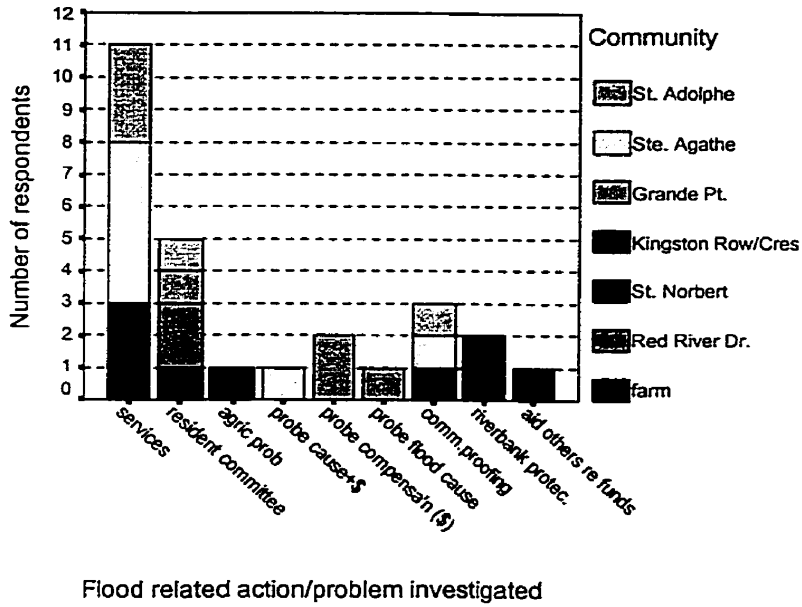
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
var 043 prior, communi-ty work * var 043a since, communi-ty work * var 031c level stress	52	100.0%	0	.0%	52	100.0%

var 043 prior, communi-ty work * var 043a since, communi-ty work * var 031c level stress Crosstabulation

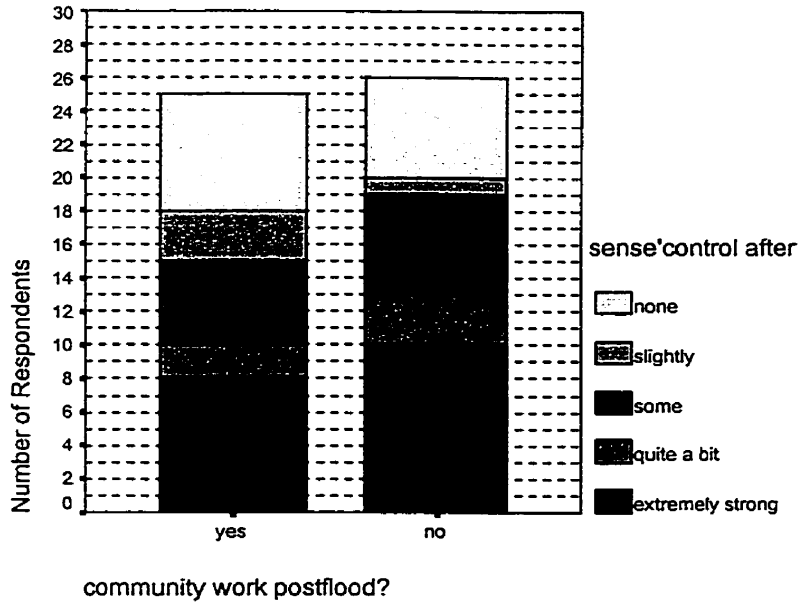
Count

var 031c level stress			var 043a since, communi-ty work		Total
			yes	no	
not applic	var 043 prior, yes		7	4	11
	communi-ty work no		5	9	14
	Total		12	13	25
high	var 043 prior, yes		6	3	9
	communi-ty work no		2	5	7
	Total		8	8	16
moderate	var 043 prior, yes		3		3
	communi-ty work no			4	4
	Total		3	4	7
low	var 043 prior, yes		1		1
	communi-ty work no		1	2	3
	Total		2	2	4

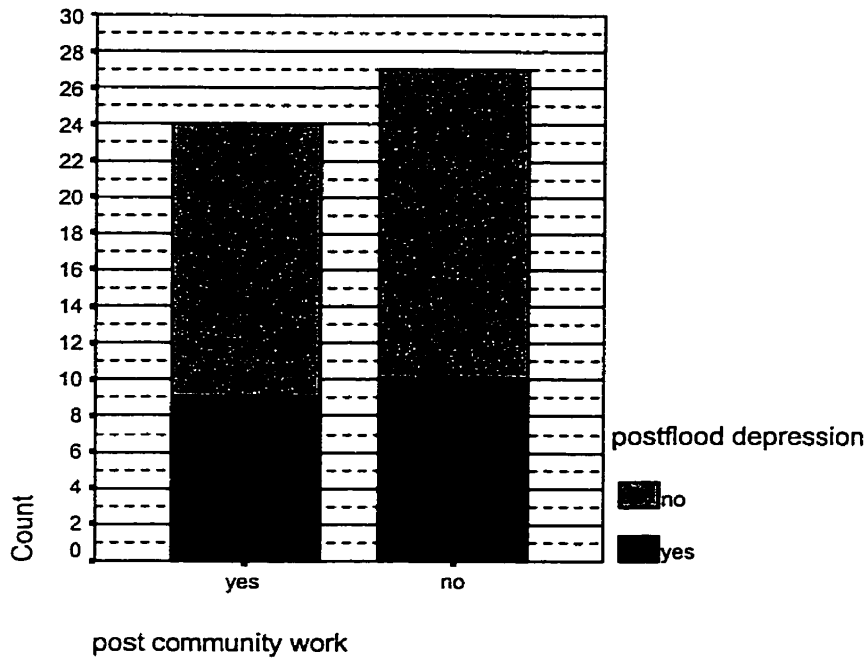
Graph 31: Type of community problem worked on after flood by community



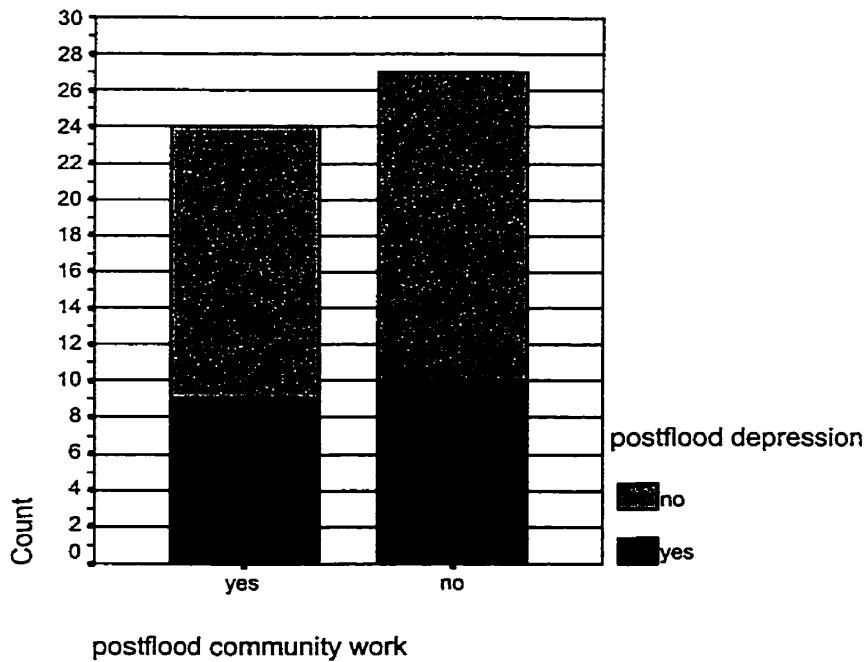
Graph 32: Work on community problem after flood by sense of control after flood



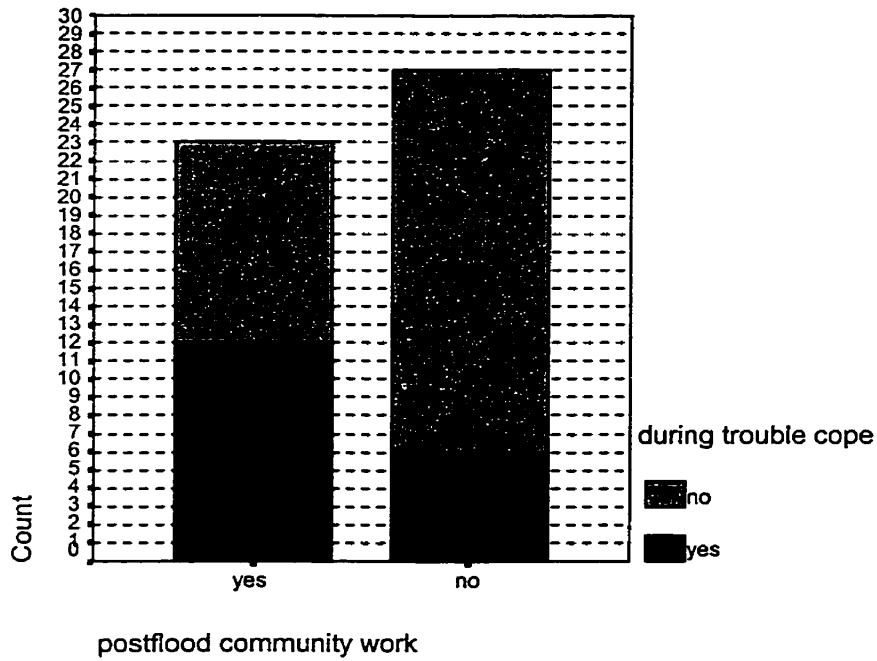
Graph 33: Work re community problem post-flood by depression during flood



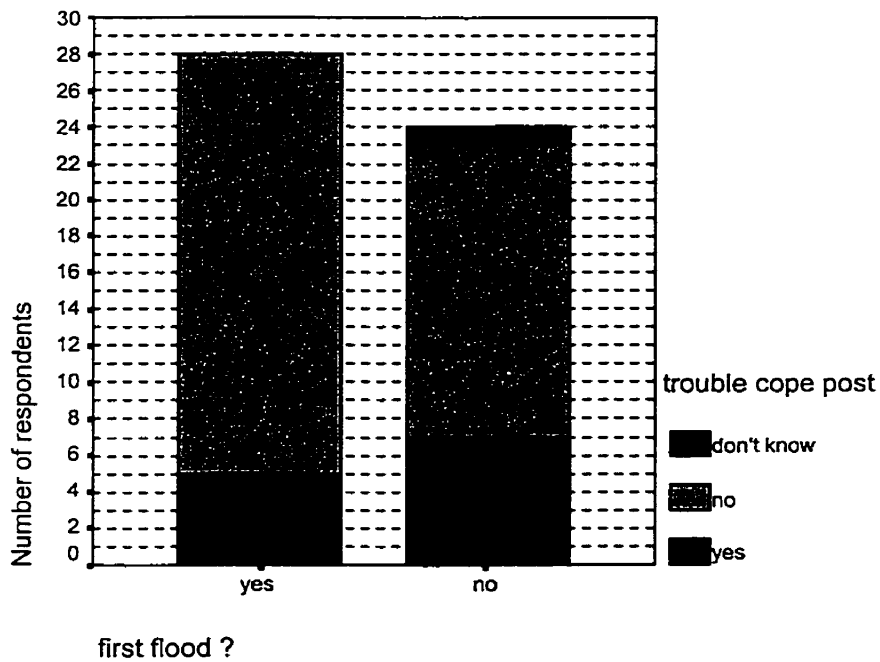
Graph 34: Work re community flood problem by depression after flood



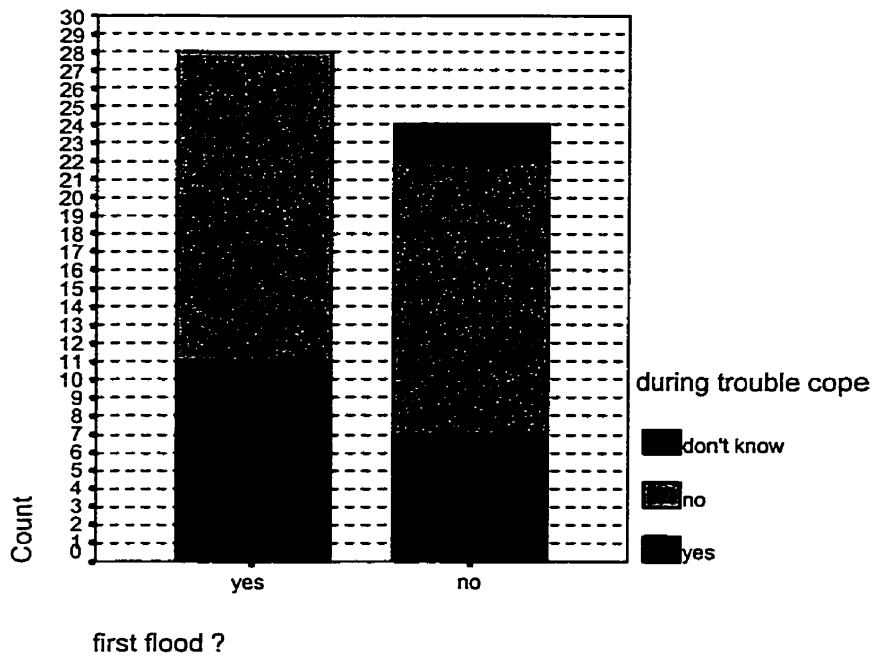
Graph 35: Work on community problem (post-flood) by trouble coping during flood



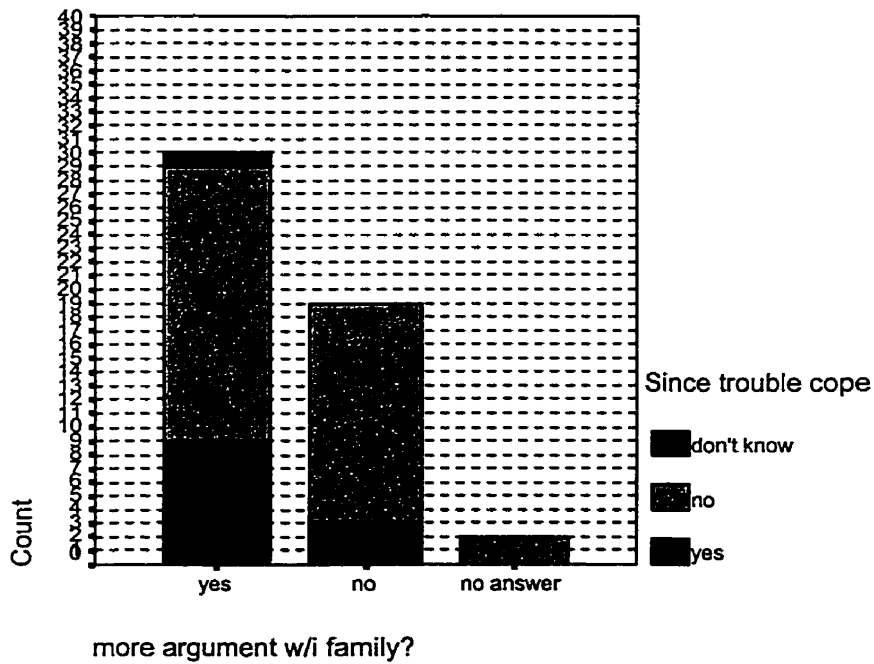
Graph 36: Trouble coping since flood by first flood experience



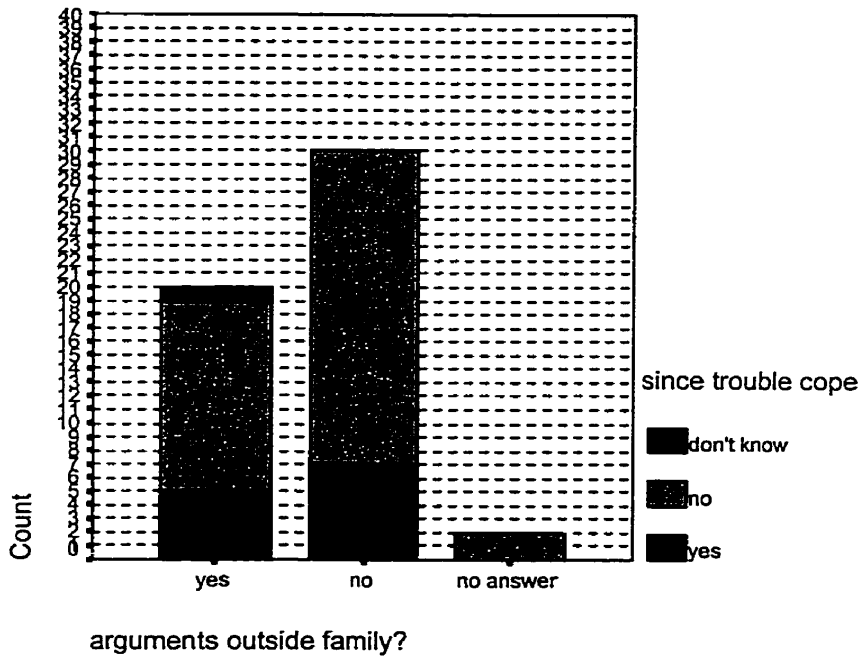
Graph 37: Prior flood experience by trouble coping during flood



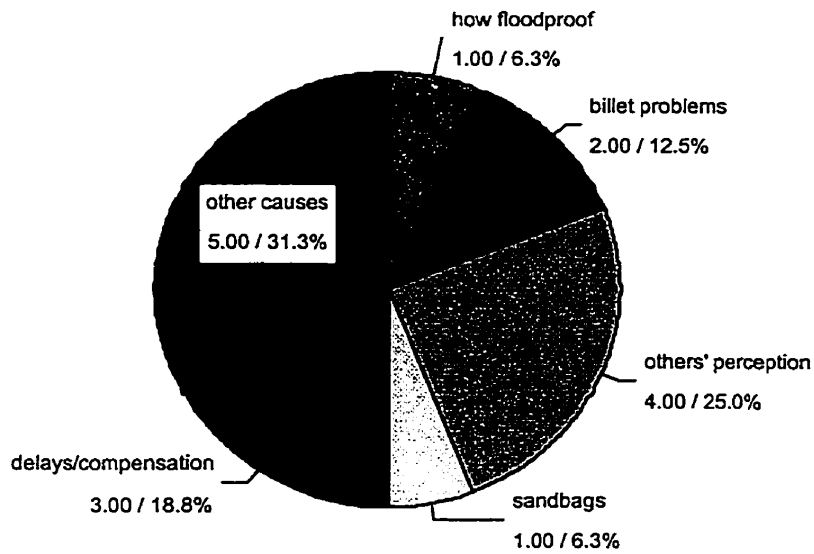
Graph 38: Trouble coping with problems since flood by arguments in family



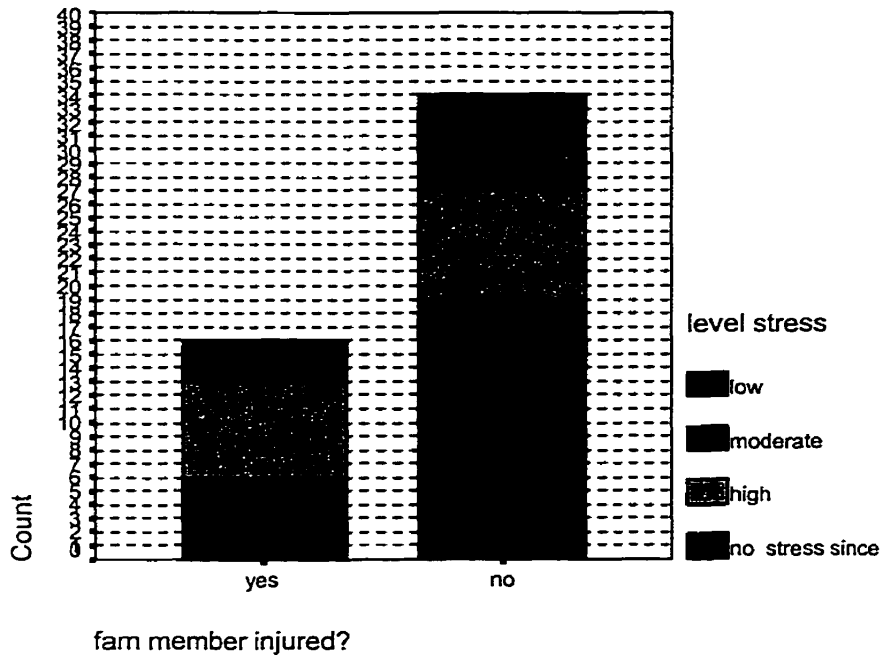
Graph 39: Trouble coping by arguments outside family



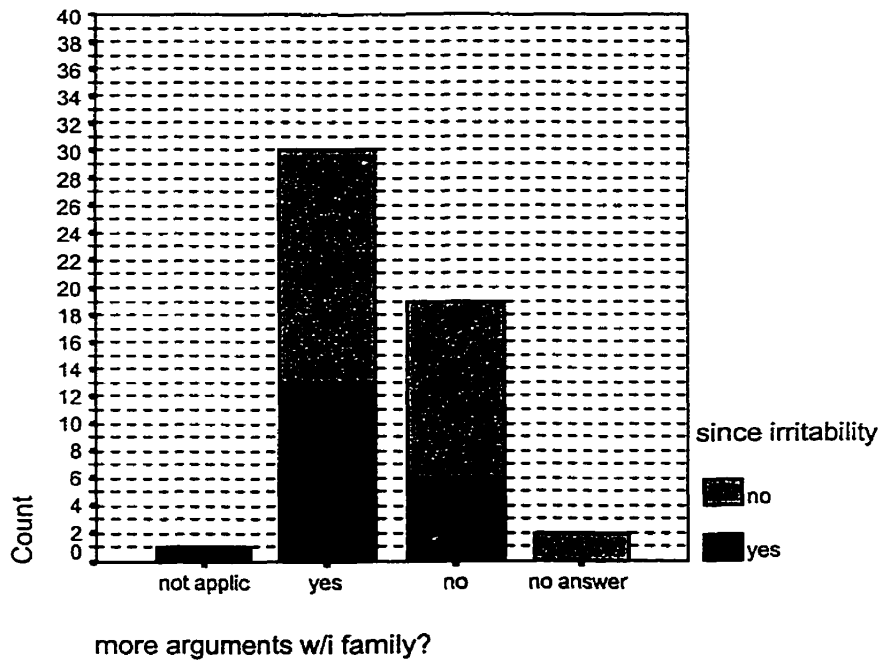
Graph 40: Pie graph of causes of arguments outside family



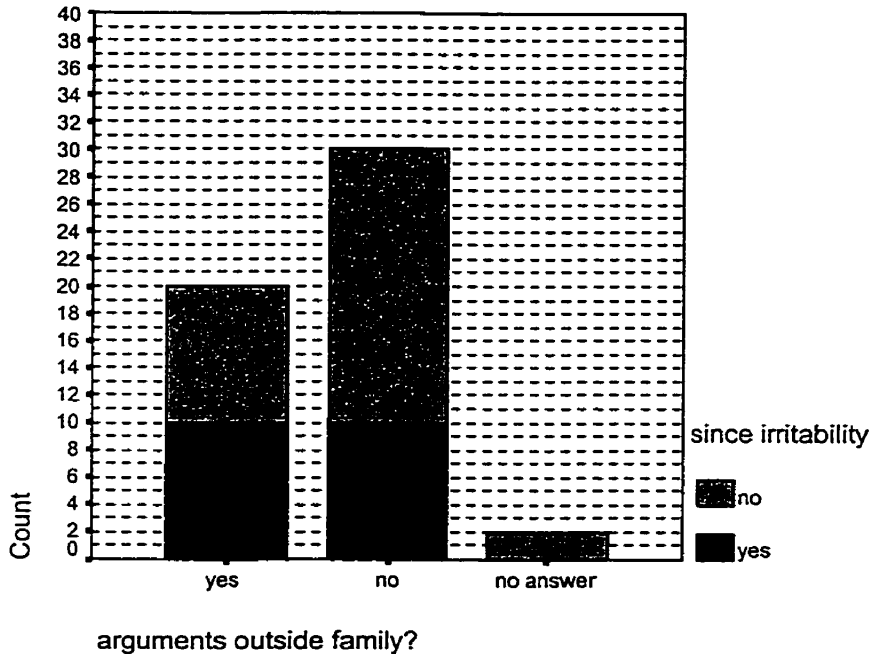
Graph 41: Family members injured (Y/N) by level of stress since flood



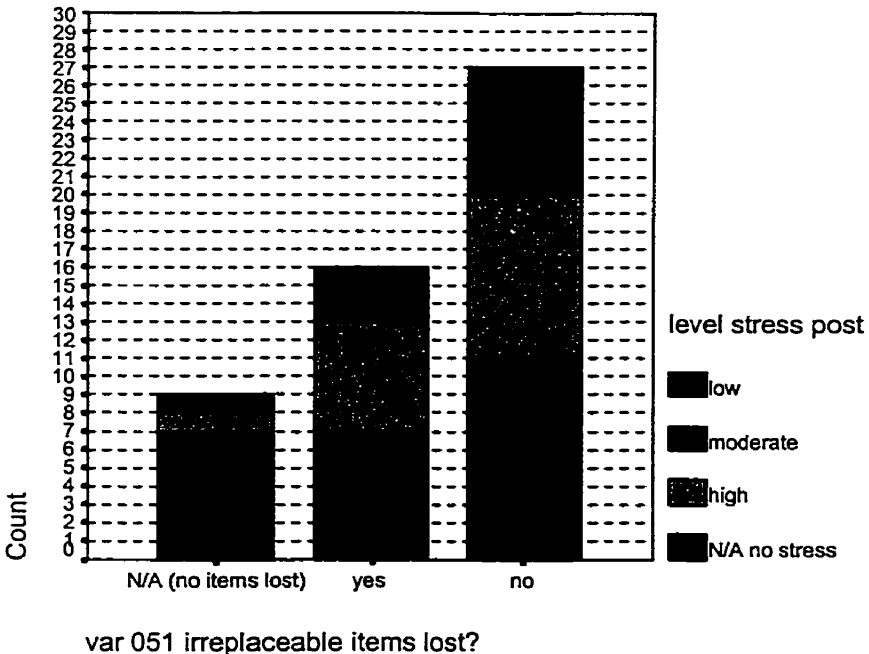
Graph 42: Irritability since the flood by arguments within family



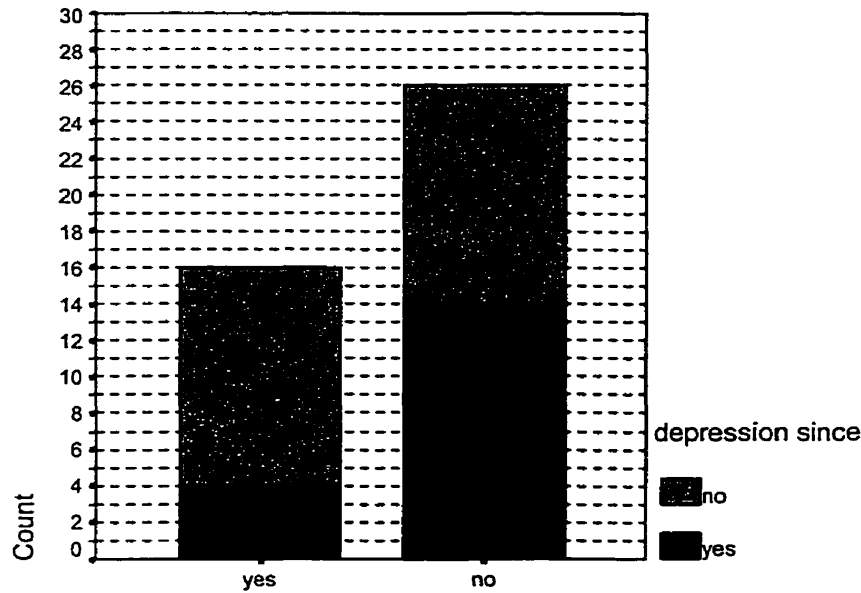
Graph 43: Irritability by arguments outside family



Graph 44: Loss of irreplaceable items by level of stress post-flood

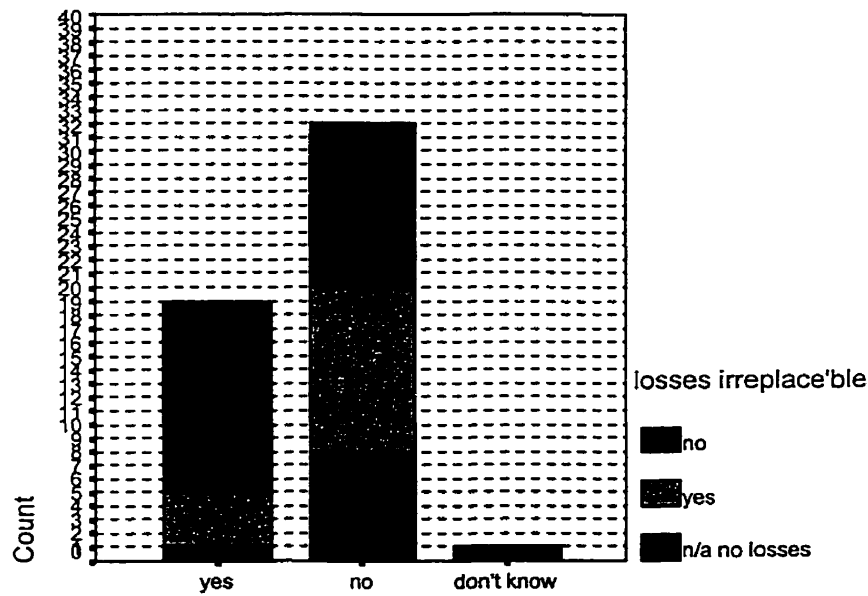


Graph 45: Loss of irreplaceable items by depression since flood



var 051 irreplaceable items lost?

Graph 46: Depression / unhappiness post-flood by loss of personal items (replaceable & irreplaceable)



depressed since flood? (var 33)

Graph 47: Crosstabulation of health before and after flood and loss of irreplaceable items

Case Processing Summary

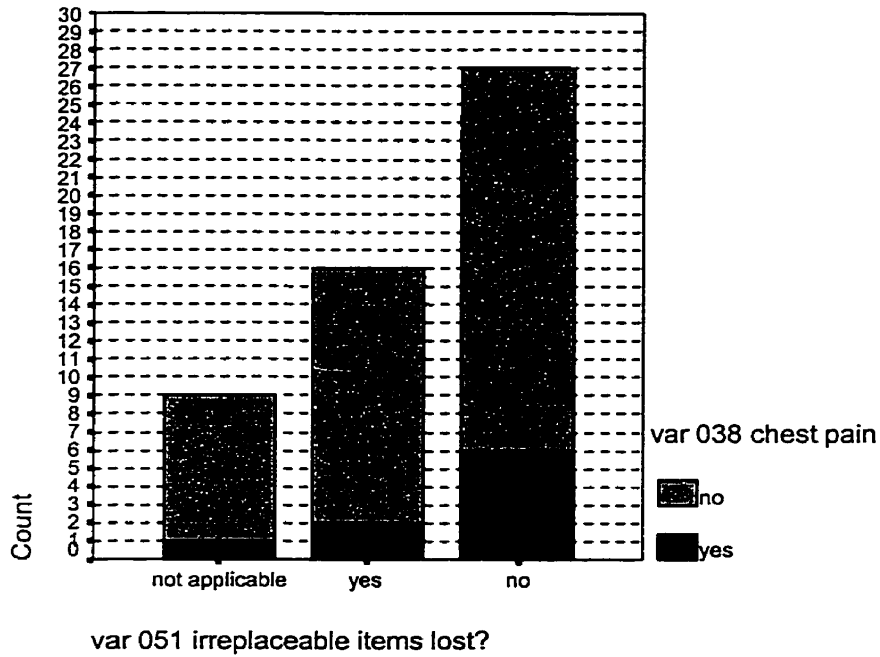
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
var 036 health before * var 036a health since * var 051 irreplaceable items lost?	52	100.0%	0	.0%	52	100.0%

var 036 health before * var 036a health since * var 051 irreplaceable items lost? Crosstabulation

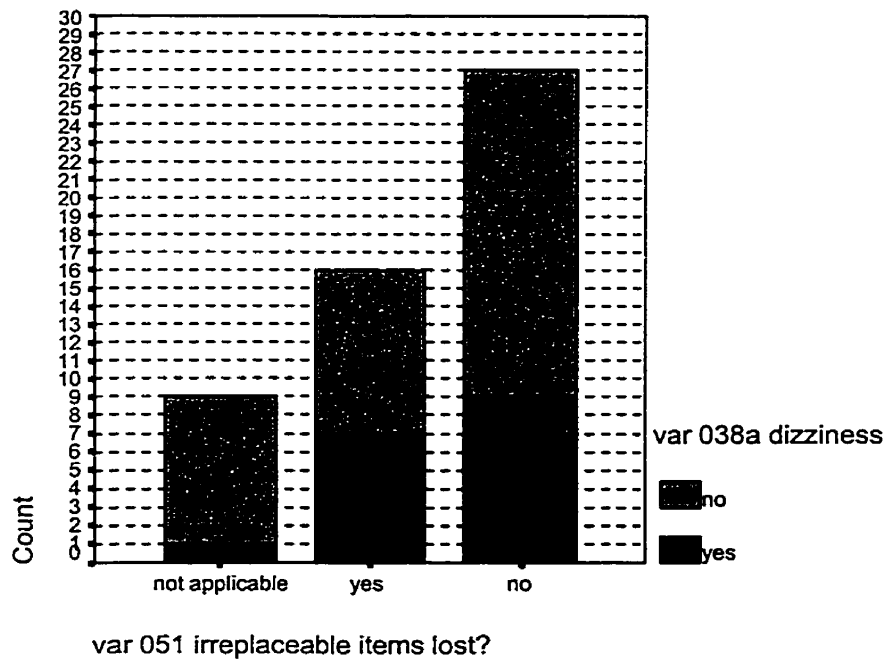
Count

var 051 irreplaceable items lost?			var 036a health since				Total
			excellent	good	fair	poor	
not applicable	var 036	excellent	5				5
	health	good		4			4
	before	Total	5	4			9
yes	var 036	excellent	5	1	2		8
	health	good		3	4		7
	before	fair			1		1
	Total		5	4	7		16
no	var 036	excellent	8	5			13
	health	good		7	3	1	11
	before	fair	1		1		2
		poor			1		1
	Total		9	12	5	1	27

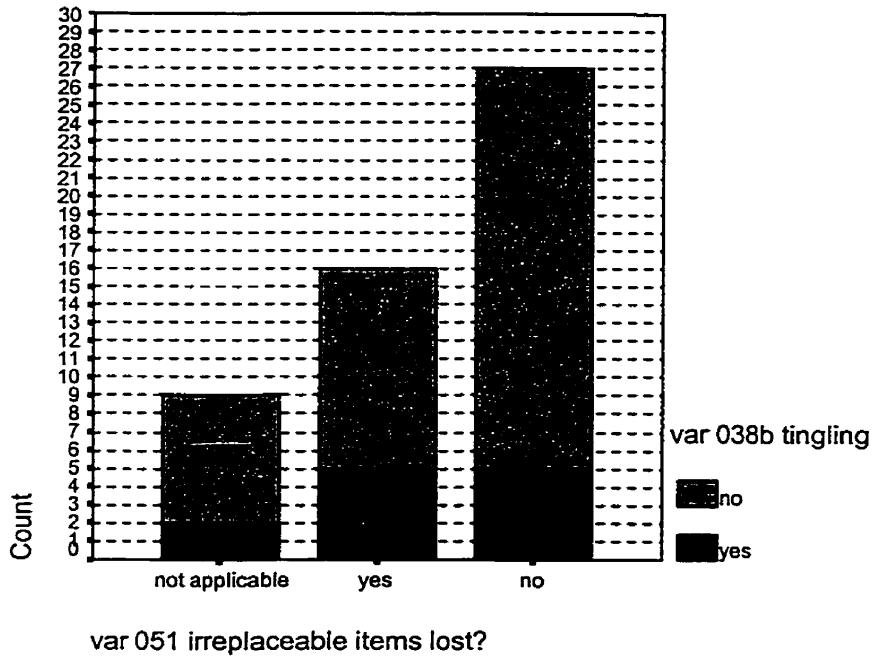
Graph 48: Chest pain by loss of irreplaceable items



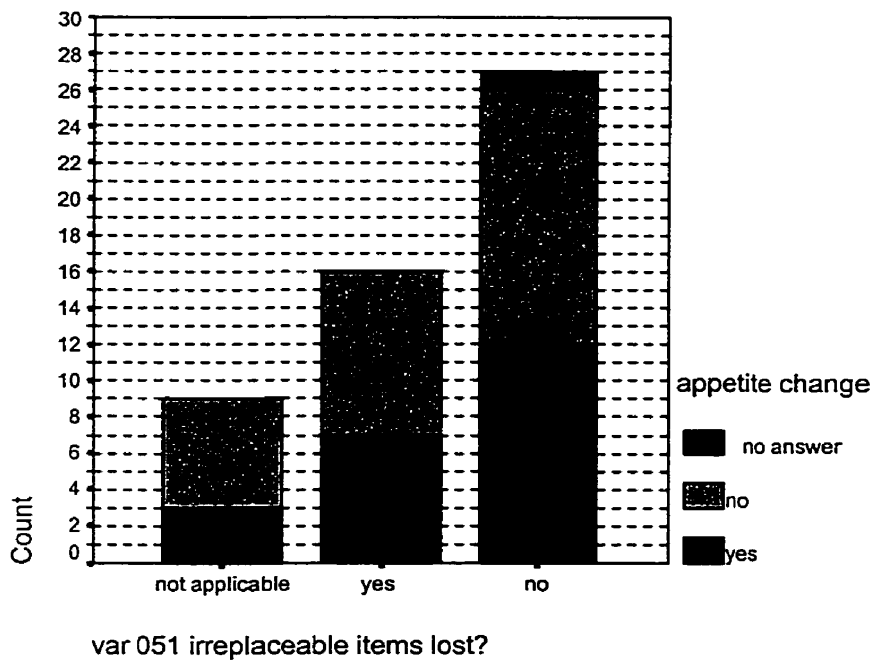
Graph 49: Loss of irreplaceable items by dizziness during / since flood



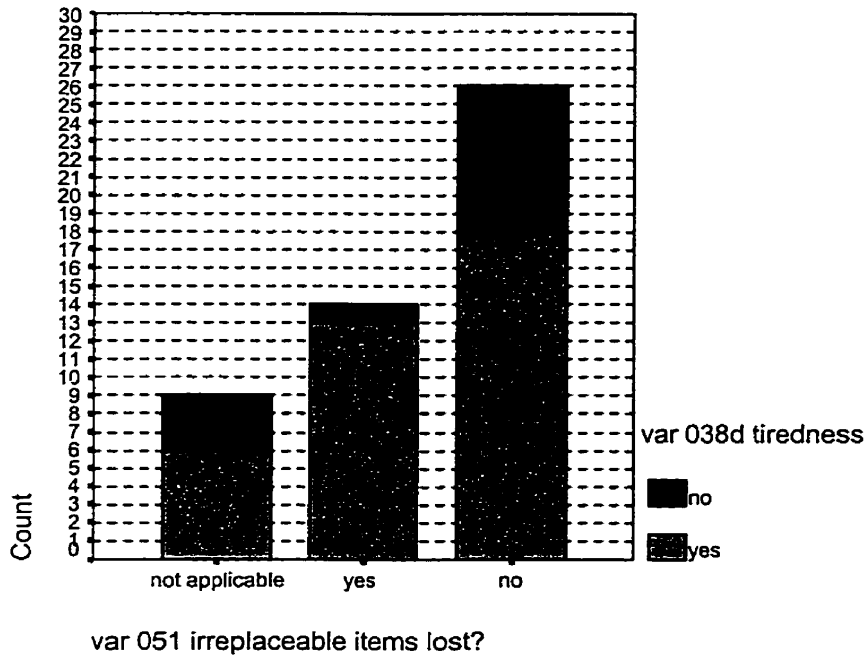
Graph 50: Loss of irreplaceable items by tingling in extremities



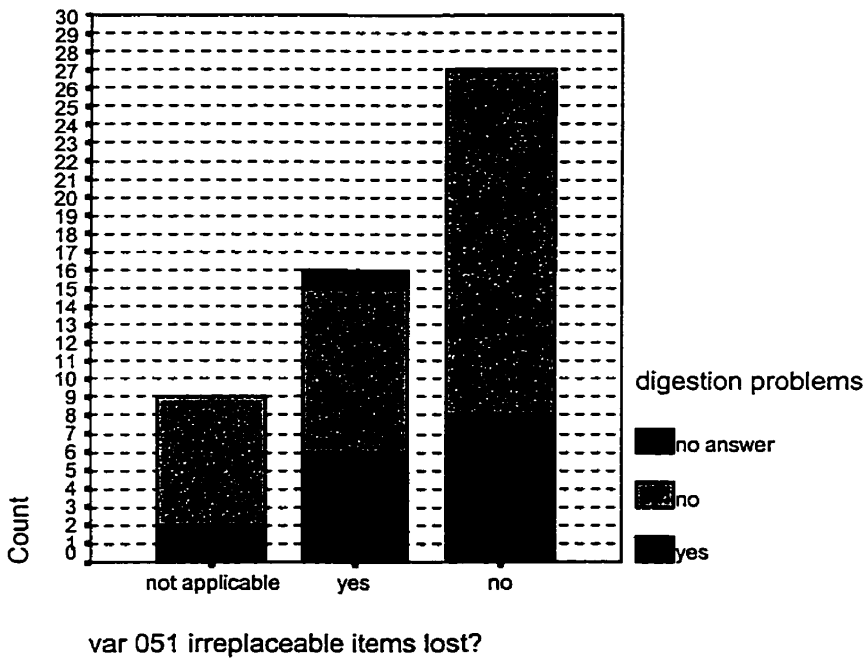
Graph 51: Loss of irreplaceable items and appetite change



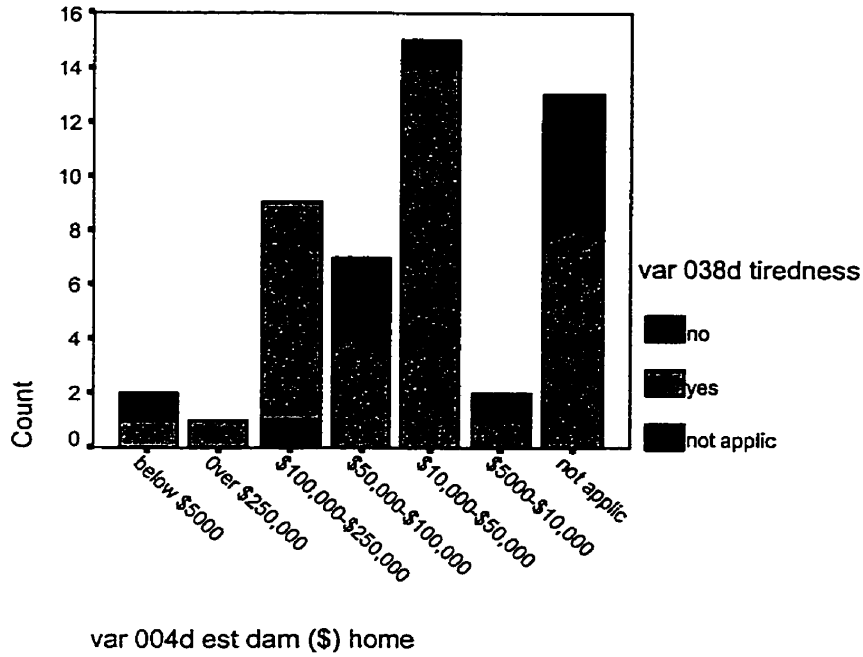
Graph 52: Loss of irreplaceable items by tiredness



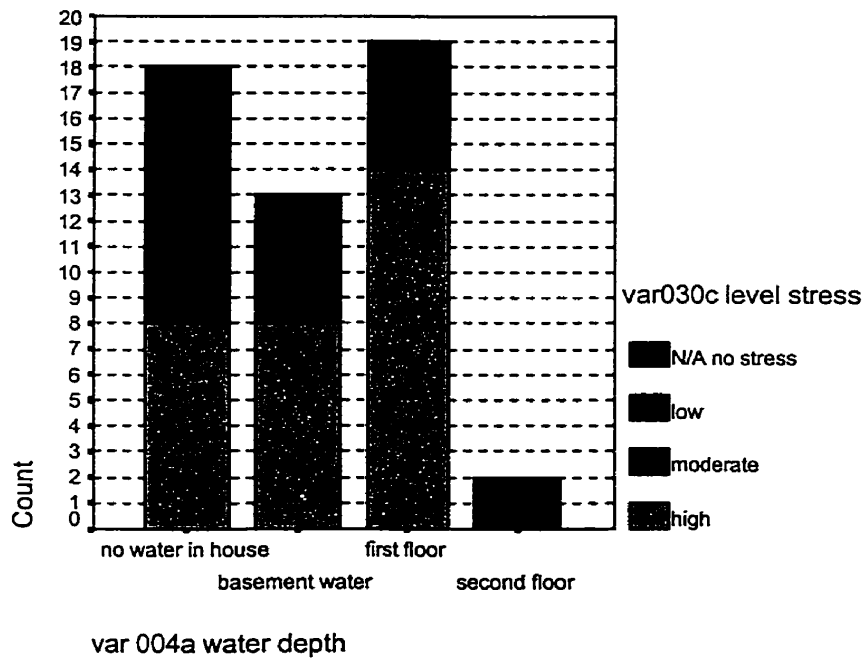
Graph 53: Loss of irreplaceable items by digestion problems



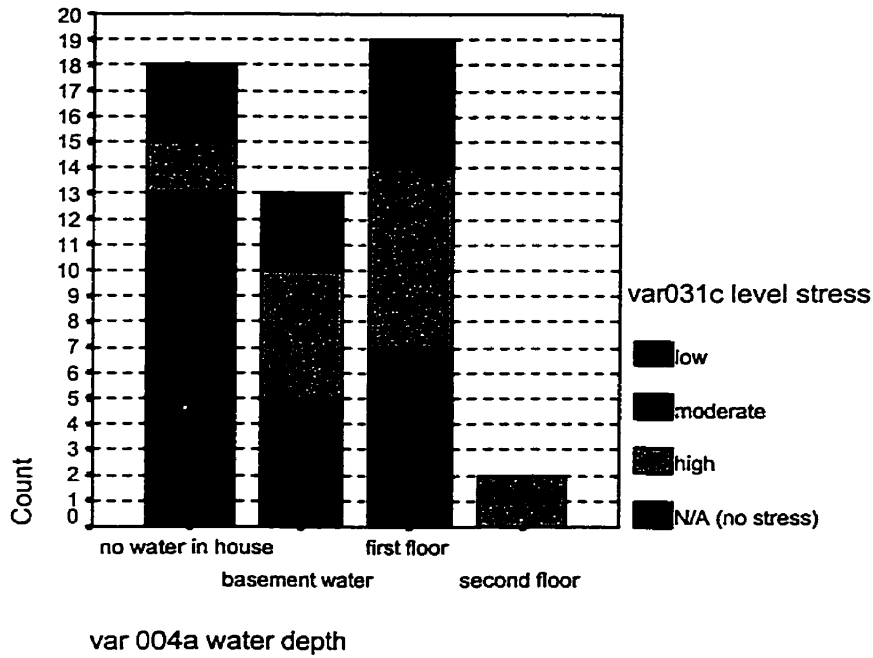
Graph 54: Estimate of damage by tiredness since / during flood



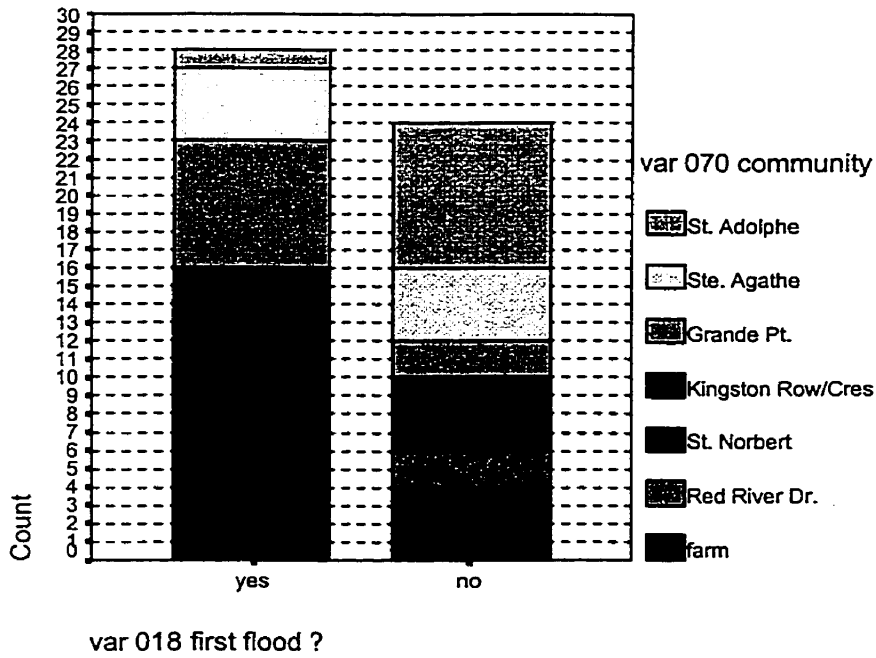
Graph 55: Depth of water in home by level of stress during flood



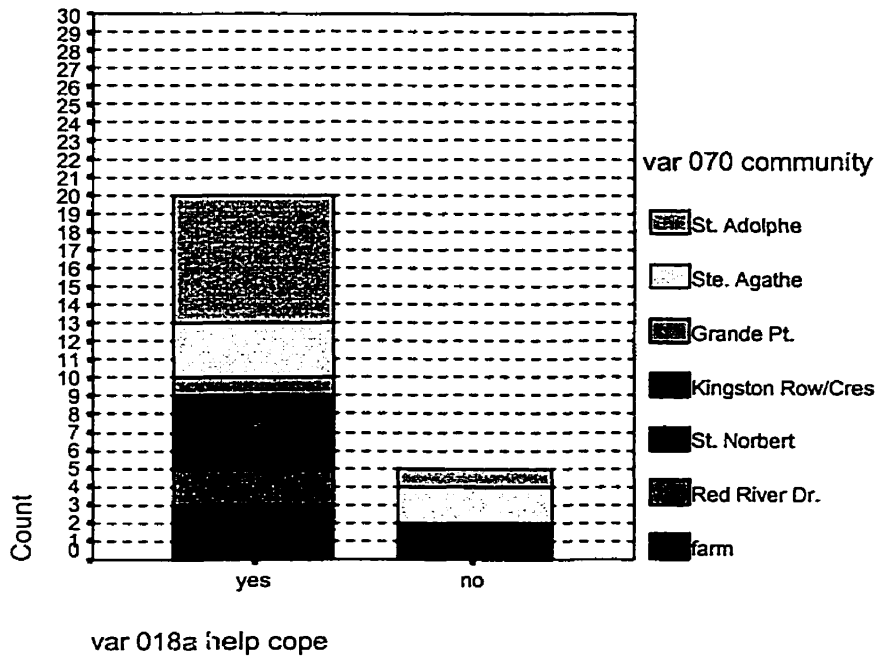
Graph 56: Depth of water by stress level since flood



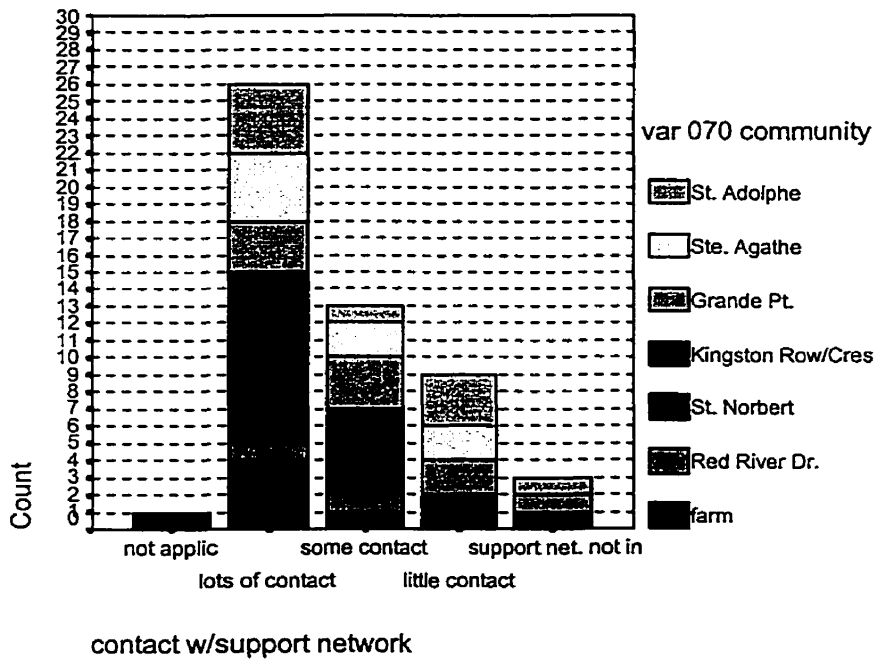
Graph 57: Prior experience (first flood) by community



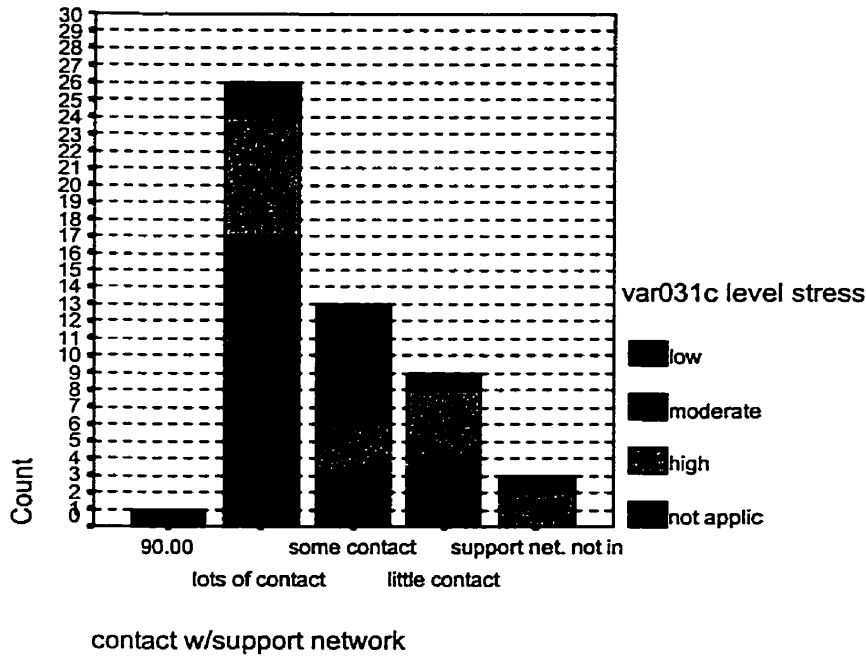
Graph 58: Prior experience helped with coping by community



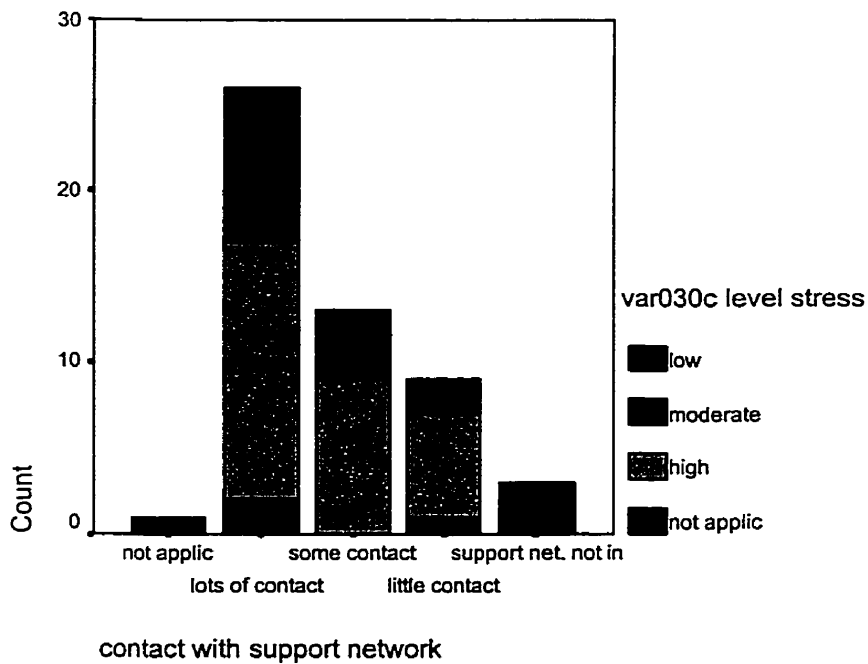
Graph 59: Contact with support network by community



Graph 60: Contact with support network by stress level after flood



Graph 61: Contact with support network by level of stress during flood



Graph 62: Crosstabulation of health before and after flood and contact with support network

Case Processing Summary

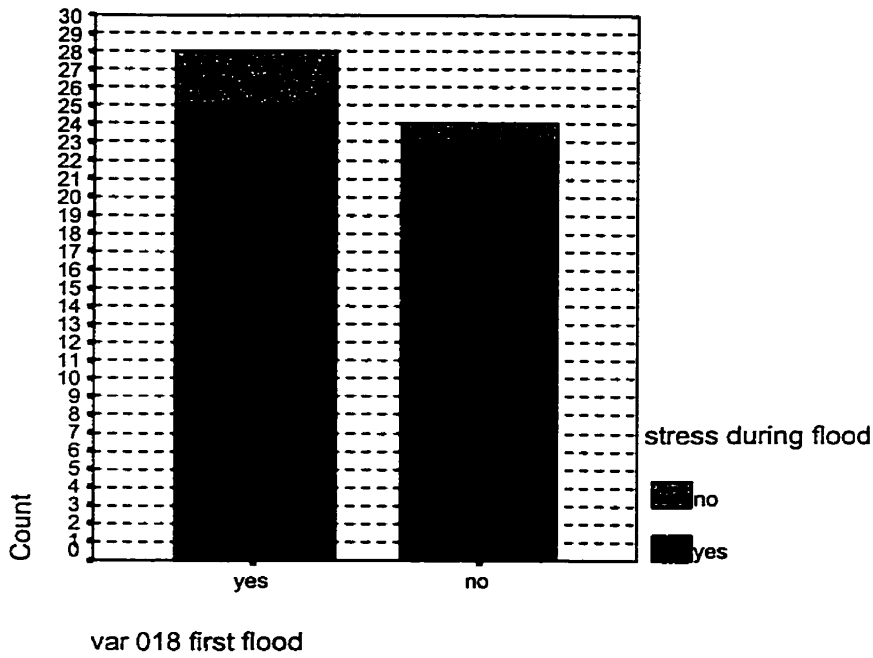
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
var 036 health before * var 036a health since * var 011a contact netw	52	100.0%	0	.0%	52	100.0%

var 036 health before * var 036a health since * var 011a contact netw Crosstabulation

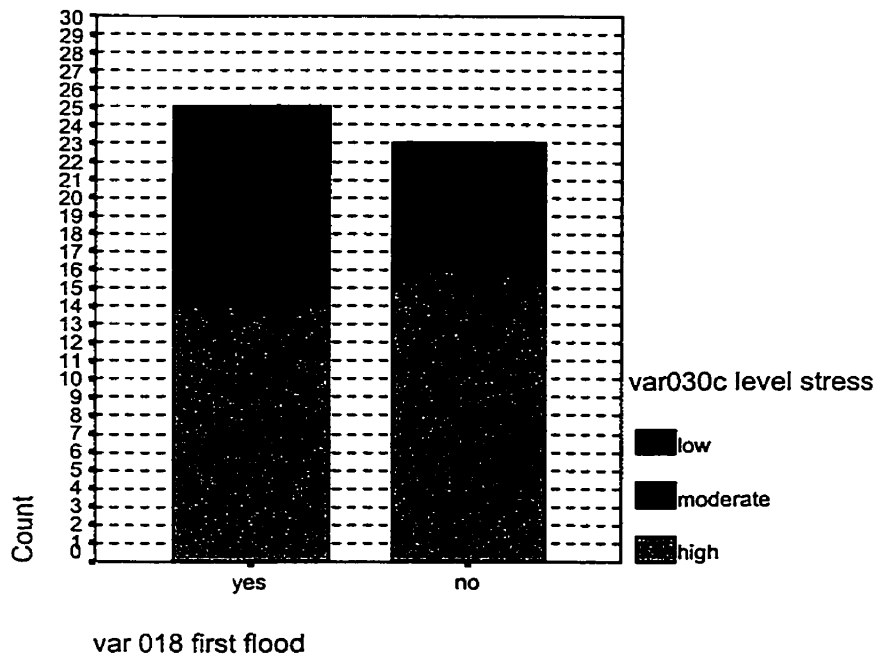
Count

var 011a contact netw			var 036a health since				Total
			excellent	good	fair	poor	
90.00	var 036 health before	excellent	1				1
		Total	1				1
lots of contact	var 036 health before	excellent	10	2			12
		good		7	3	1	11
		fair	1		1		2
		poor			1		1
	Total		11	9	5	1	26
some contact	var 036 health before	excellent	4	3	1		8
		good		1	3		4
		fair			1		1
		Total	4	4	5		13
little contact	var 036 health before	excellent	2	1	1		4
		good		4	1		5
		Total	2	5	2		9
support net. not in comm	var 036 health before	excellent	1				1
		good		2			2
		Total	1	2			3

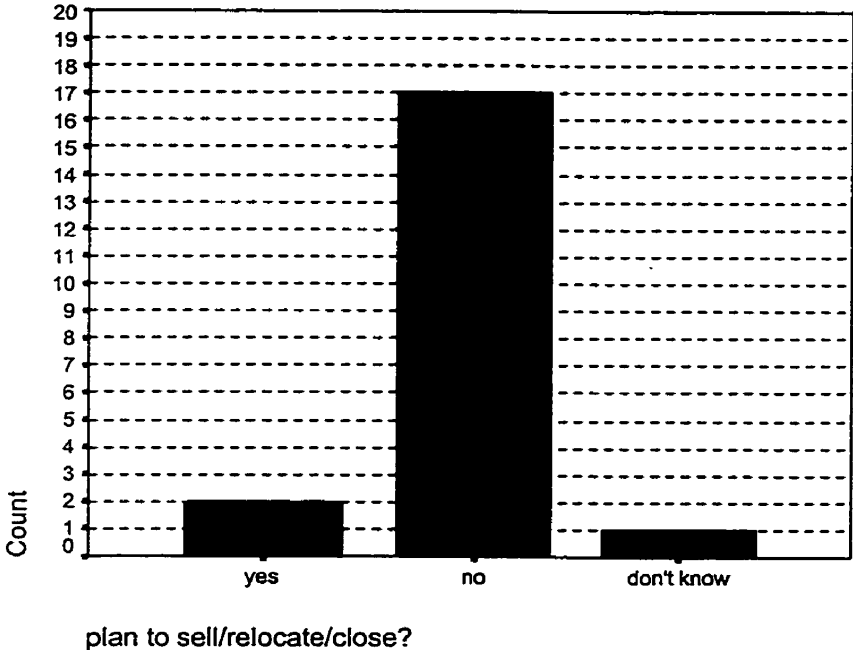
Graph 63: Previous flood experience by stress during flood



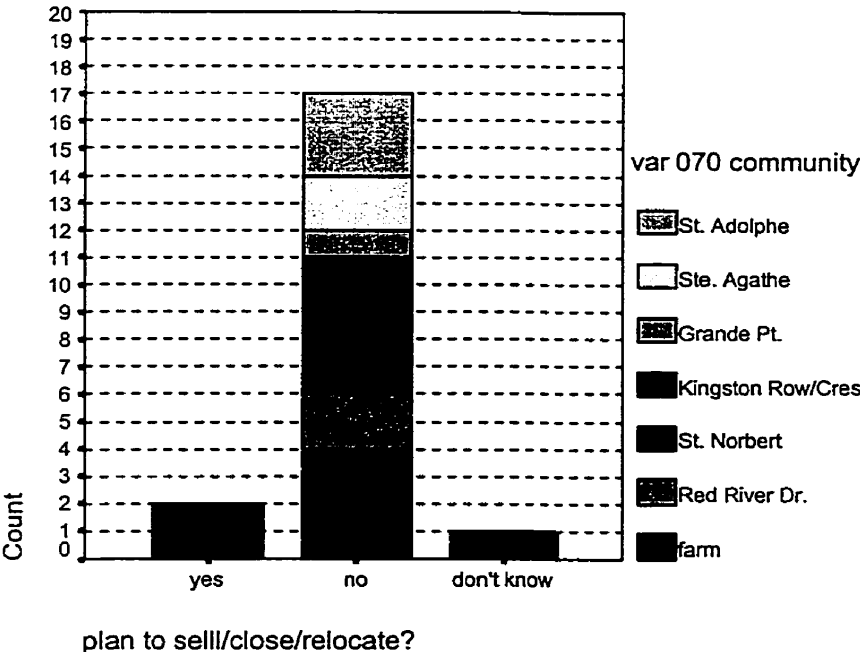
Graph 64: Previous experience by level of stress



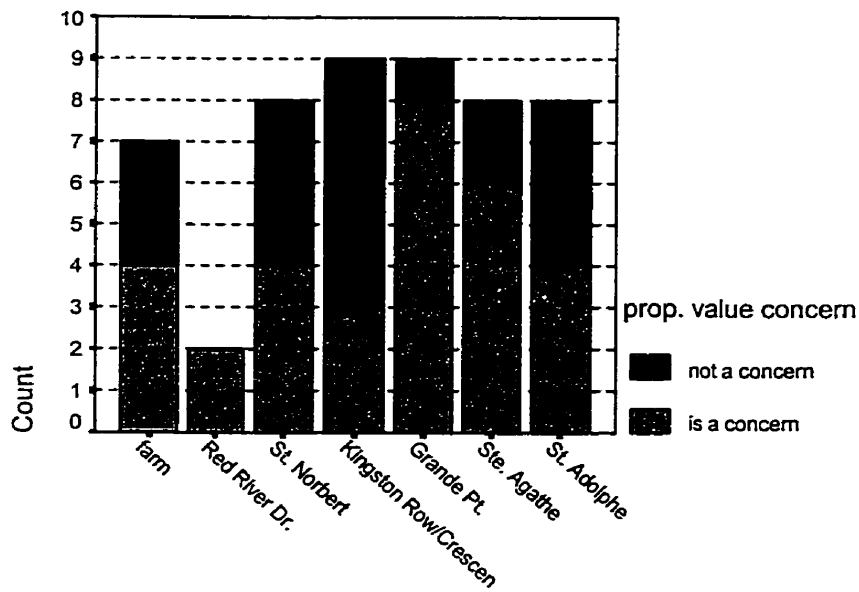
Graph 65: Businesses planning to close / relocate / sell



Graph 66: Relocate / sell / close business by community

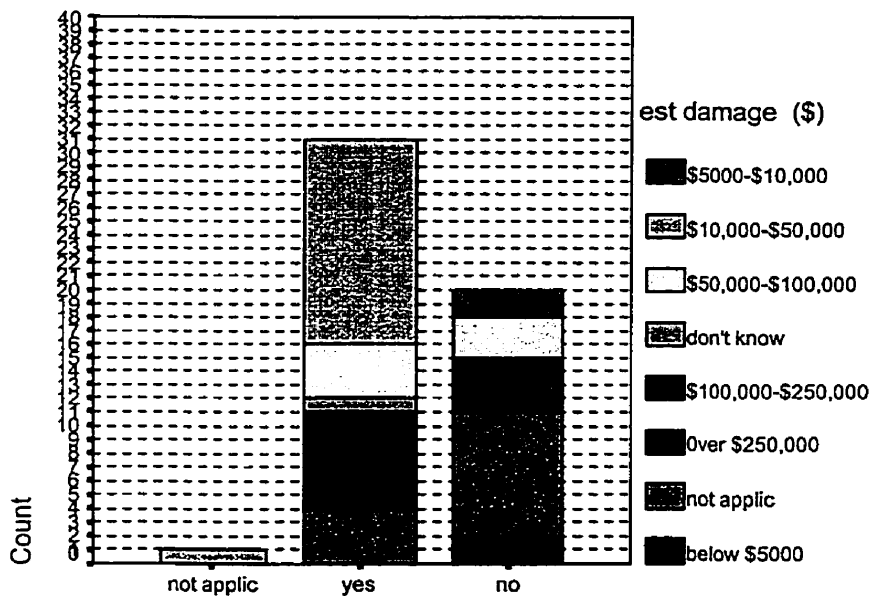


Graph 67: Property value concern by community



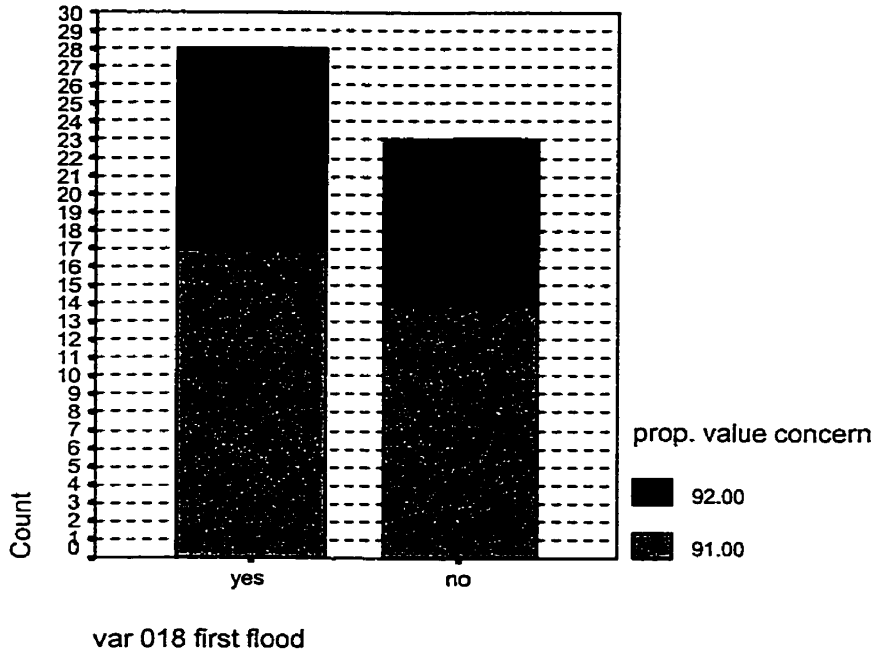
var 070 community

Graph 68: Property value concern by estimate damages (\$)

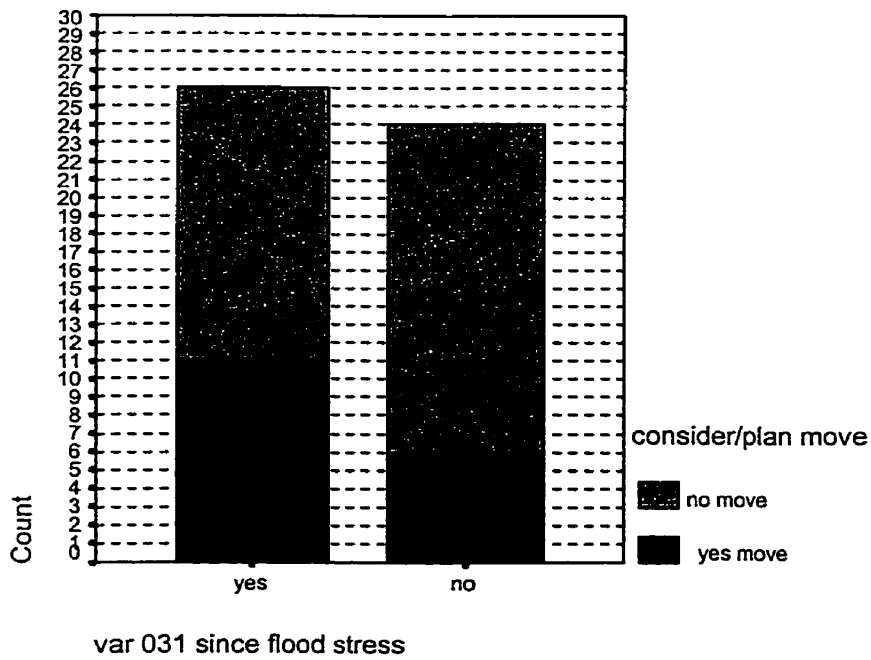


var 052 property values a concern?

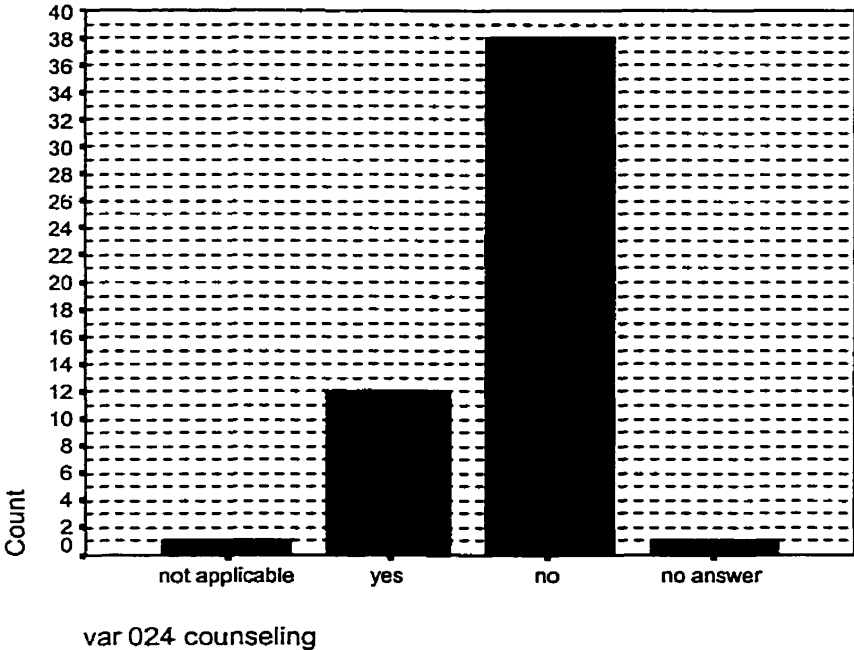
Graph 69: Concern re property value by prior experience



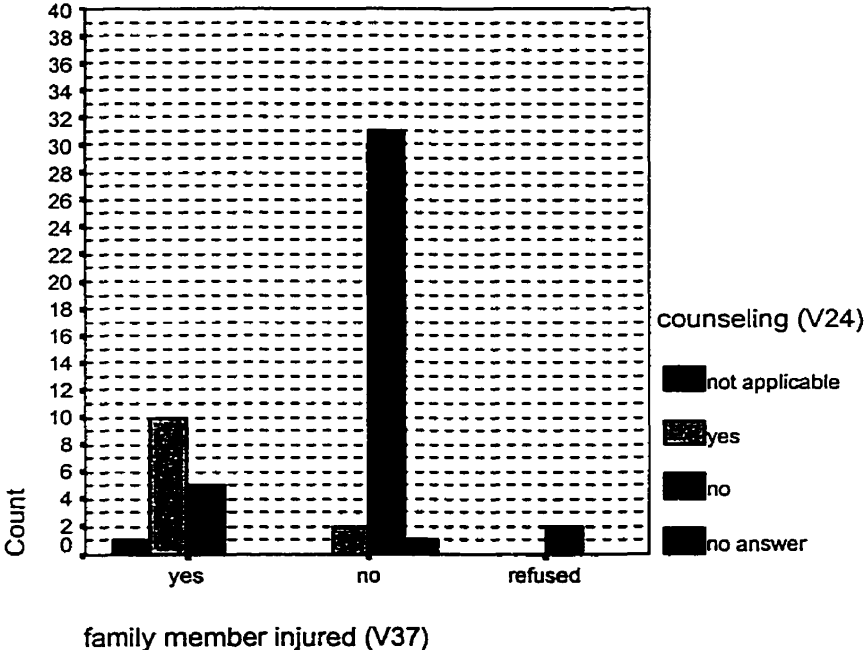
Graph 70: Considering move by stress since flood



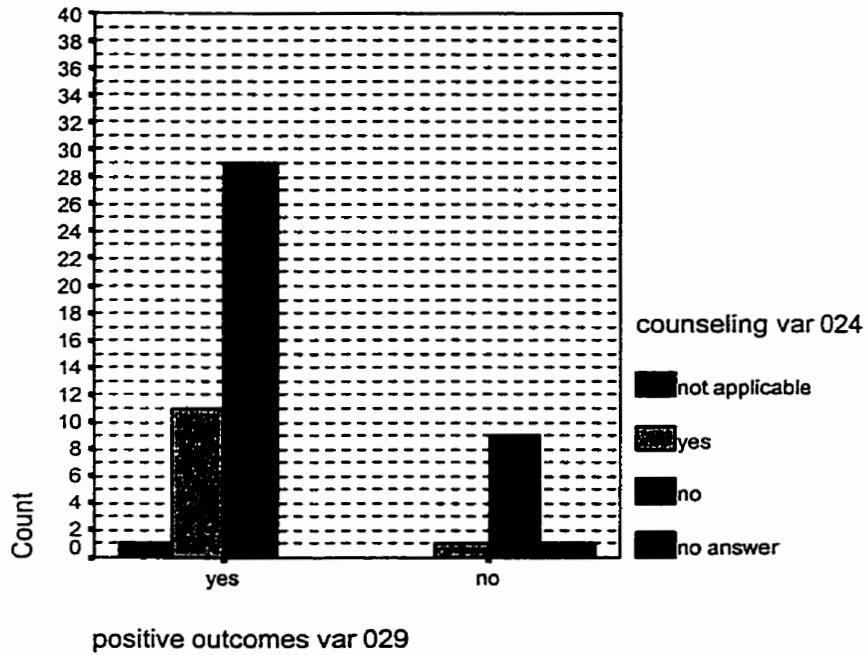
Graph 71: Counseling sought by respondent or family member



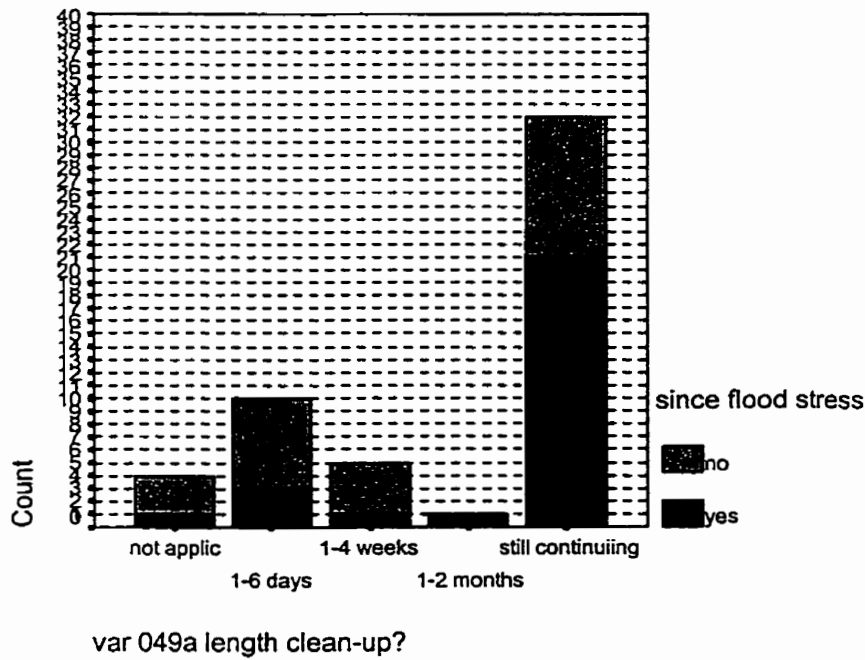
Graph 72: Family member sought counseling by a family member injured



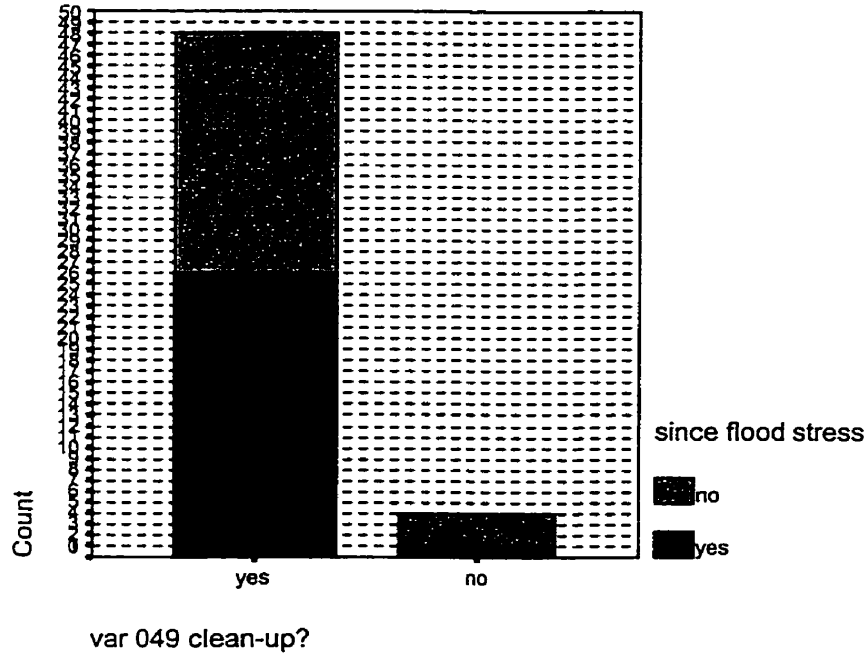
Graph 73: Perceived positive outcomes from flood by family member sought counseling



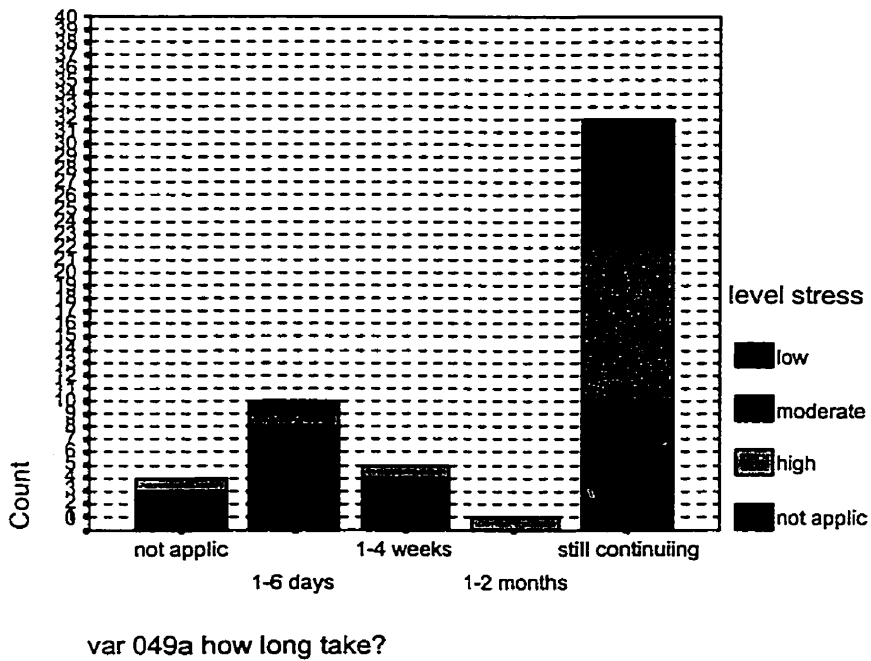
Graph 74: Length cleanup by stress post-flood (Y/N)



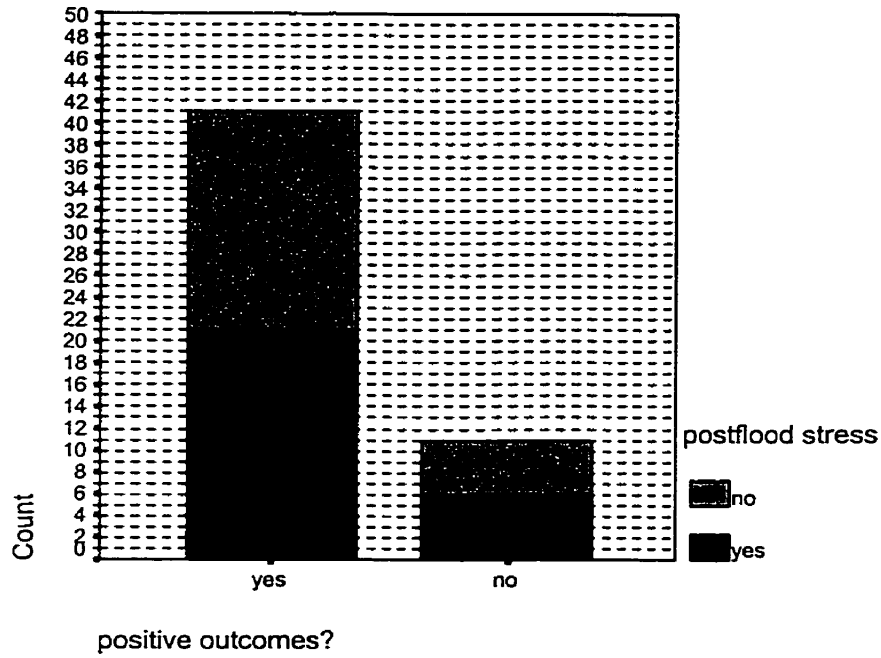
Graph 75: Cleanup by stress post-flood



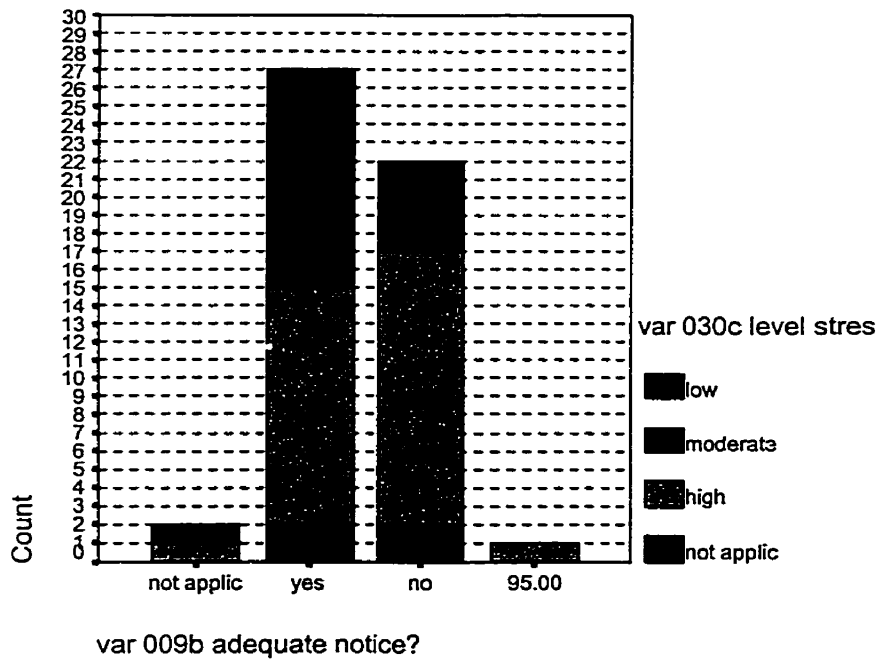
Graph 76: Length of cleanup by stress level since flood



Graph 77: Positive outcomes for family by stress post-flood



Graph 78: Adequate notice by stress during flood



Graph 79: Crosstabulation of awareness of risk for flooding by community

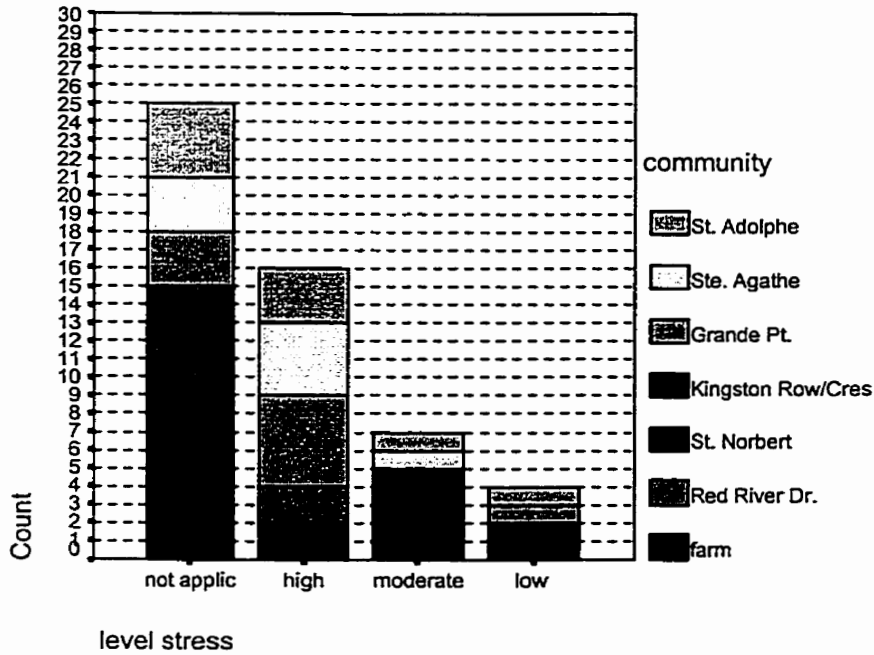
Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
var 019 aware risk * var 070 comm-unity	52	100.0%	0	.0%	52	100.0%

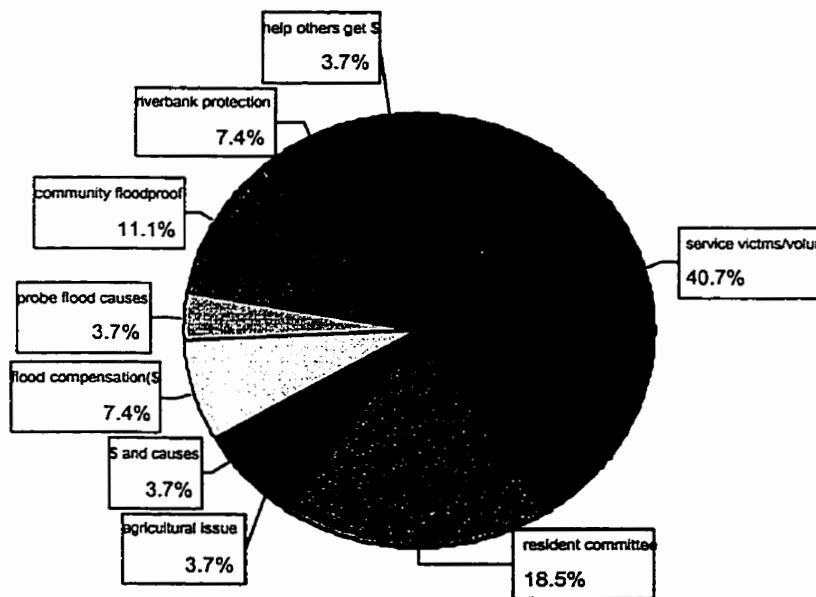
var 019 aware risk * var 070 comm-unity Crosstabulation

Count		var 070 comm-unity							Total
		farm	Red River Dr.	St. Norbert	Kingston Row/Crescent	Grande Pt.	Ste. Agathe	St. Adolphe	
var 019 aware risk	yes	4	2	2	6	3	2	7	26
	no	3		5	3	6	6	2	25
	no answer			1					1
Total		7	2	8	9	9	8	9	52

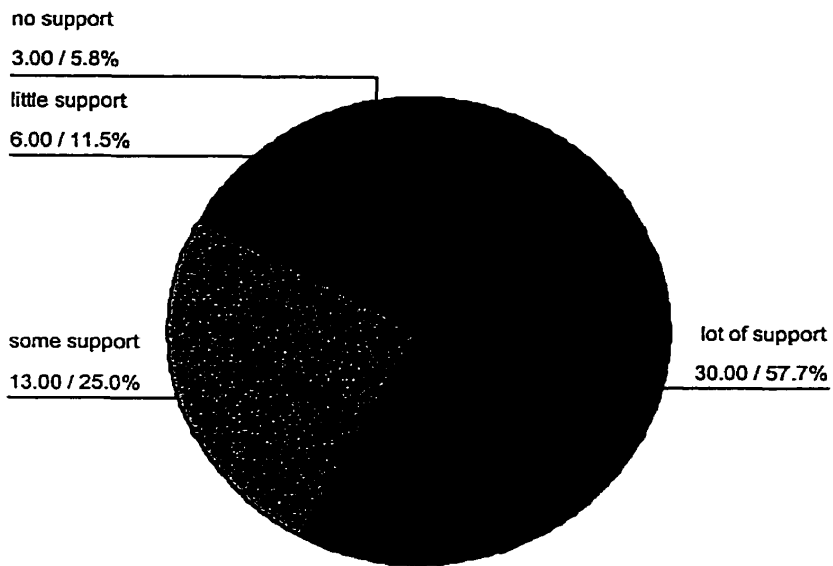
Graph 80: Stress level post-flood by community



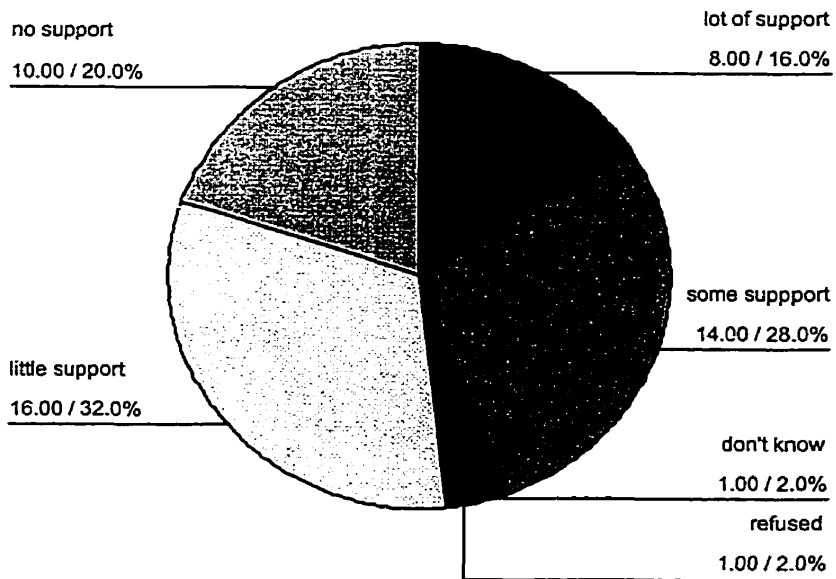
Graph 81: Pie chart of flood related community problems addressed by respondents



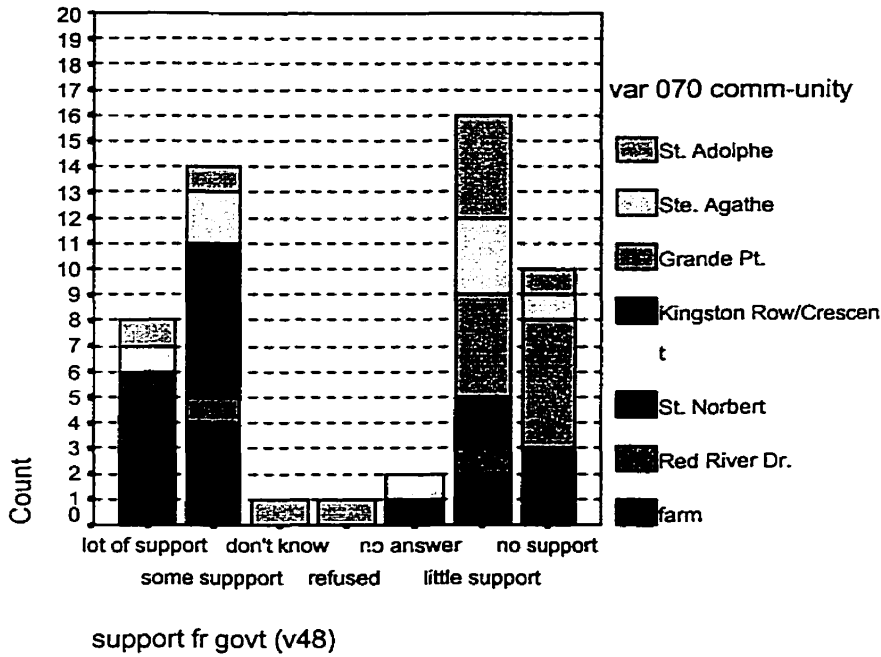
Graph 82: Perceived support of community



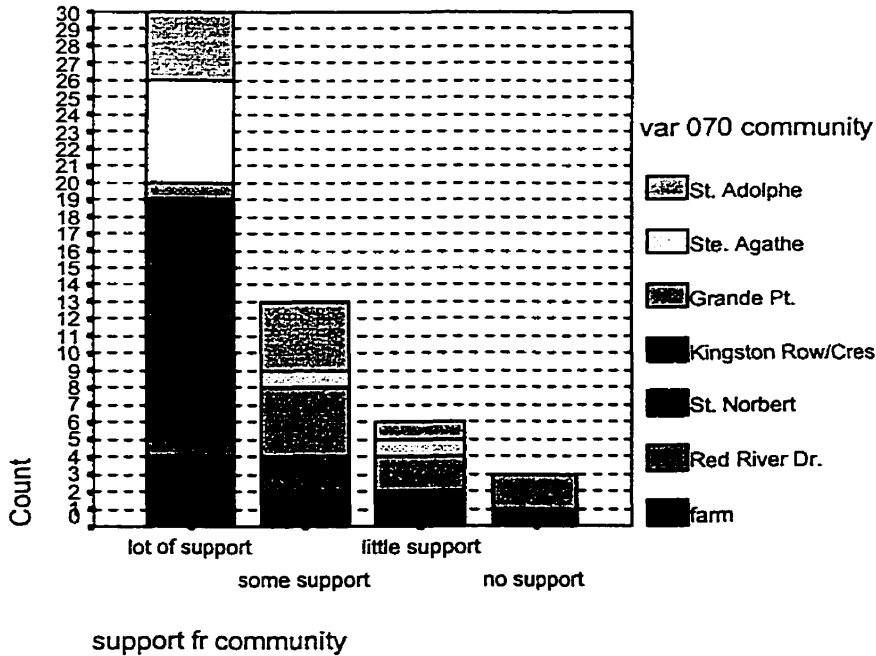
Graph 83: Perceived support of government



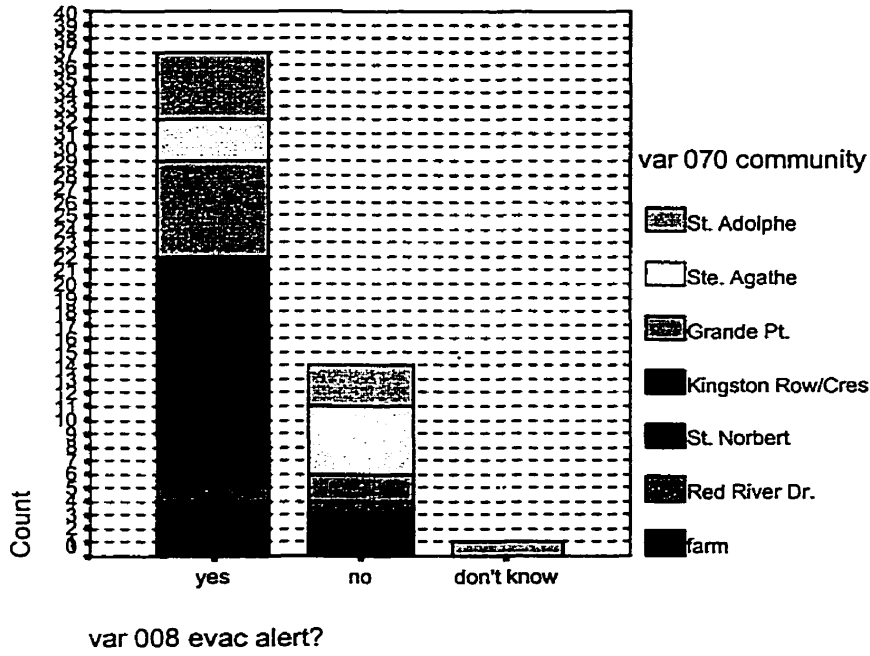
Graph 84: Perceived support from provincial government by community



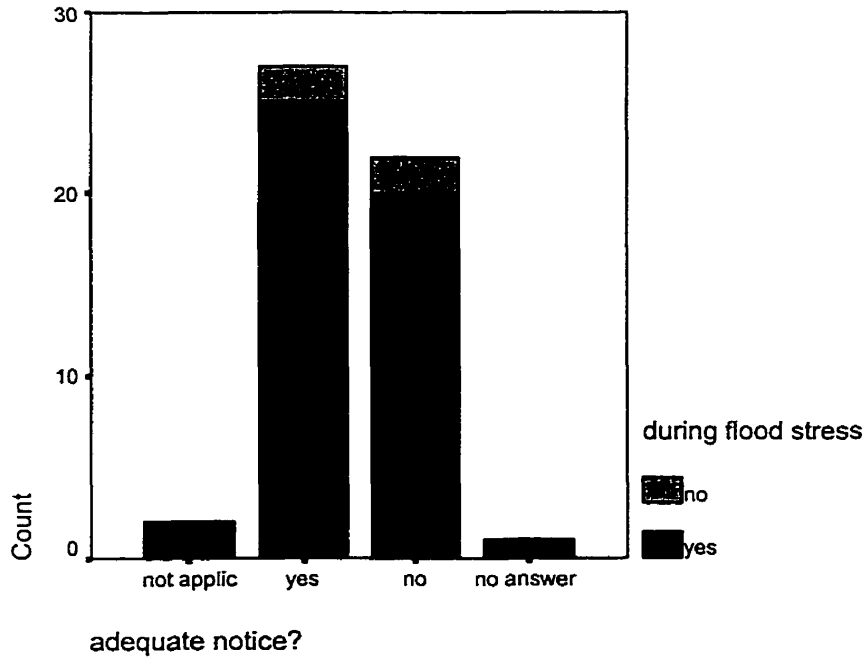
Graph 85: Perceived support from community by community



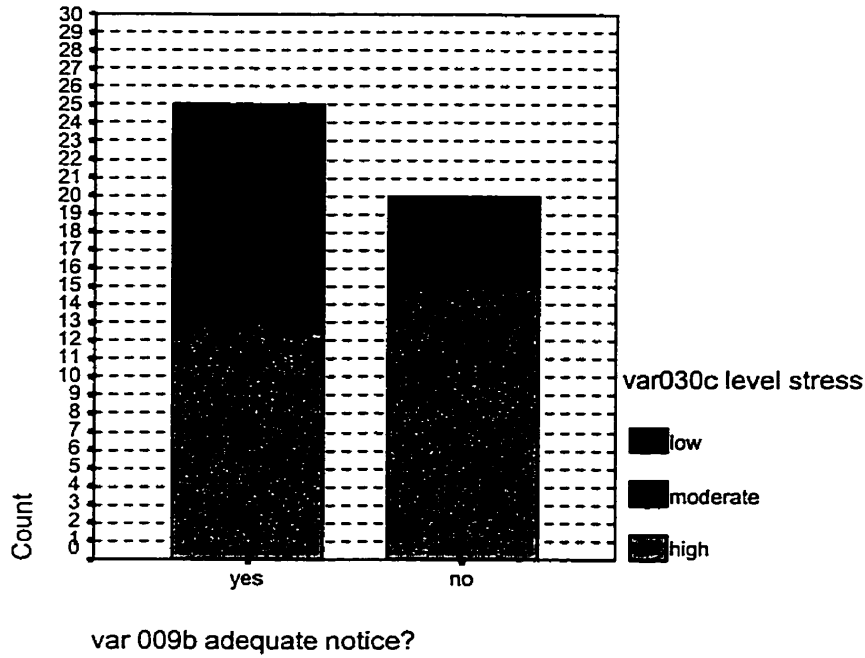
Graph 86: Receipt alert notice by community



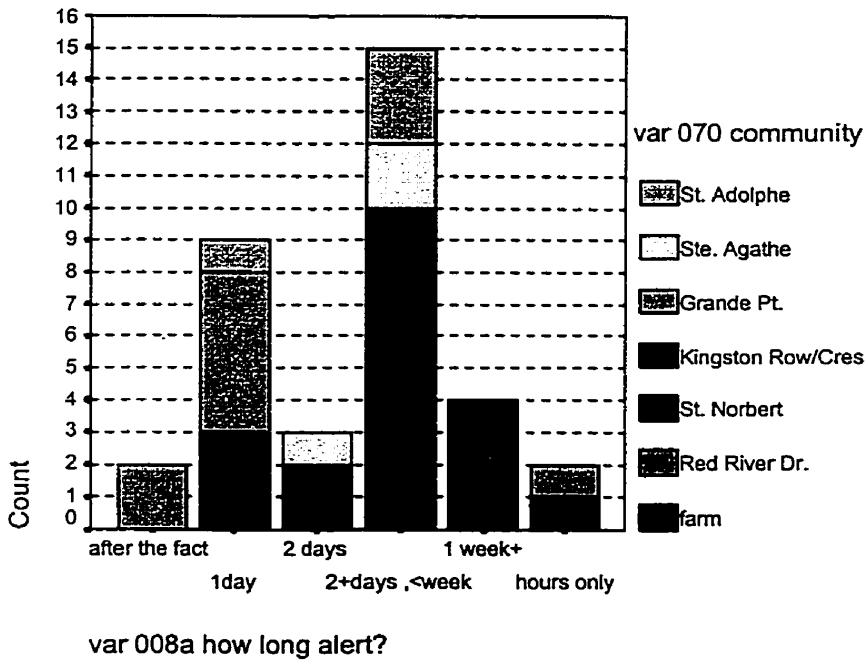
Graph 87: Adequate notice by experience increased stress during flood



Graph 88: Adequate notice of evacuation by level of stress during flood



Graph 89: How long on alert by community



Graph 90: Crosstabulation of awareness of risk by level of stress and by community

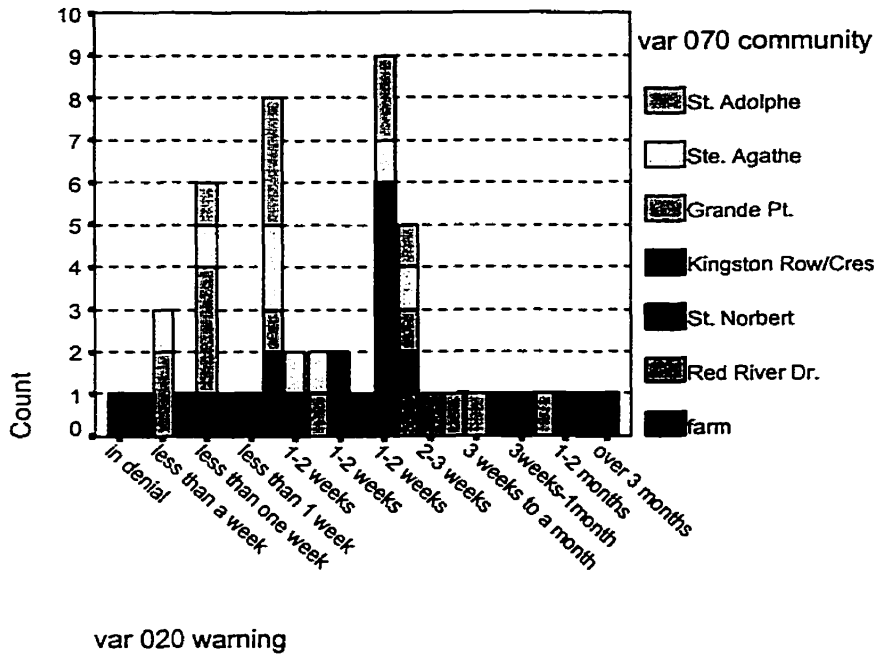
Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
var 019 aware risk * var 070 comm-unity * var 030c level stress	52	100.0%	0	.0%	52	100.0%

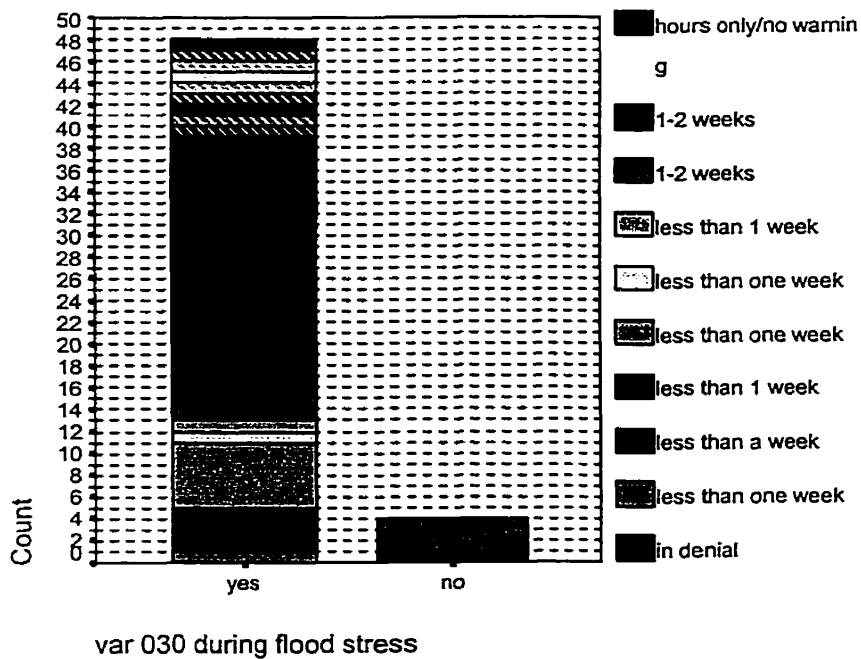
var 019 aware risk * var 070 comm-unity * var 030c level stress Crosstabulation

Count			var 070 comm-unity							Total
var 030c level stress	var 019 aware risk		farm	Red River Dr.	St. Norbert	Kingston Row/Crescent	Grande Pt.	Ste. Agathe	St. Adolphe	
not applic	yes		1			1				2
	no				1				1	2
	Total		1		1	1			1	4
high	yes		2	2	1	3	2	2	4	16
	no		1		2	1	4	4	1	13
	no answer				1					1
	Total		3	2	4	4	6	6	5	30
moderate	yes		1		1	1	1		2	6
	no				1	2	2	1		6
	Total		1		2	3	3	1	2	12
low	yes					1			1	2
	no		2		1			1		4
	Total		2		1	1		1	1	6

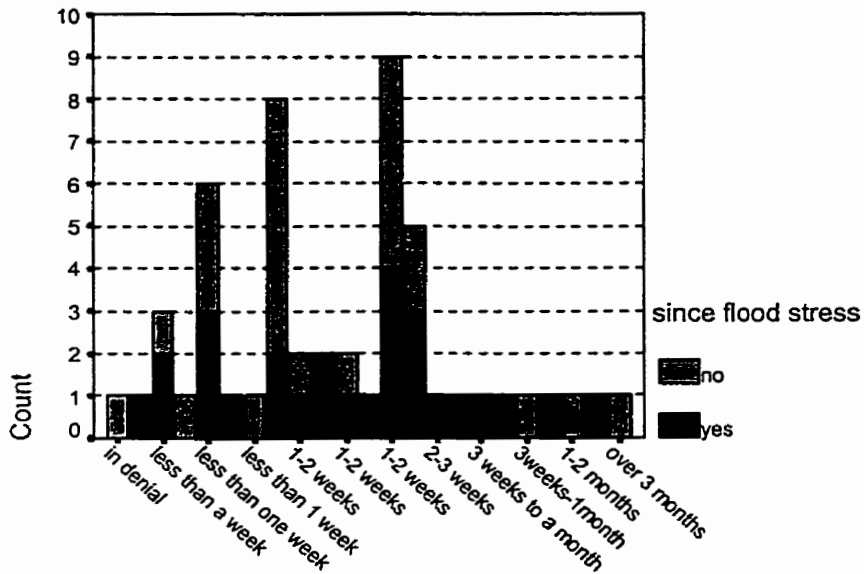
Graph 91: Warning respondents felt they had by community



Graph 92: Stress during flood and warning

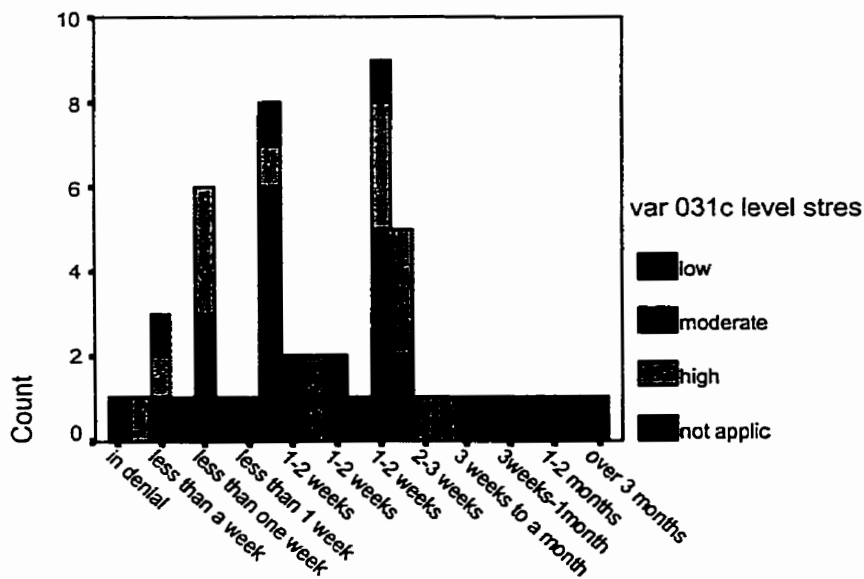


Graph 93: Warning respondents felt they had by stress since flood



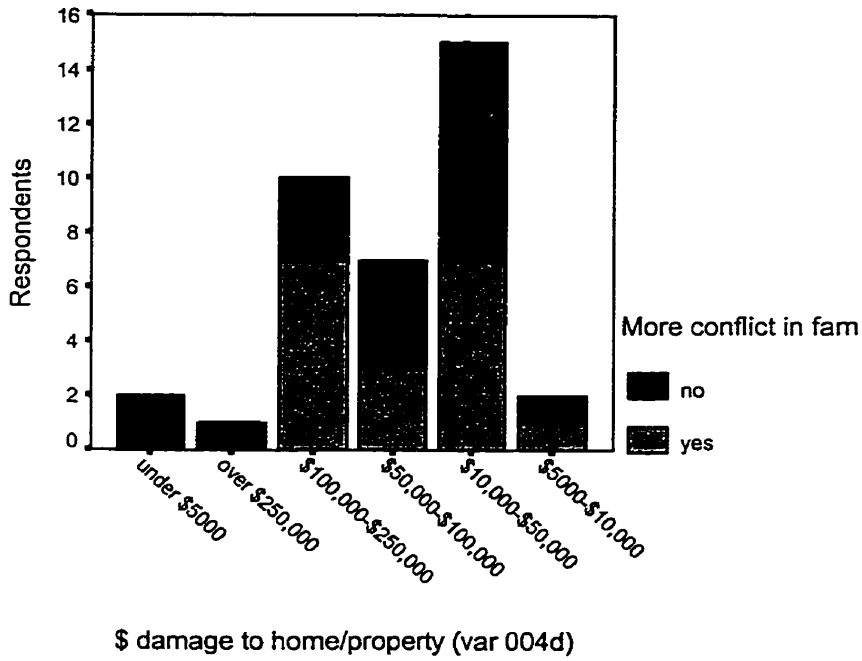
var 020 warning days

Graph 94: Warning respondents felt they had by stress level since flood

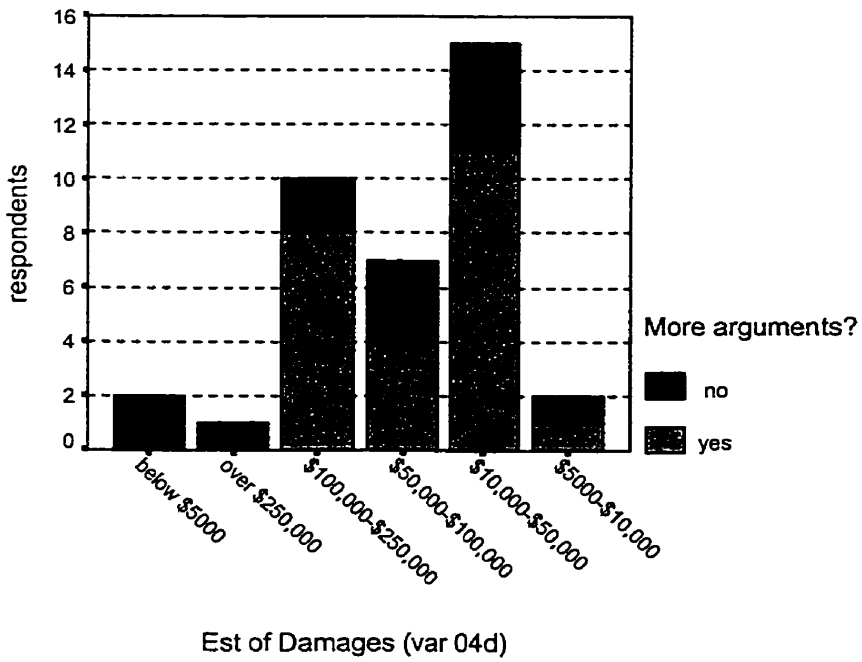


var 020 warning days

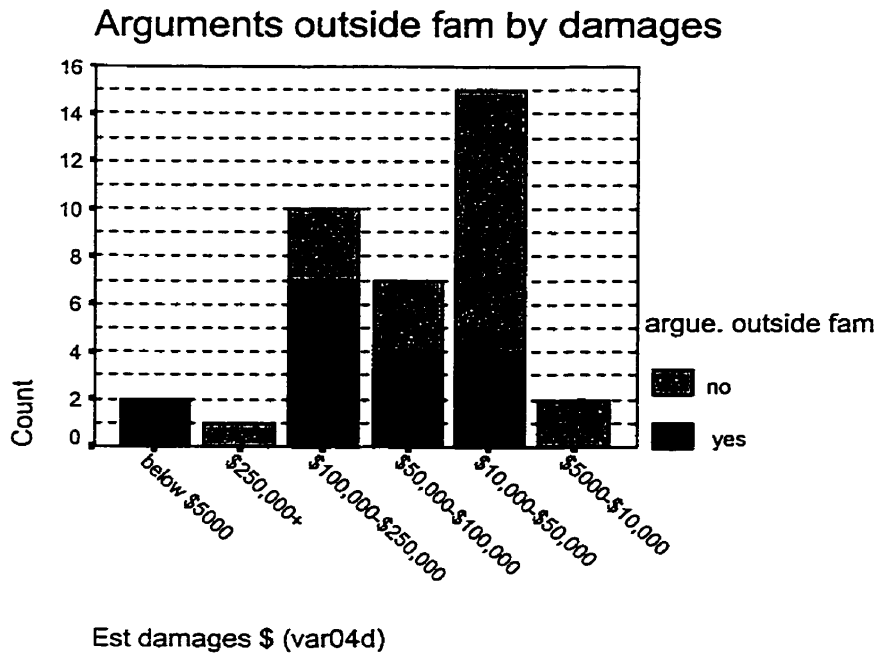
Graph 95: Damages sustained and family conflict



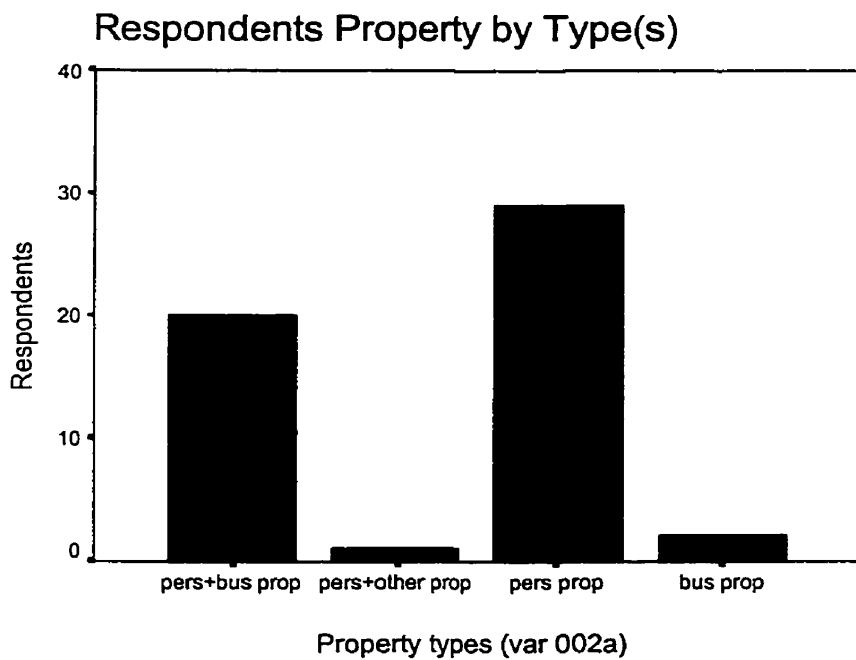
Graph 96: Damages and family arguments



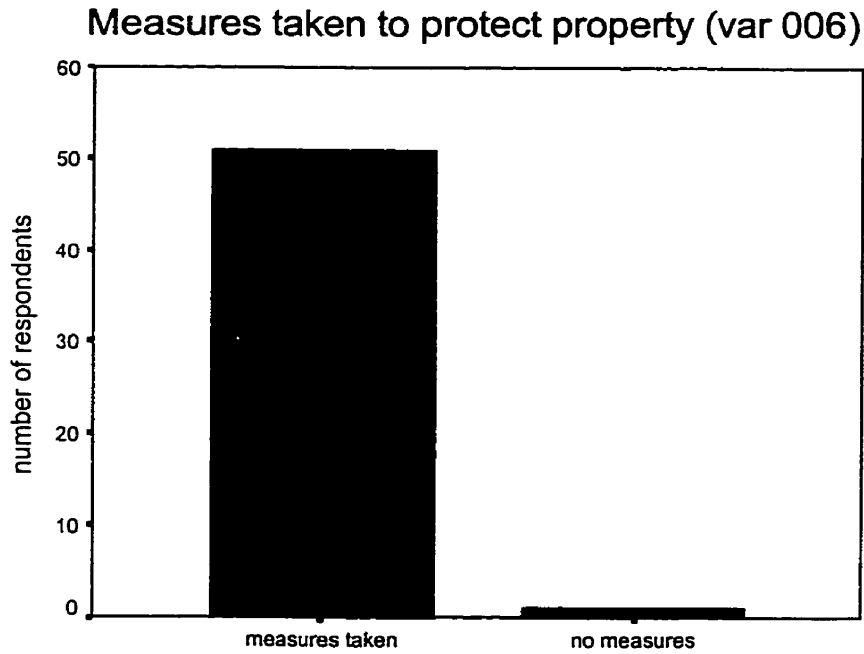
Graph 97: Arguments outside family and damages



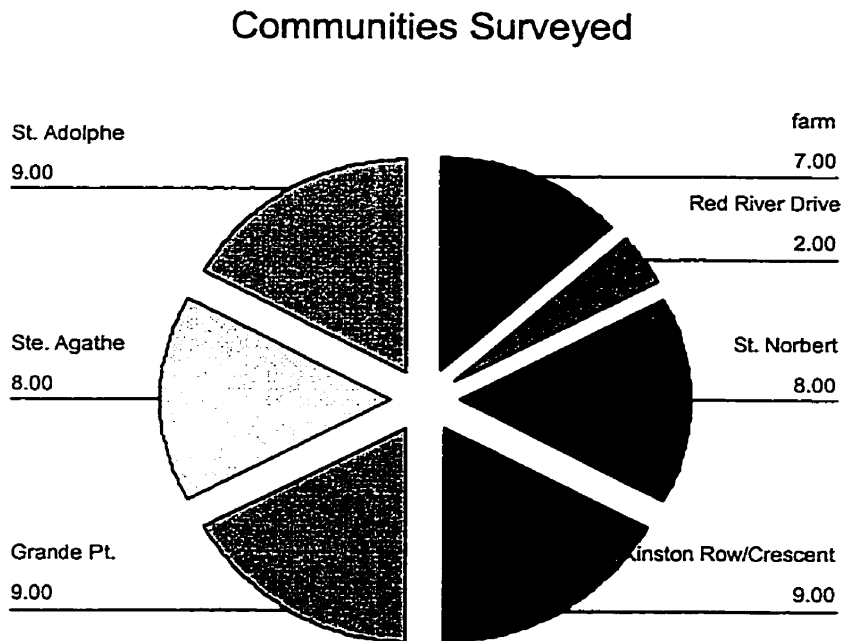
Graph 98: Respondents property types



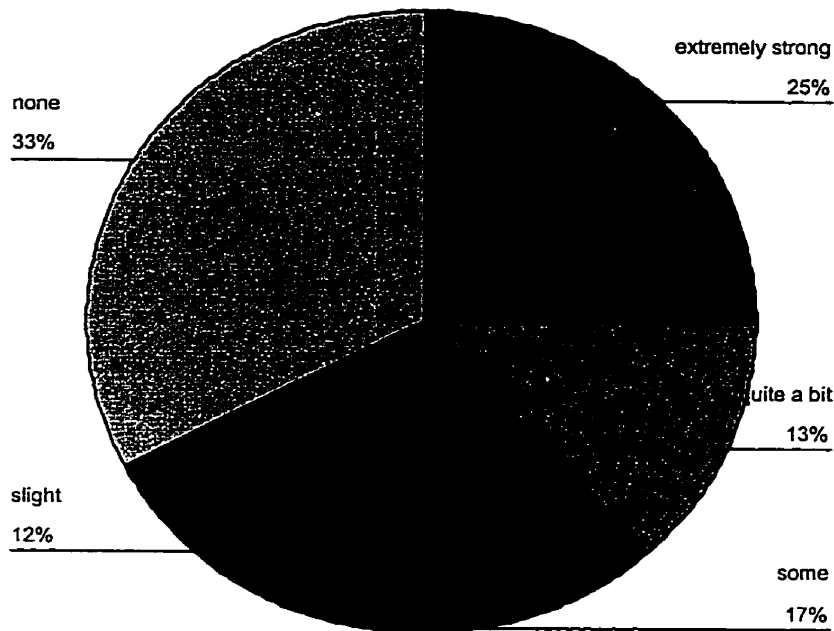
Graph 99: Number of respondents who took measures to protect property



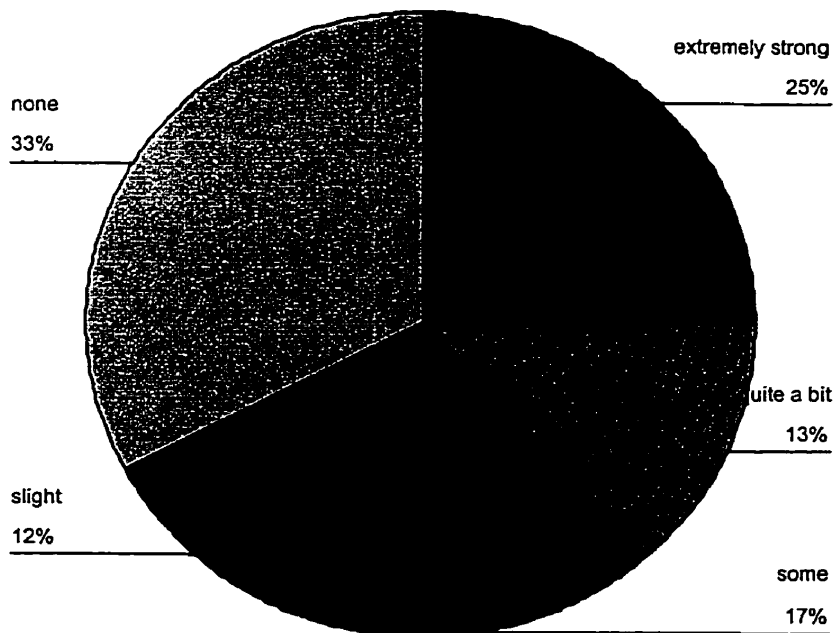
Graph 100: Number of respondents per communities surveyed



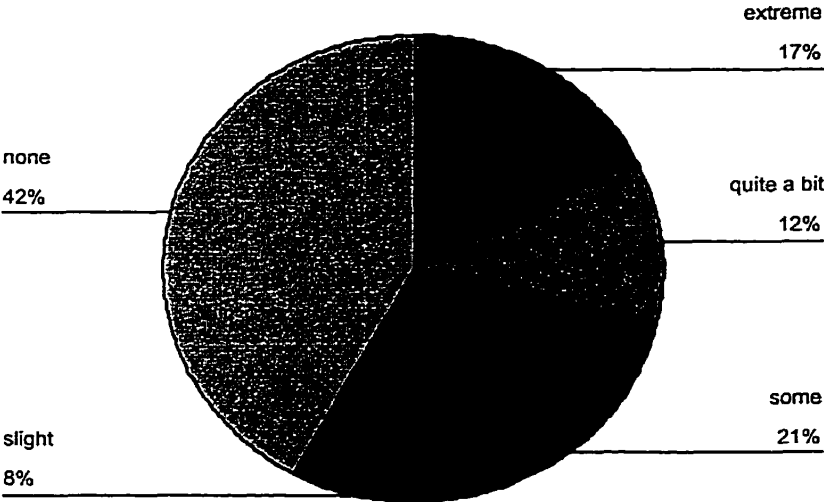
Graph 101: Pie chart of respondent's "sense of control over life" during peak of flood



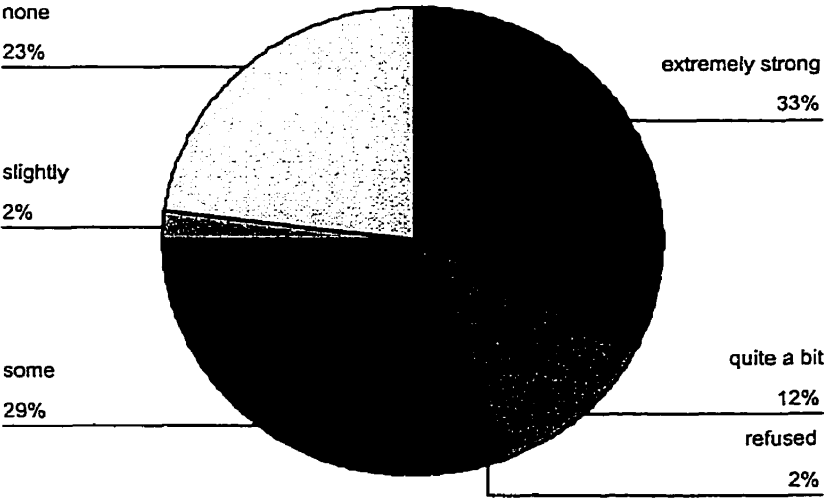
Graph 102: Pie chart of respondent's "confusion" during peak of flood



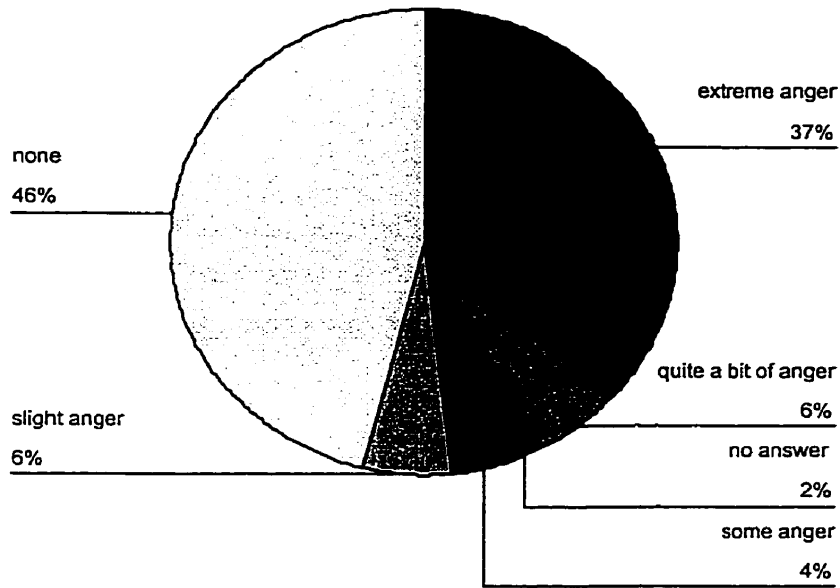
Graph 103: Pie chart of respondent's "fear" at peak of flood



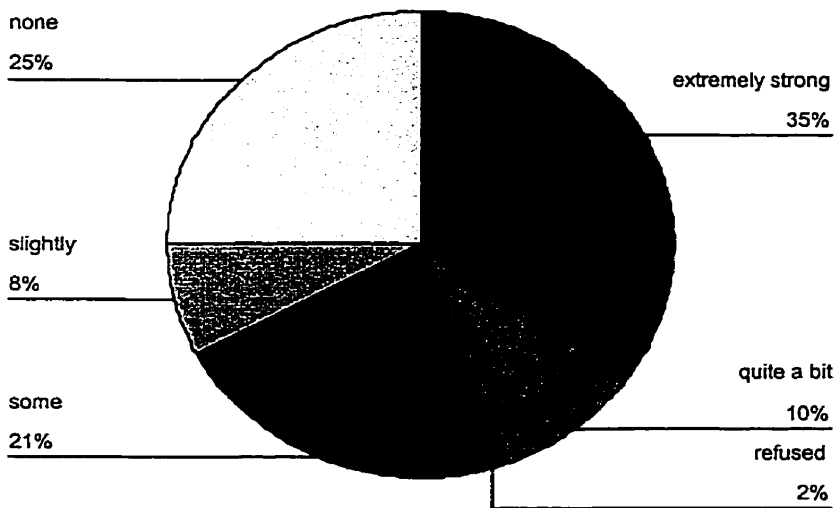
Graph 104: Pie chart of respondent's "sense of dependency on others" during the peak of the flood



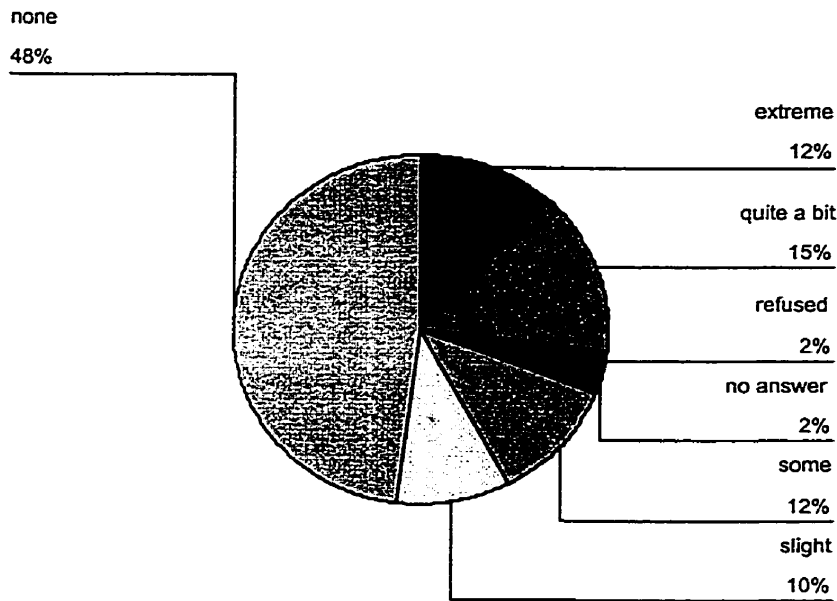
Graph 105: Pie chart of respondent's "anger" during the peak of the flood



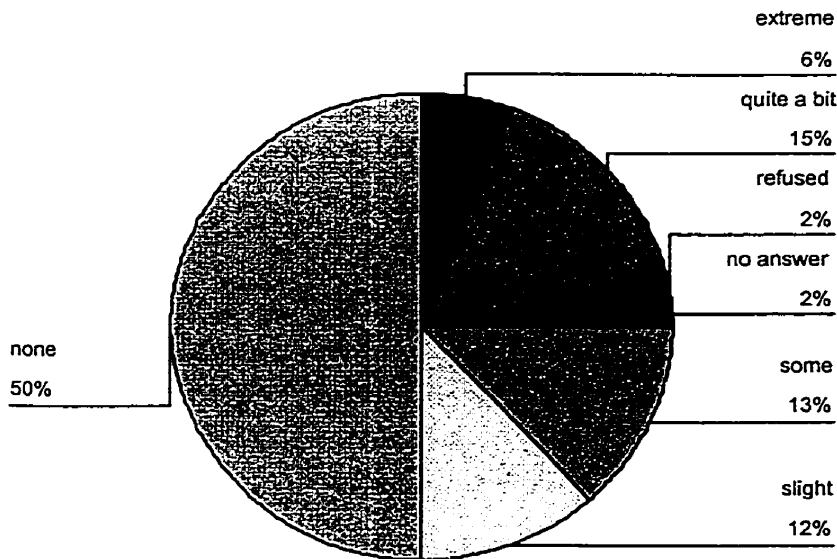
Graph 106: Pie chart of respondent's "sense of control" at time of interview



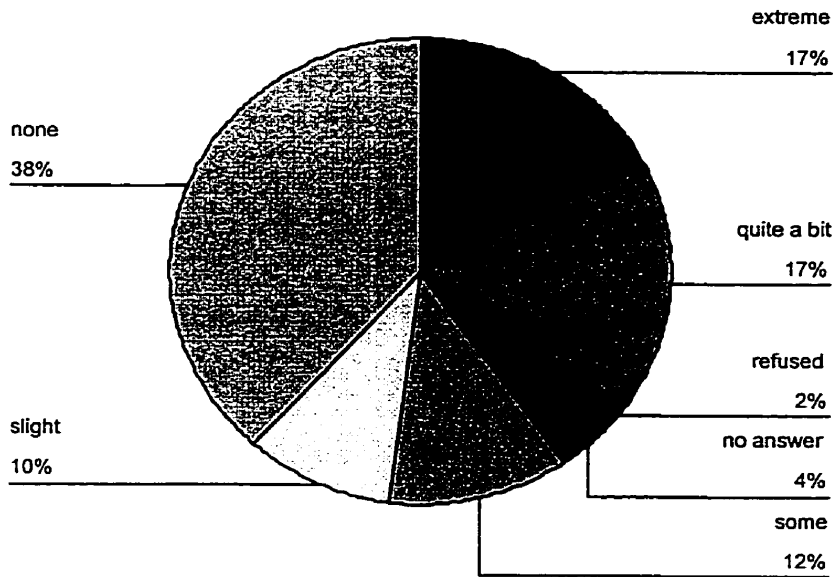
Graph 107: Pie chart of respondent's "confusion" at time of interview



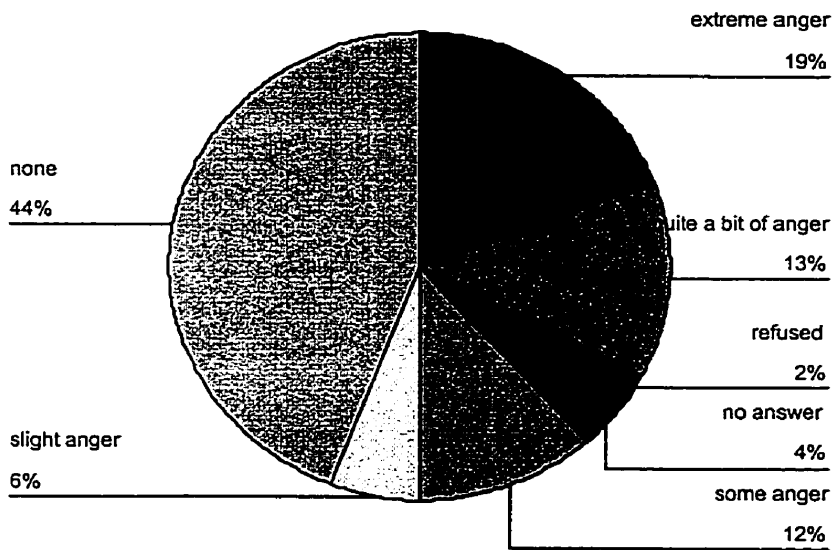
Graph 108: Pie chart of respondent's "fear" at the time of the interview



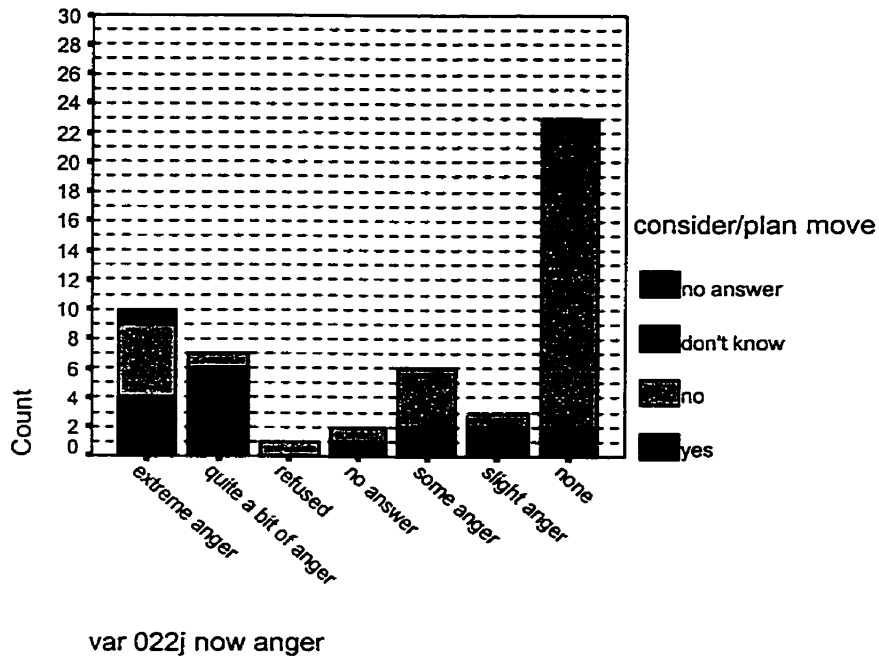
Graph 109: Pie chart of respondent's "sense of dependency on others" at time of interview



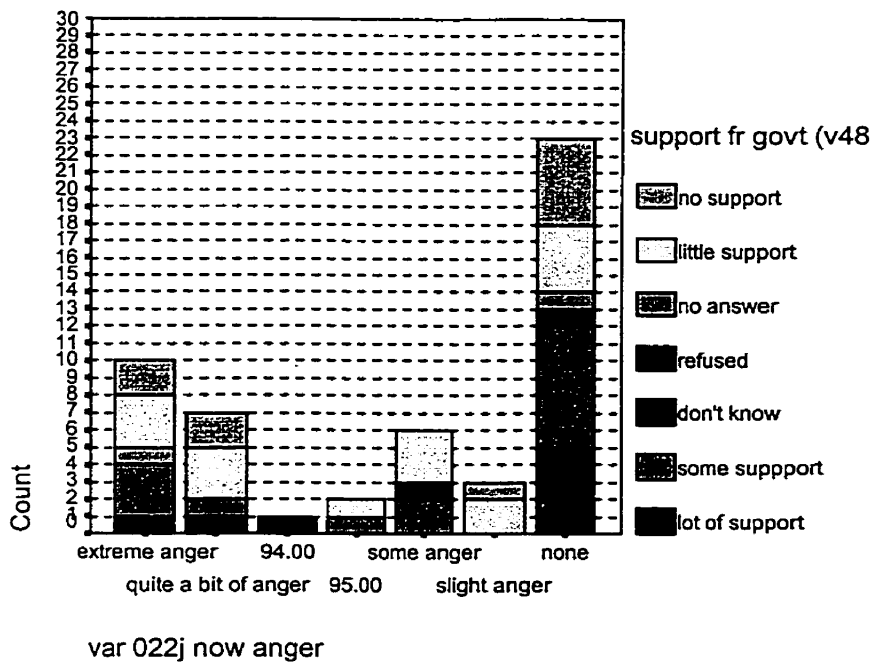
Graph 110: Pie chart of respondent's "anger" at time of interview



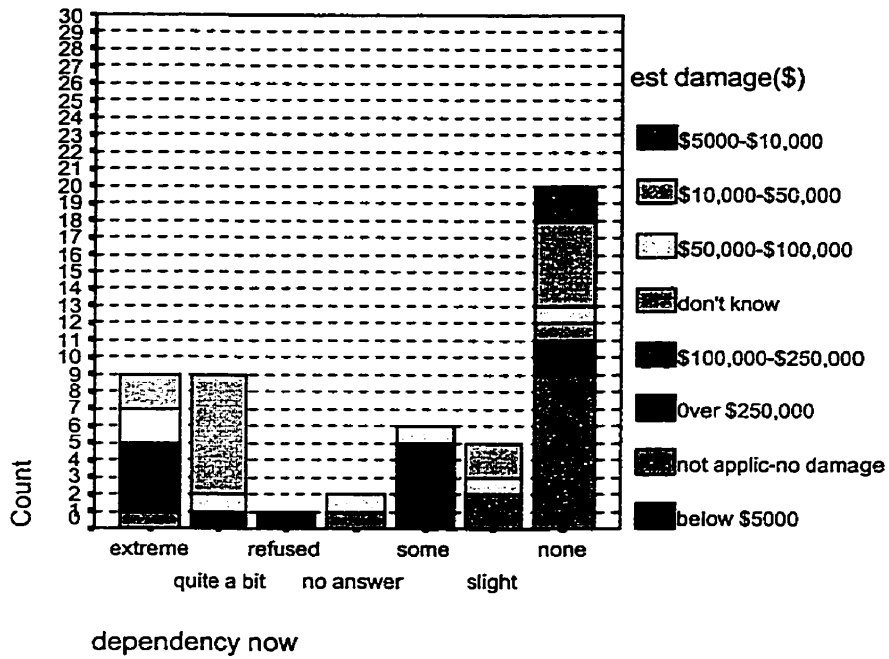
Graph 111: Respondent's perception of "anger" feelings and plan / consider moving



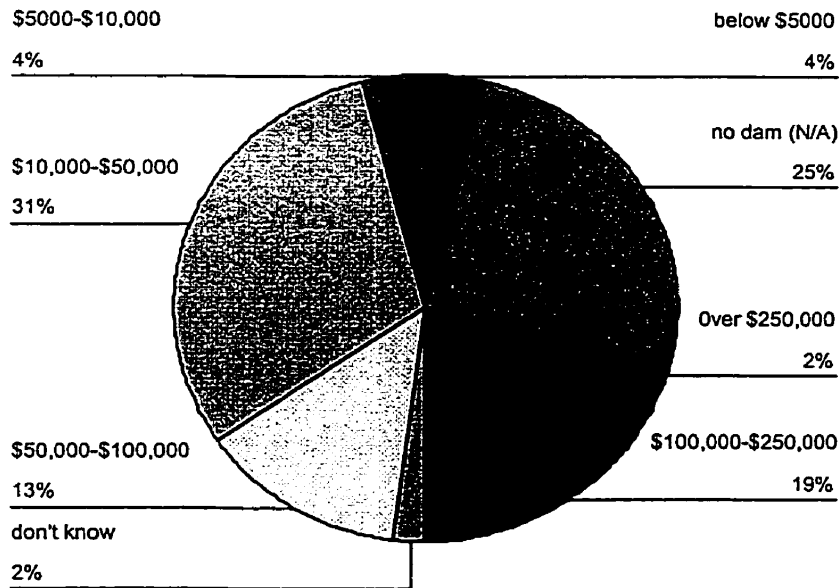
Graph 112: Respondent's anger at time of interview and perception of support from government



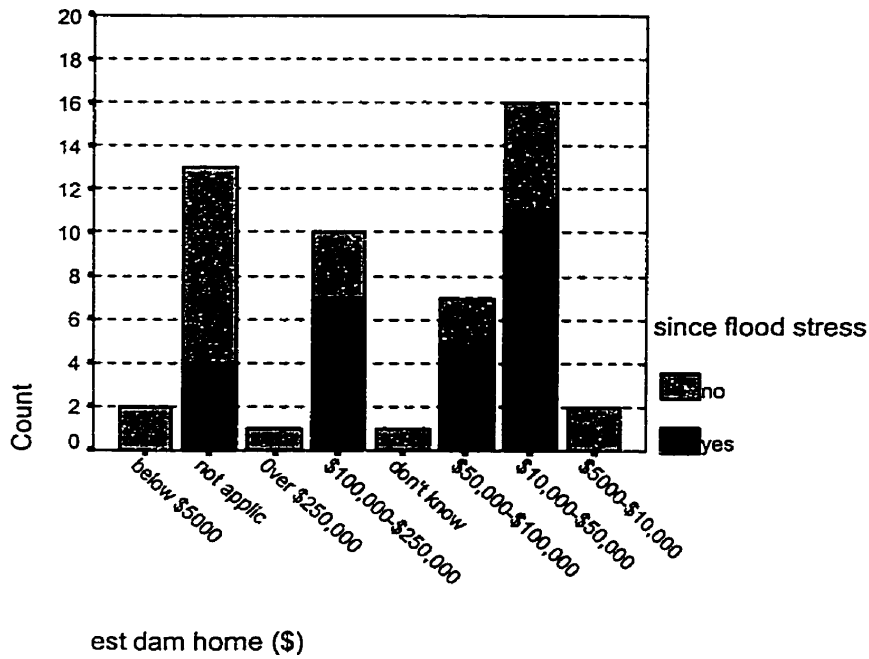
Graph 113: Feelings of dependency on others at time of interview and amount of damage sustained



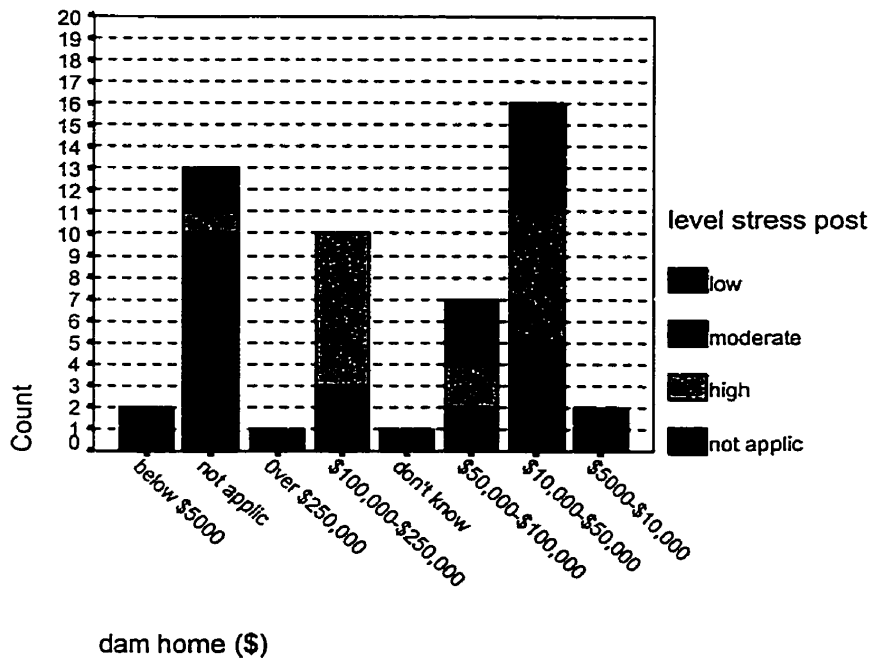
Graph 114: Pie chart of estimates of damage to home / property



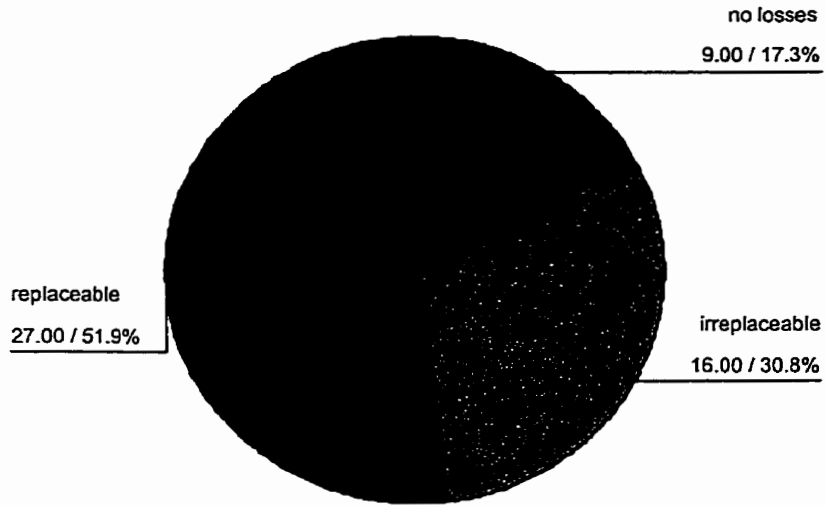
Graph 115: Estimate of damages to stress since flood



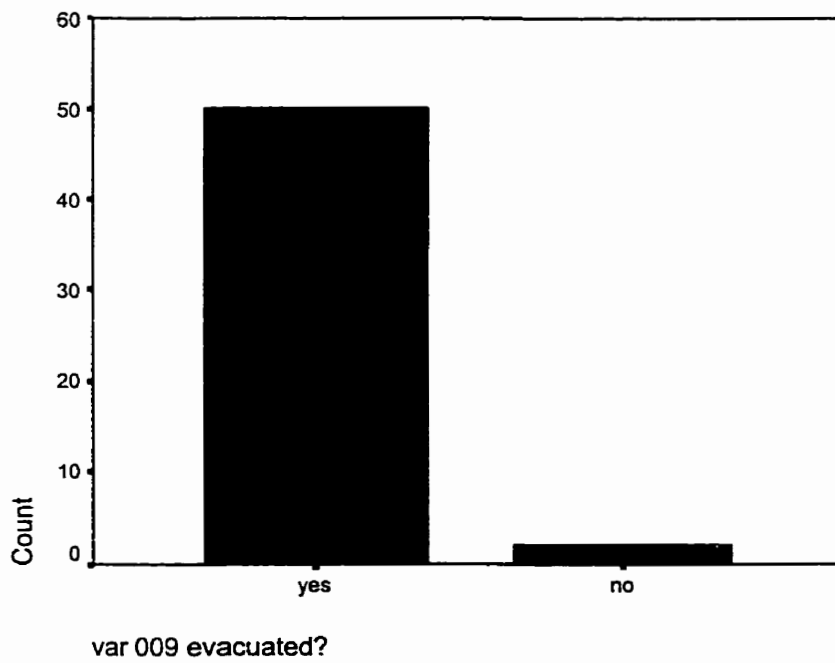
Graph 116: Estimate of damage and stress level post-flood



Graph 117: Pie chart of personal losses - no losses, replaceable, and non-replaceable



Graph 118: Number of respondents evacuated



Graph 119: Crosstabulation of number of days evacuated and quality of accommodation

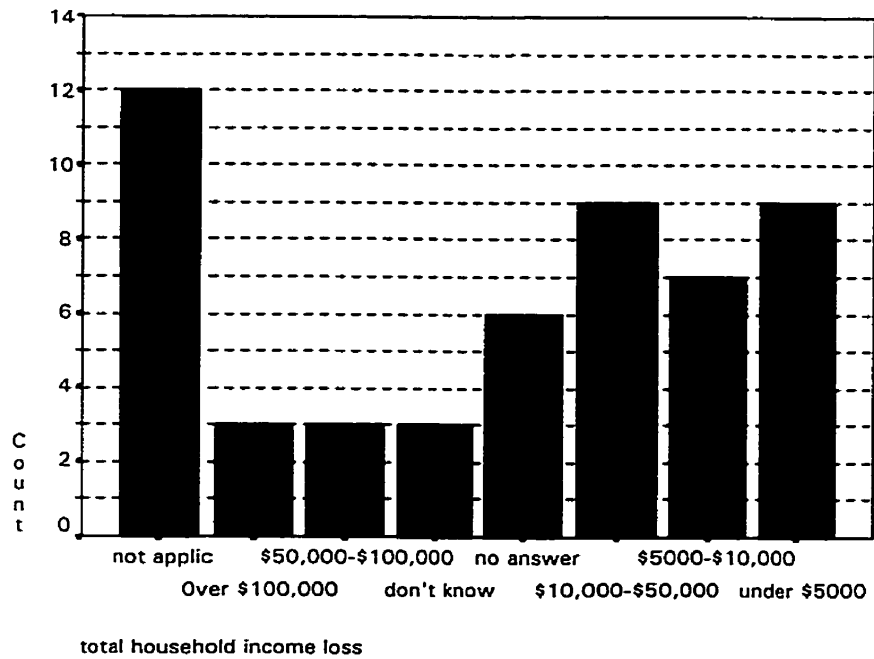
Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
var 009a # days * var 009d accomoda-tion good?	51	98.1%	1	1.9%	52	100.0%

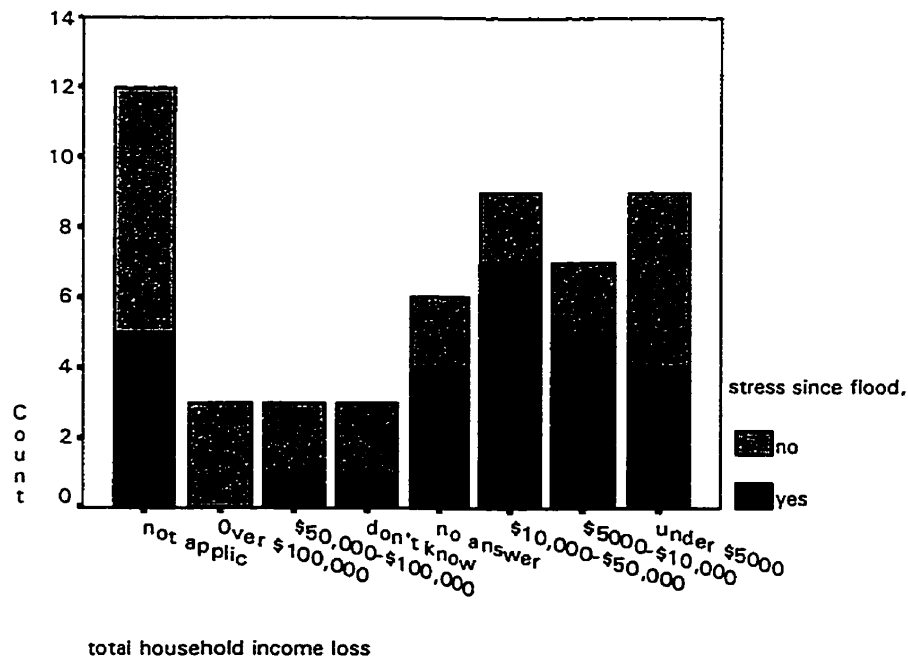
var 009a # days * var 009d accomoda-tion good? Crosstabulation

Count		var 009d accomoda-tion good?						Total
		not applicable	excellent	good	refused	no answer	poor	
var 12.00				1				1
009a 14.00			3	1			1	5
# 16.00				1				1
days 18.00			1					1
20.00				1				1
21.00			5			1		6
22.00			1					1
27.00			1					1
28.00			3				1	4
29.00			1					1
32.00			2					2
35.00			3				1	4
42.00			4	2				6
43.00				1				1
45.00			1					1
46.00			1					1
49.00				1				1
56.00			1	1				2
63.00			1					1
70.00				1				1
84.00			1					1
90.00		2						2
95.00			1					1
101.00				1				1
120.00				1				1
154.00				1				1
still out				1	1			2
Total		2	30	14	1	1	3	51

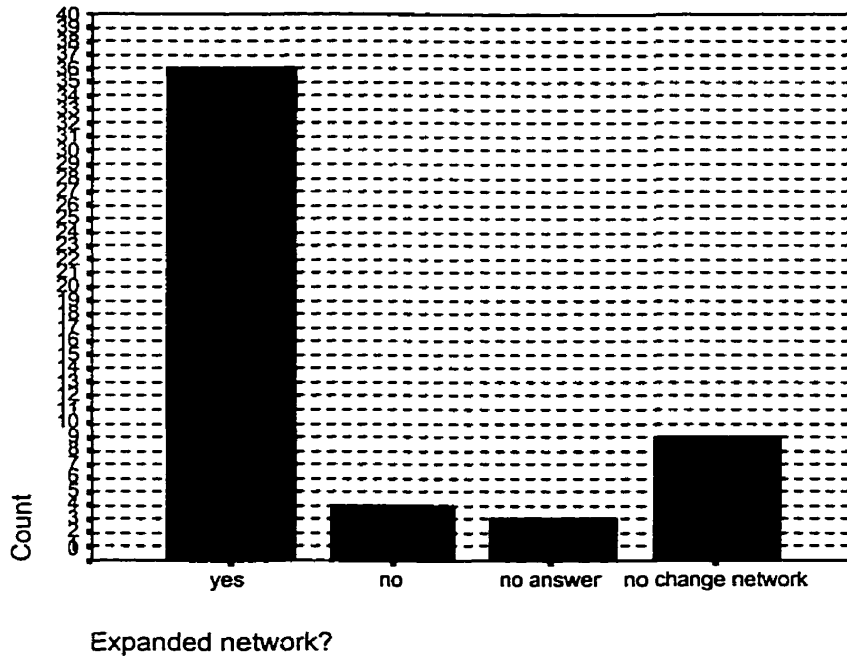
Graph 120: Estimate of total lost household income due to flood



Graph 121: Total household loss of income by stress since flood



Graph 122: Expanded support network (Y/N)



Graph 123: Crosstabulation of stress since flood by general health before and since flood

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
var 031 since flood, stress * var 036 health before * var 036a health since	52	100.0%	0	.0%	52	100.0%

var 031 since flood, stress * var 036 health before * var 036a health since Crosstabulation

Count

var 036a health since			var 036 health before				Total
			excellent	good	fair	poor	
excellent	var 031 since flood, stress	yes	6		1		7
		no	12				12
		Total	18		1		19
good	var 031 since flood, stress	yes	4	8			12
		no	2	6			8
		Total	6	14			20
fair	var 031 since flood, stress	yes	2	5	1		8
		no		2	1	1	4
		Total	2	7	2	1	12
poor	var 031 since flood, stress	no		1			1
		Total		1			1

Graph 124: Crosstabulation of health before and since flood and length of evacuation

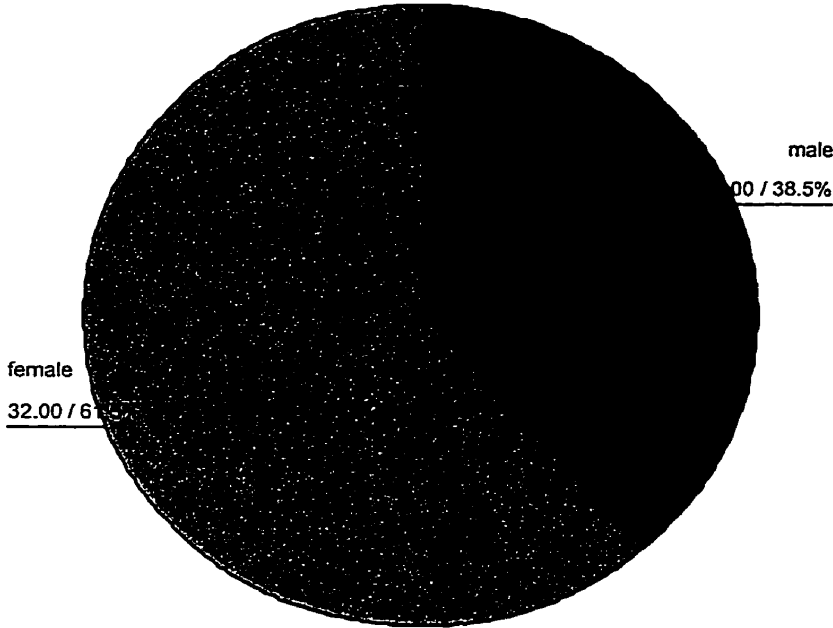
Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
var 036 health before * var 009a # days * var 036a health since	51	98.1%	1	1.9%	52	100.0%

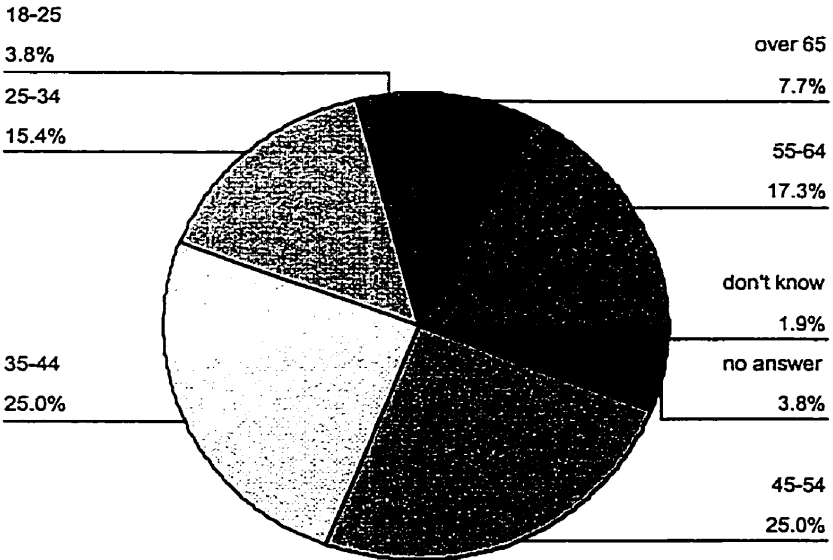
var 036 health before * var 009a # days * var 036a health since Crosstabulation

Count			var 009a # days																								still out	Total			
var 036a health since	var 036 health before	var 036 health since	12.00	14.00	16.00	18.00	20.00	21.00	22.00	27.00	28.00	29.00	32.00	35.00	42.00	43.00	45.00	46.00	49.00	58.00	63.00	70.00	84.00	90.00	95.00	101.00			120.00	154.00	
excellent	excellent	excellent		2	1				1	1	3		1	2	2				1					1	2					1	1
	fair	fair													1																
	Total	Total		2	1				1	1	3		1	2	3				1					1	2					1	
good	excellent	excellent						3						2							1									6	
	good	good	1	2		1		2			1	1			1	1		1			1					1			1	14	
	Total	Total	1	2		1		5			1	1		2	1	1		1			1	1				1			1	20	
fair	excellent	excellent											1		2						1						1		1	2	
	good	good					1										1				1								1	7	
	fair	fair						1																						2	
	poor	poor		1																							1			1	
	Total	Total		1			1	1					1		2						1						1	1	1	12	

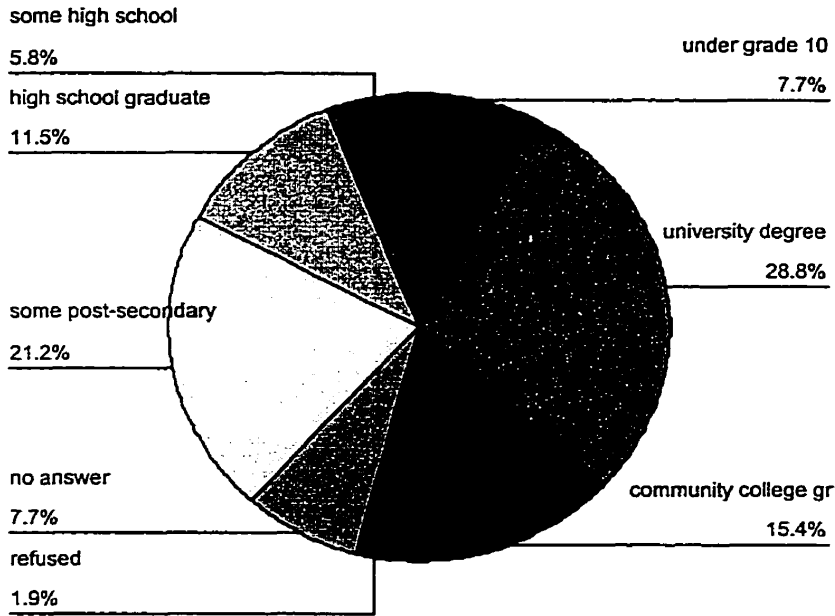
Graph 125: Gender of respondents (number and percentage)



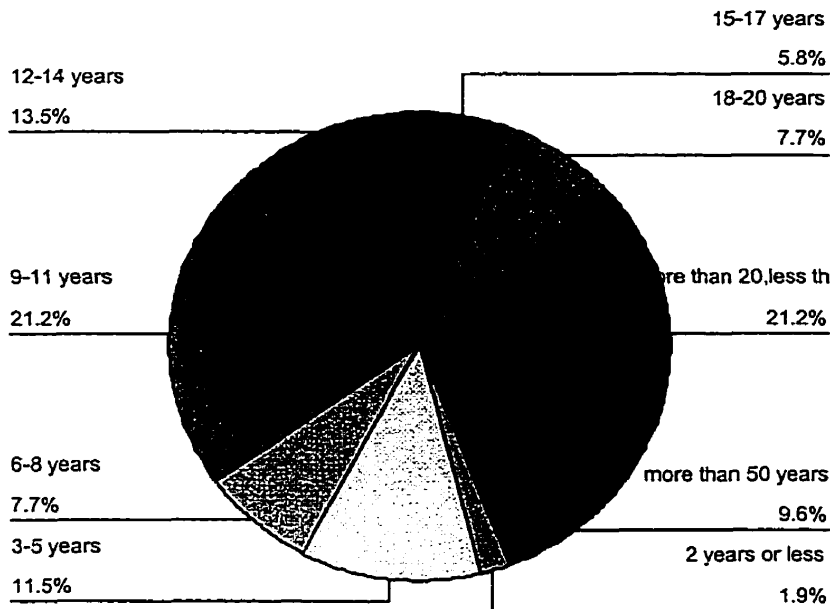
Graph 126: Age break down of respondents



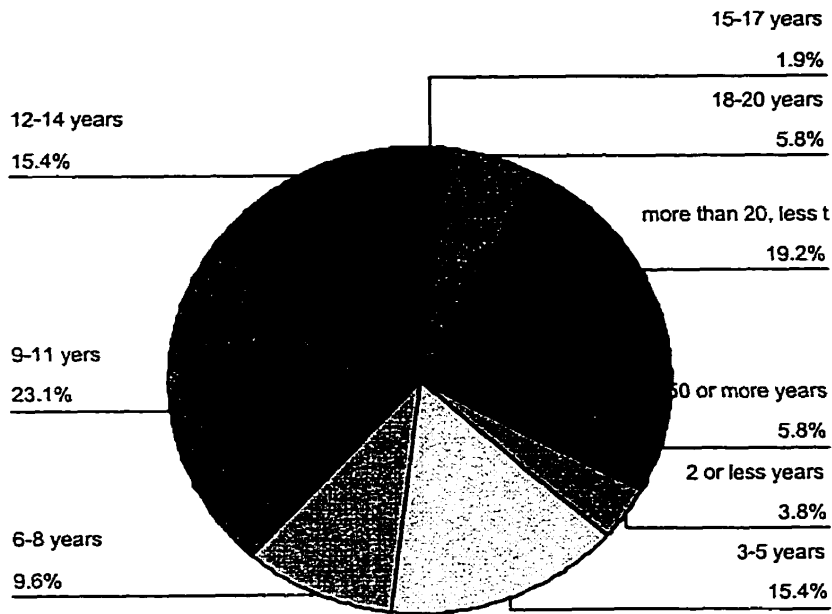
Graph 127: Highest education level attained by respondents



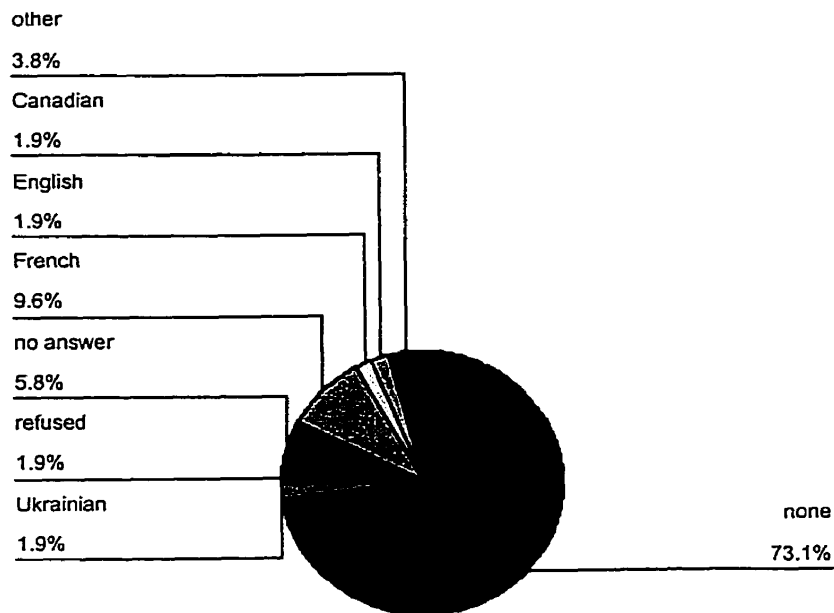
Graph 128: Years in current community



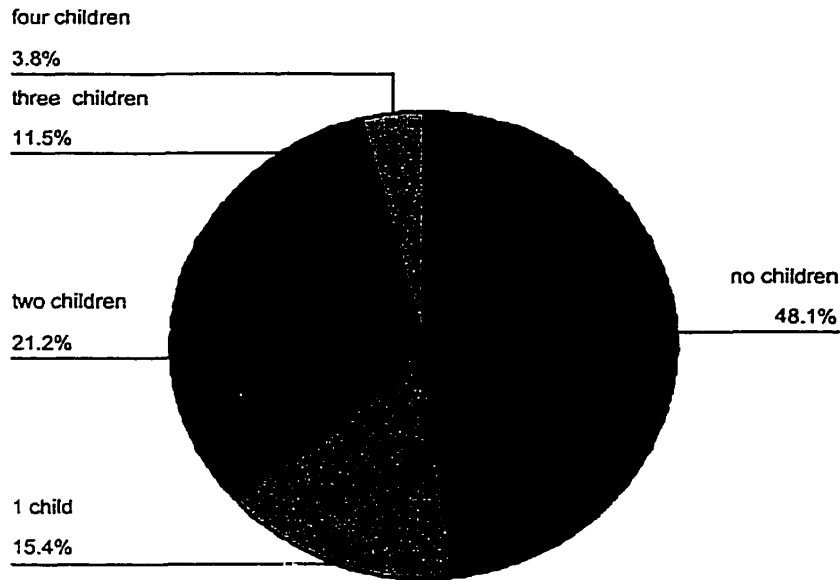
Graph 129: Years at current address



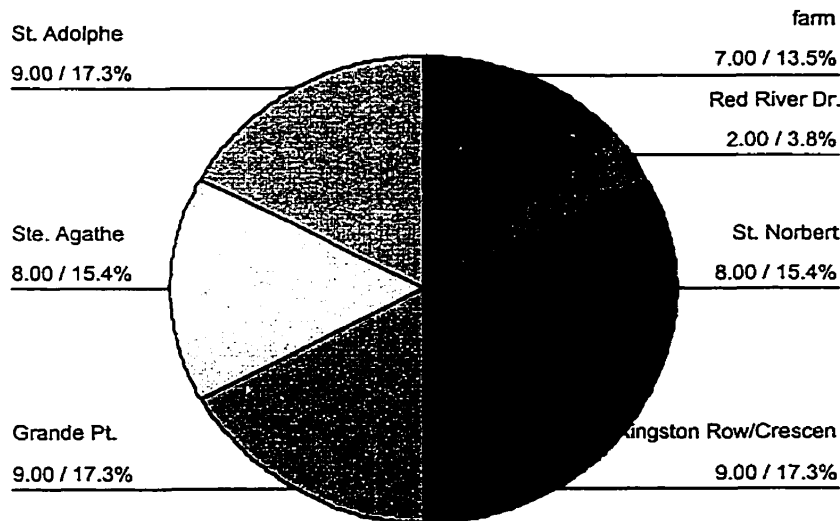
Graph 130: Ethnic group identified with, if any



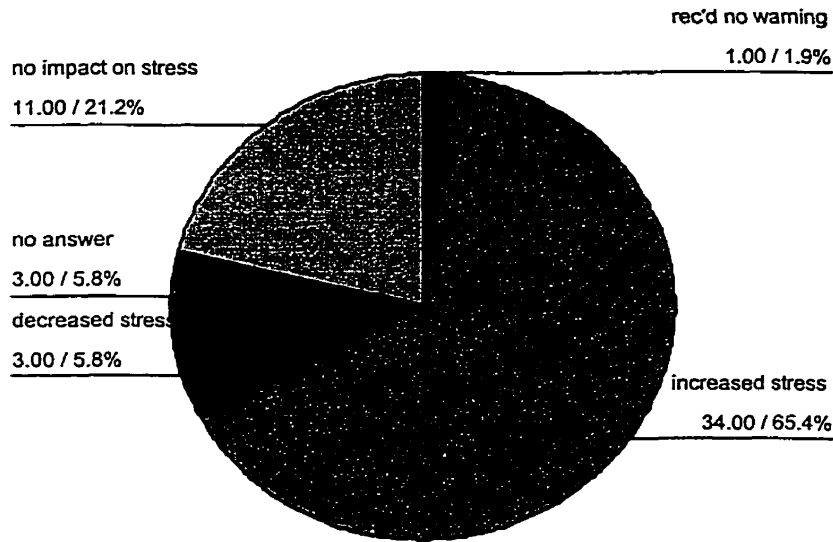
Graph 131: Children under age 18



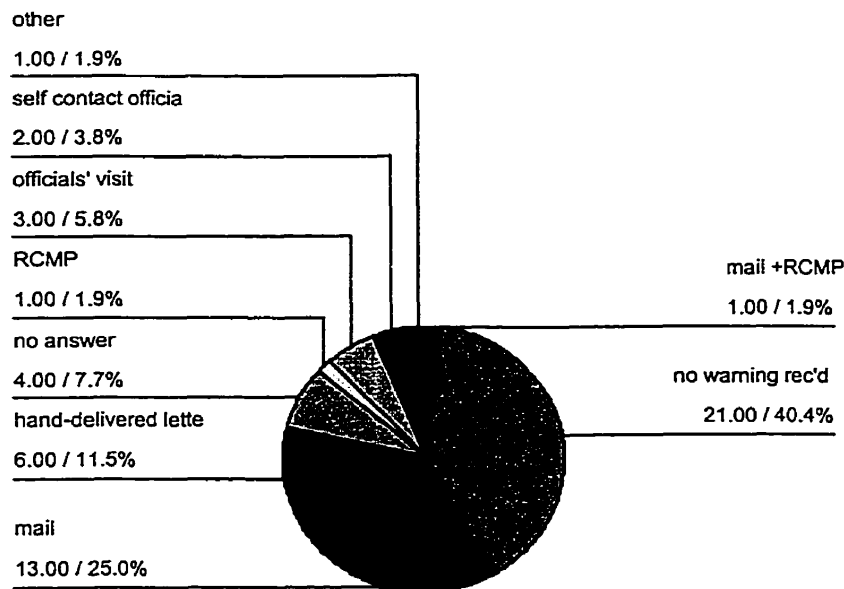
Graph 132: Respondents by community (number and percentage)



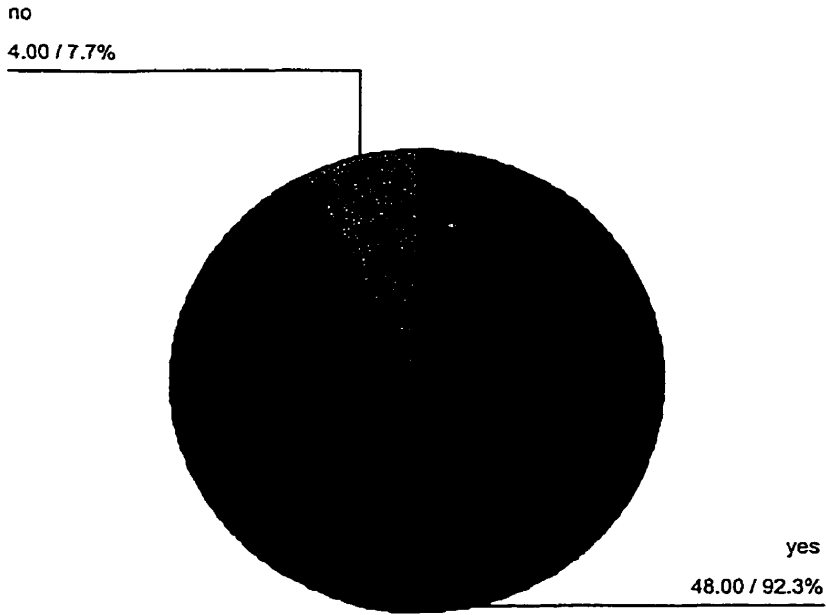
Graph 133: Pie chart of how respondents felt that warning affected their stress level if at all



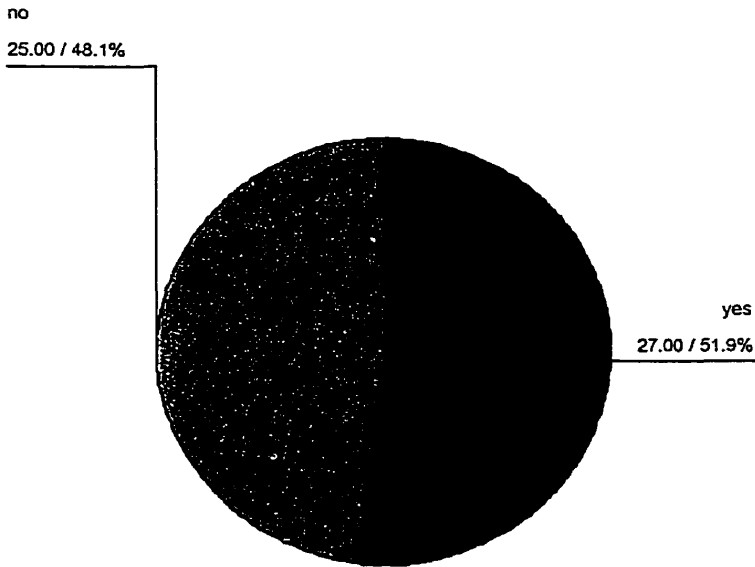
Graph 134: Pie chart of how respondents were told by officials that their home was at risk



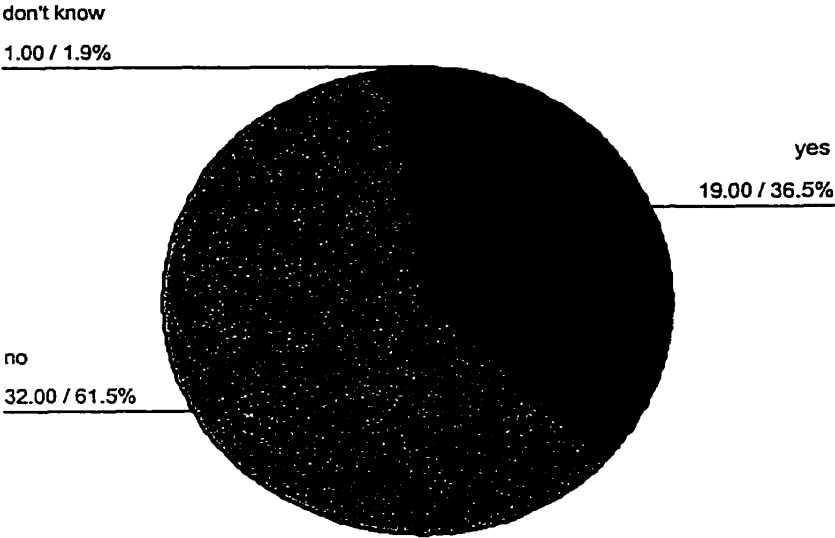
Graph 135: Pie chart of respondent's experiencing more stress than before the flood during the flood



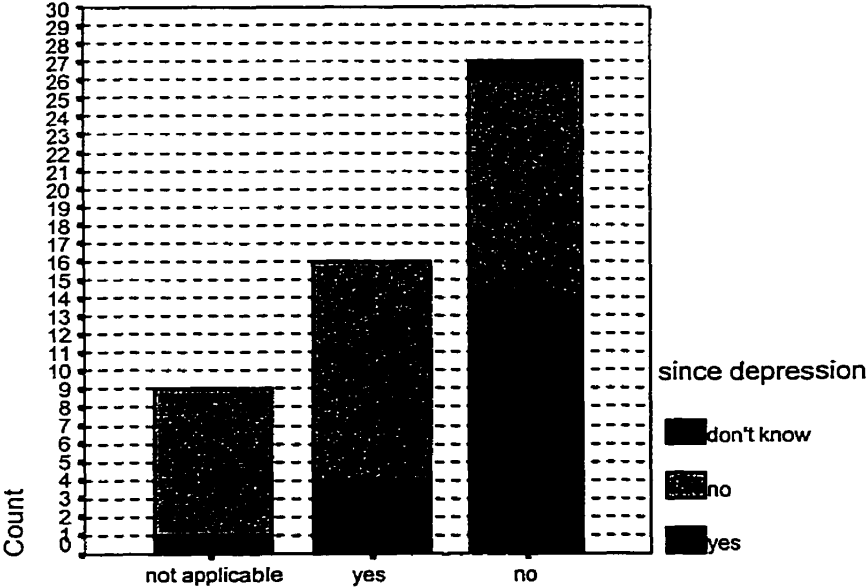
Graph 136: Pie chart of respondent's experiencing stress more than prior to flood after the flood



Graph 137: Pie chart of respondents with post-flood depression / unhappiness

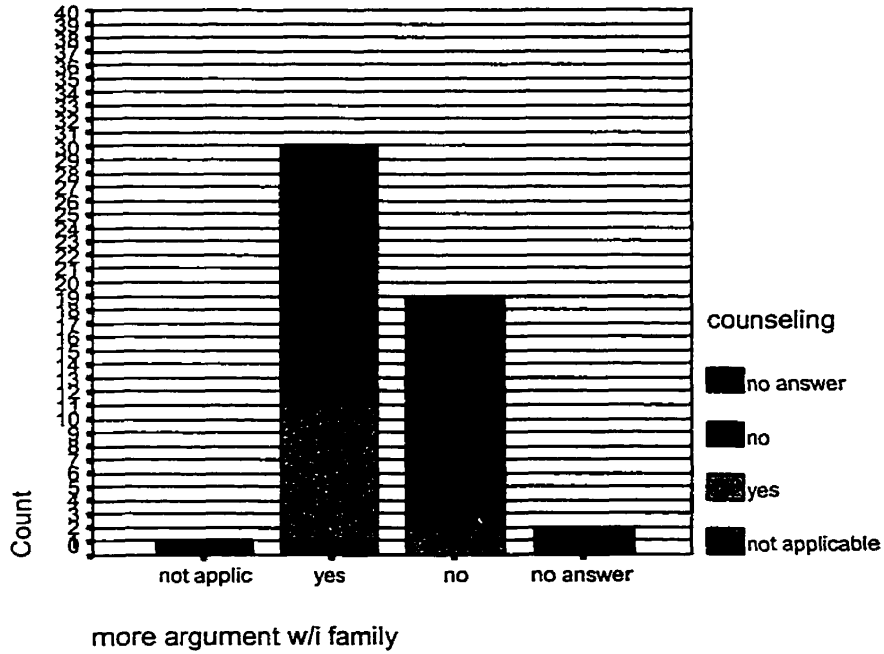


Graph 138: Irreplaceable items lost by depression since flood

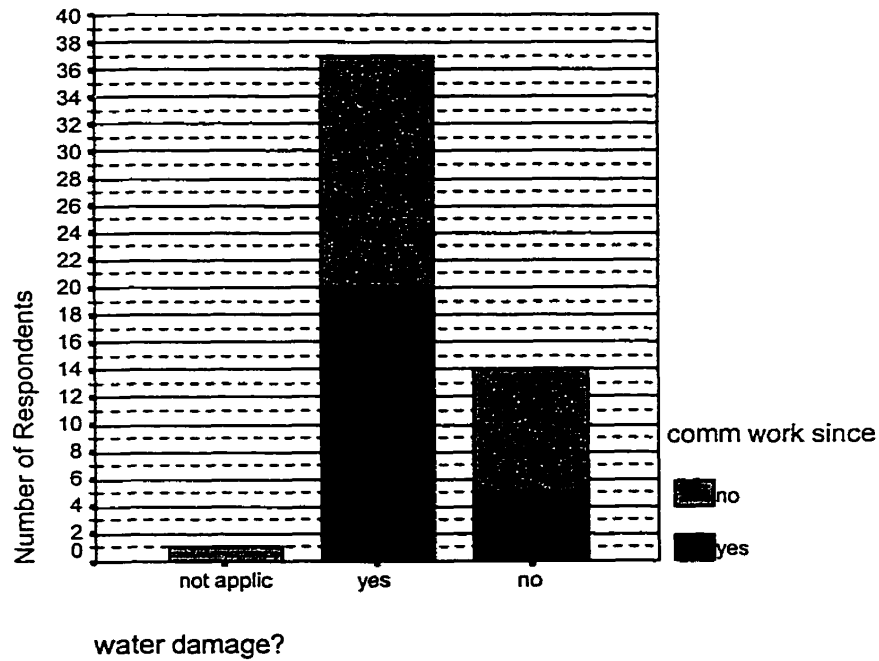


var 051 irreplaceable items lost?

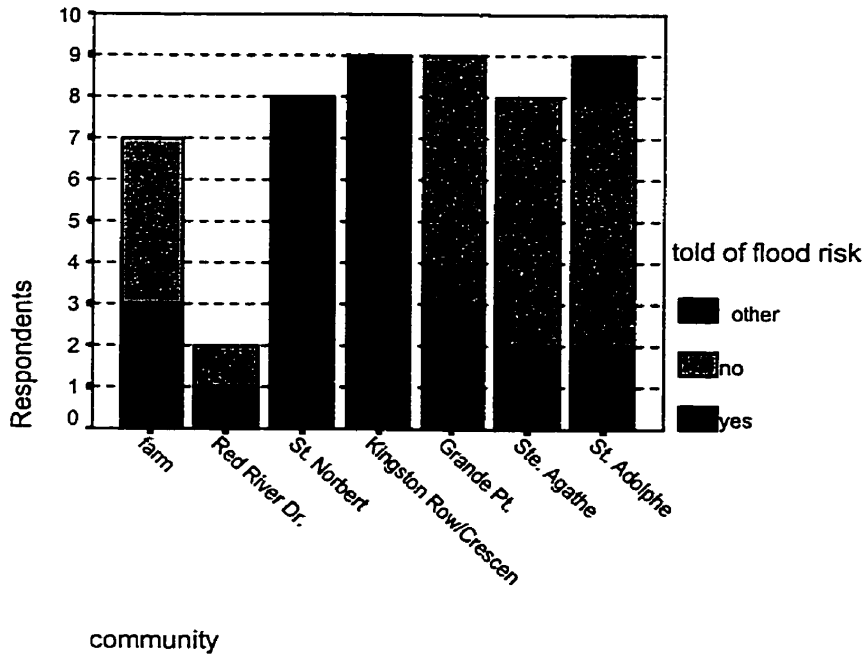
Graph 139: Arguments within the family by sought counseling



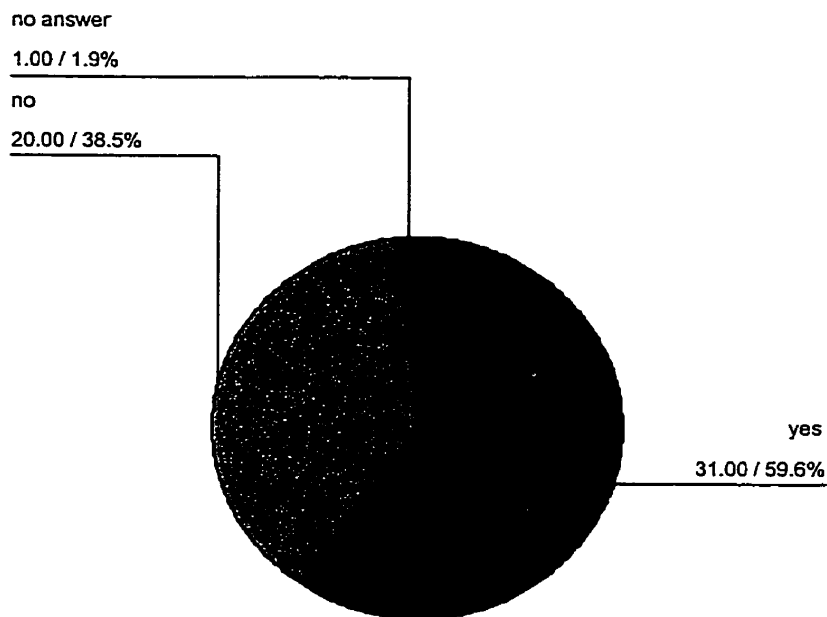
Graph 140: Work on flood related community problem by water damage



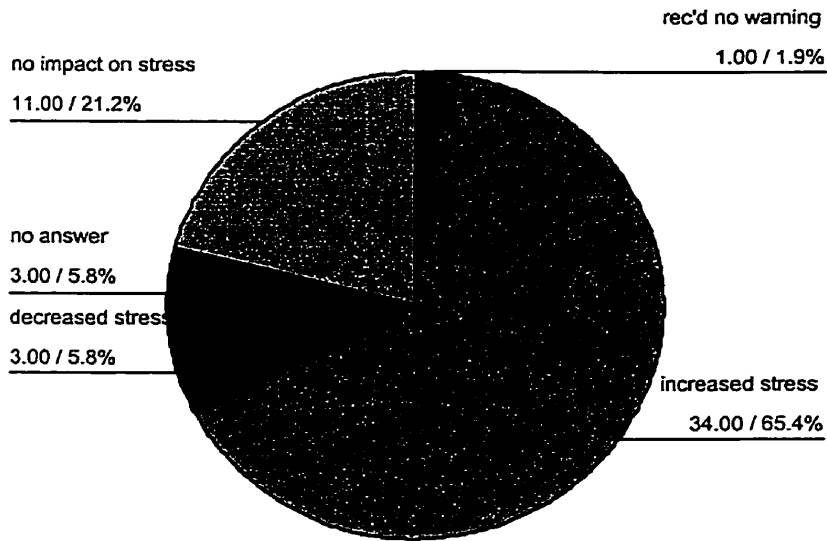
Graph 141: Community by official notification of risk



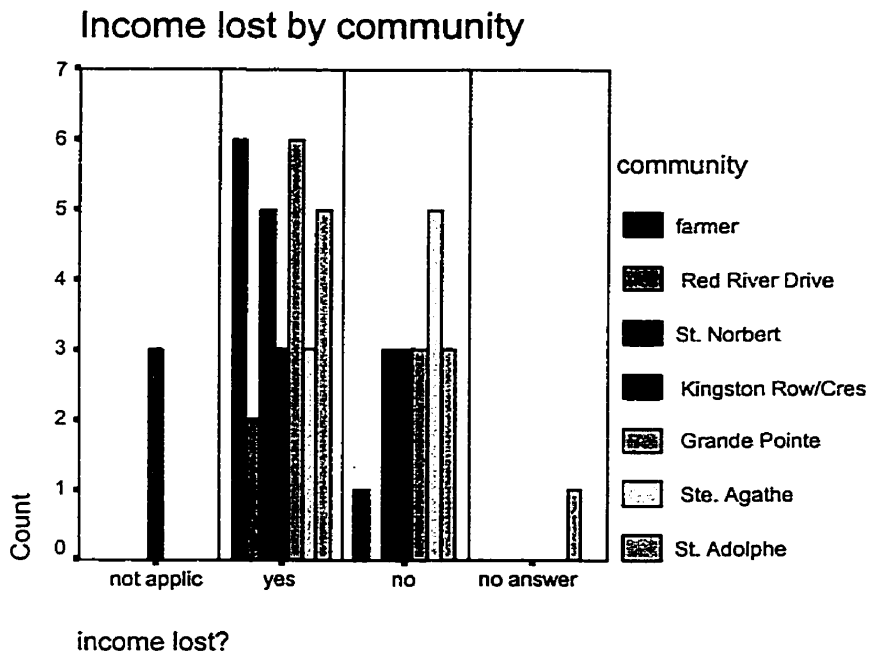
Graph 142: Lost income from job or livelihood (Y/N)



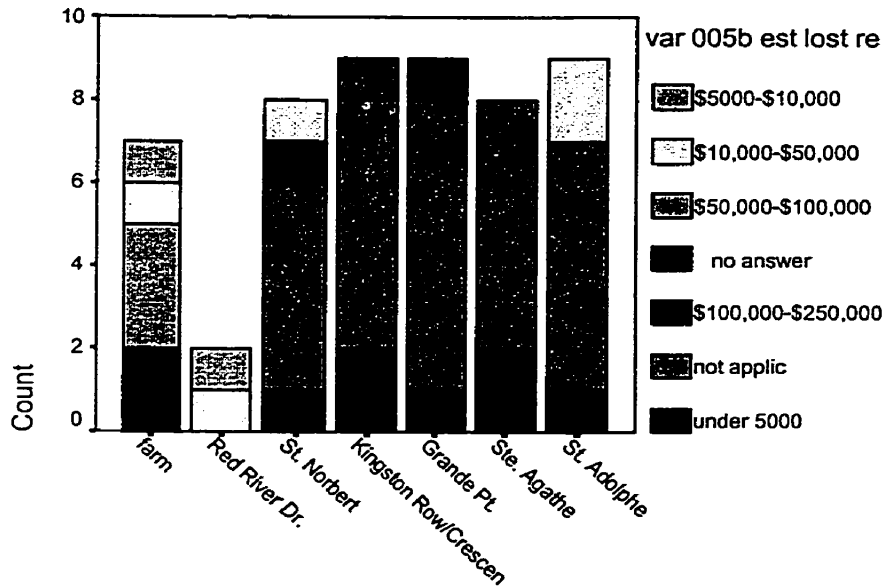
Graph 143: Perceived impact warning had on stress



Graph 144: Income Lost by Community

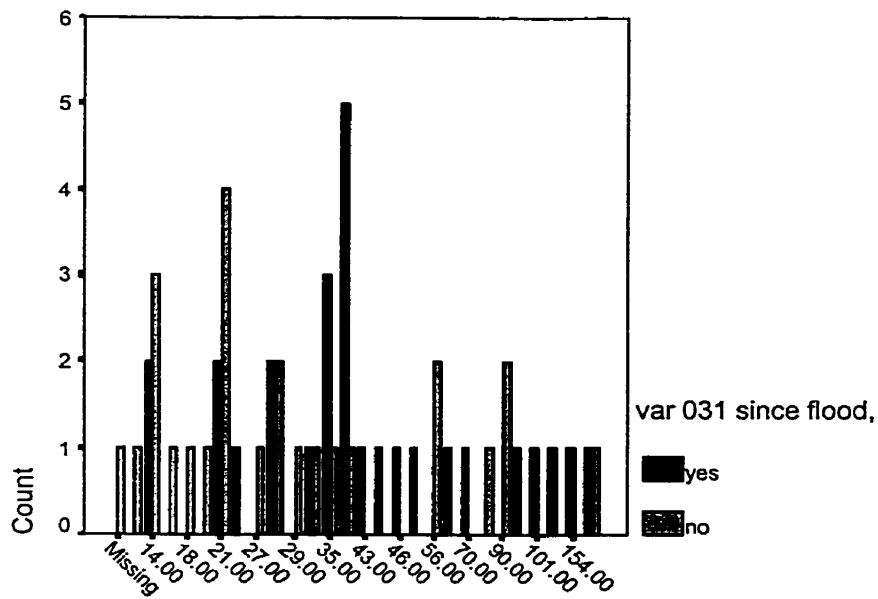


Graph 145: Community by lost business revenue



var 070 comm-unity

Graph 146: Number of days evacuated by stress since flood (Y/N)



var 009a # days