THE ROLE OF INFORMATION
IN THE
DEVELOPMENT OF FLOODPLAIN POLICIES:
The Southlands Case Study

By

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B.A., Simon Fraser University, 1974

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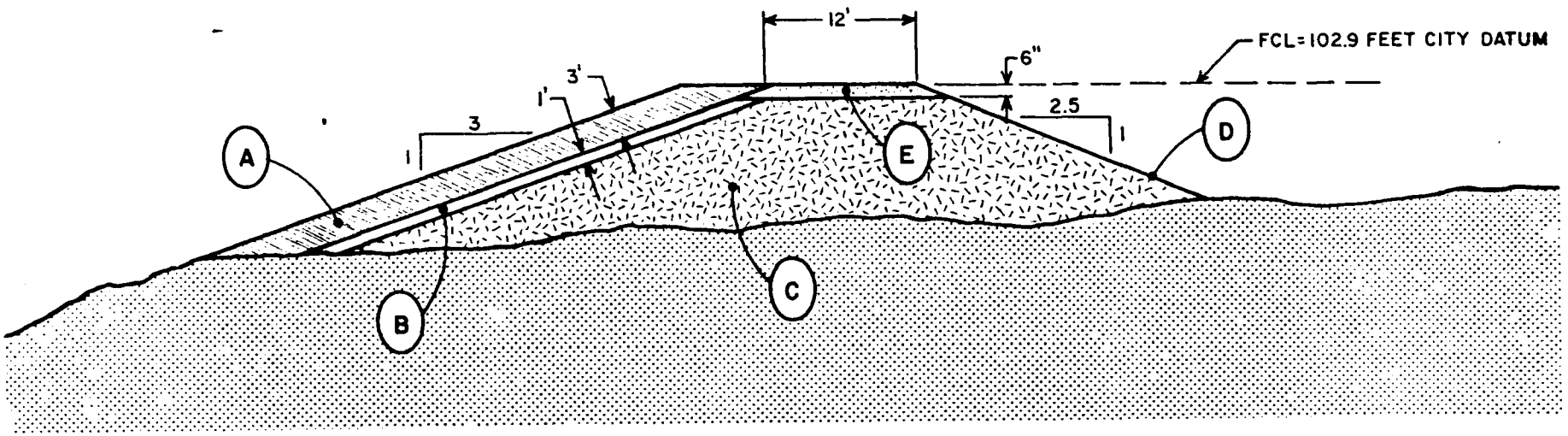

A	RIP RAP
B	FILTER
C	FILL
D	TOPSOIL AND SEEDING
E	CRUSHED ROAD SURFACING

NOTE : THIS PLAN IS A CONCEPT ONLY. NOT TO BE USED FOR CONSTRUCTION

APPENDIX IV

CITY OF VANCOUVER ENGINEERING DEPARTMENT	
FIGURE 7-5 IMPROVED DYKE	
SOUTHLANDS FLOODPROOFING STUDY	
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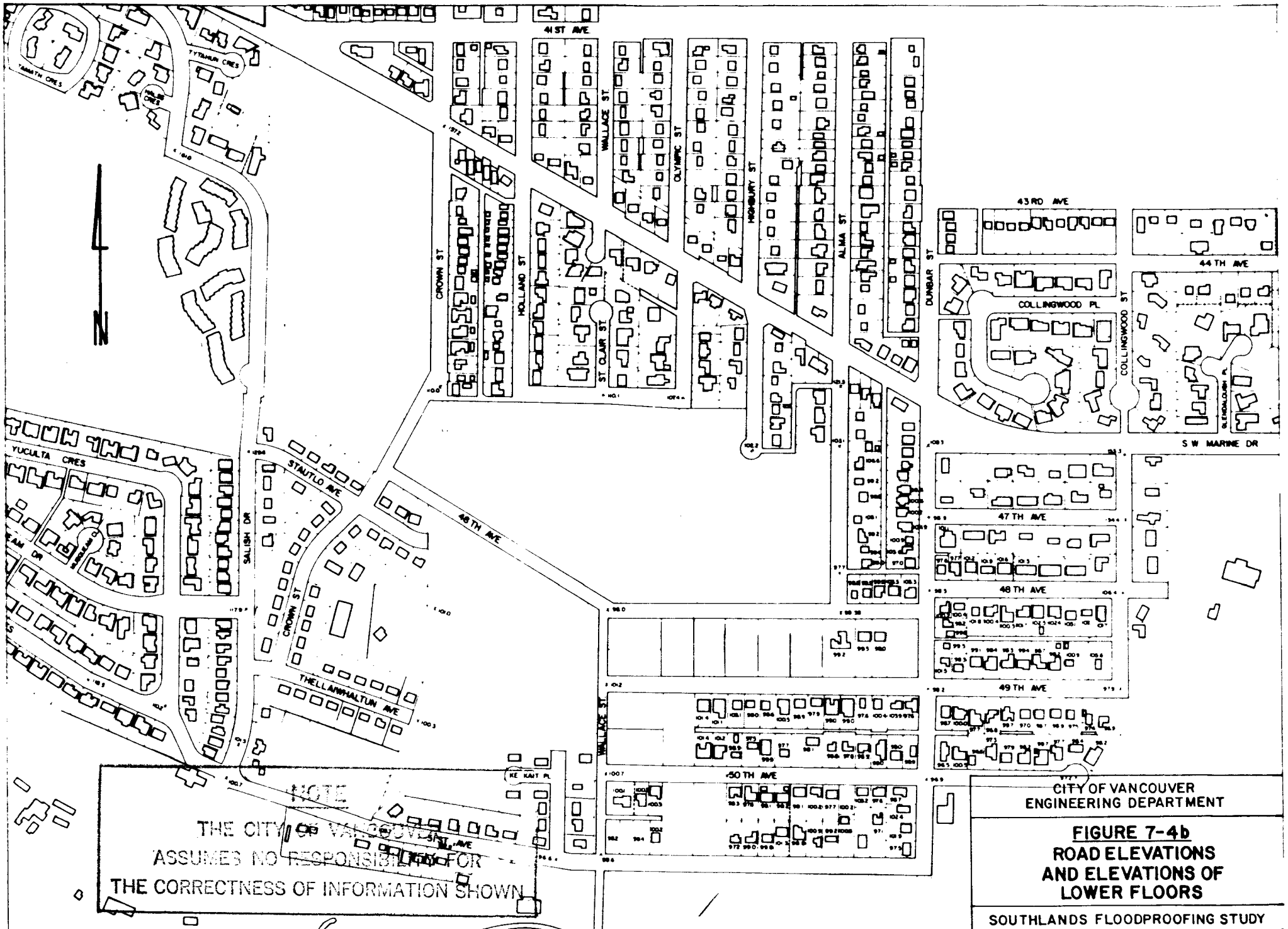
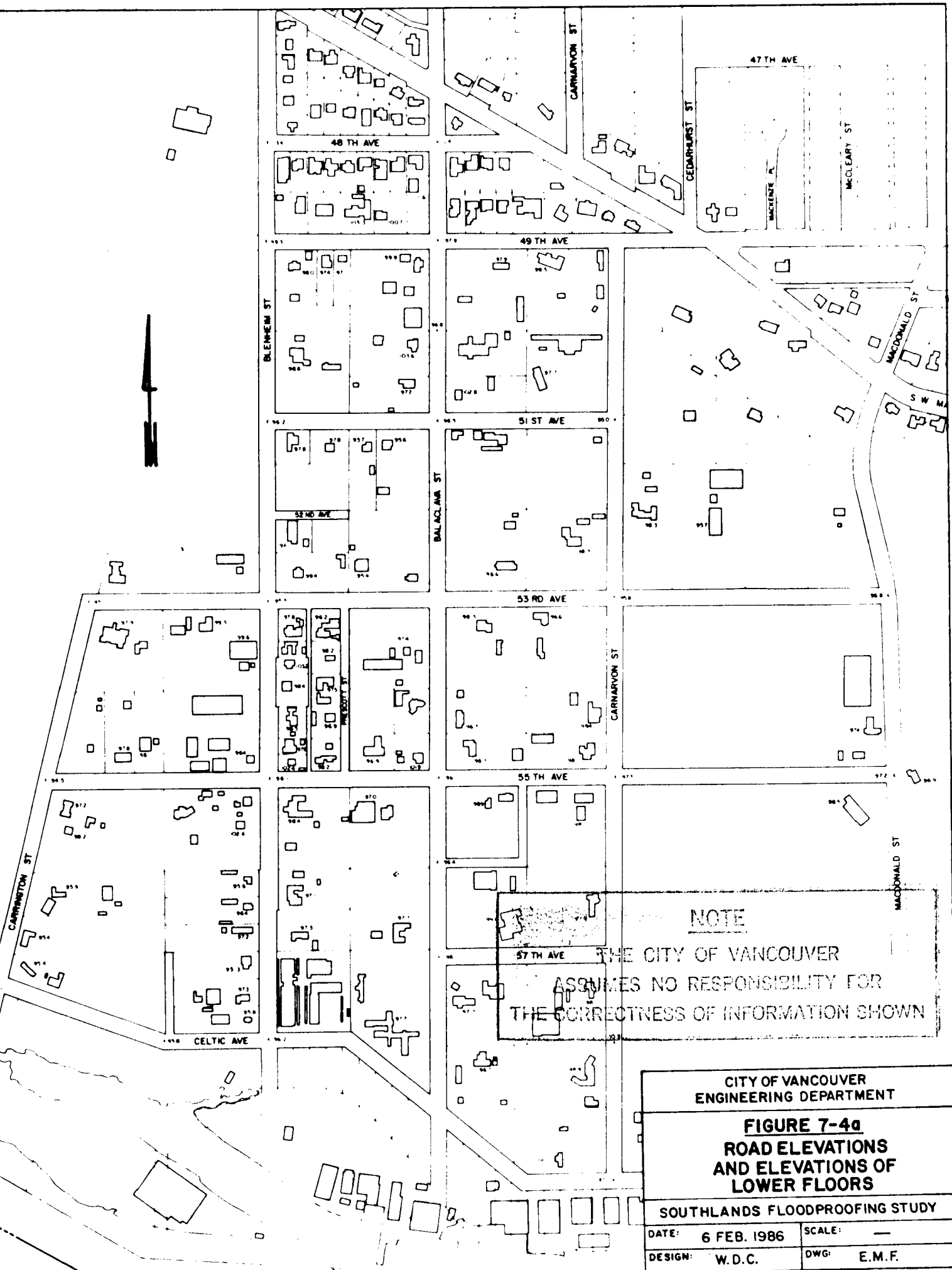


CITY OF VANCOUVER
ENGINEERING DEPARTMENT

FIGURE 7-4b
ROAD ELEVATIONS AND ELEVATIONS OF LOWER FLOORS

SOUTHLANDS FLOODPROOFING STUDY



NOTE

THE CITY OF VANCOUVER ASSUMES NO RESPONSIBILITY FOR THE CORRECTNESS OF INFORMATION SHOWN

CITY OF VANCOUVER
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FIGURE 7-4a

ROAD ELEVATIONS AND ELEVATIONS OF LOWER FLOORS

SOUTHLANDS FLOODPROOFING STUDY

DATE:	6 FEB. 1986	SCALE:	—
DESIGN:	W.D.C.	DWG:	E.M.F.

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ABSTRACT

Increasing development of floodplain lands has led to the need for government officials to be more discerning about the quality and distribution of flood hazard information during the formulation of floodplain management policies. This thesis examines the relationship between flood hazard awareness and the adoption of floodplain policies, and includes a case study in the Southlands area of the City of Vancouver, British Columbia. The research points to methods for improving the quality and distribution of hazard information and education in the public decision-making process.

A literature review of natural hazard research presents the available evidence on the relationship between hazard awareness and response, and general information principles that should be followed in developing a successful hazard advisory program. The thesis presents the necessary information to understand the full range of flood adjustment measures available to deal with flood hazard, as well as the formal institutional and legislative framework and government programs that affect flood management decisions in the Province of British Columbia and City of Vancouver. Background information on the study area is provided, including its location, flood hazard, history of flood management and the planning program used to develop floodplain management policies.

The empirical research involved interviews of government officials and a survey of floodplain residents in the Southlands area to establish flood-related perceptions. The findings from the interviews and surveys are integrated to demonstrate the perceptions of the government's and community's awareness of flood risk and responses as a result of information that has been provided as part of the Southlands Local Area Planning Program.

Recommendations are made for improvements in information approaches that could be used in future flood management programs.

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CHAPTER 1

INTRODUCTION

1.1 RESEARCH FOCUS

This thesis examines the relationship between flood hazard awareness and the adoption of floodplain policies and includes a case study in the Southlands local area of the City of Vancouver, British Columbia. The original research for this involved interviewing government officials at the city, provincial and federal levels and surveying floodplain residents in Southlands to determine the awareness of flood risk and flood adjustment measures. The results lead to general recommendations for improving the effectiveness of information delivery in other flood hazard advisory programs.

1.2 RESEARCH PROBLEM

The City of Vancouver recently adopted floodplain policies in the Southlands area which recommend traditional structural measures, such as floodproofing and dyking to reduce flood damage. However, it is clear from studies done in the United States, that even with structural measures, a substantial residual flood hazard continues to exist. Structural measures tend to generate the perception that the flood hazard has been eliminated, thus encouraging more development in the areas protected by these measures. As a result, more property can be put at risk of major flooding and additional adjustments to the flood hazard may be necessary (Smith, 1979).

The present planning process in Vancouver did not appear to recognize this possibility, largely because the government officials charged with the responsibility for developing floodplain policies were not aware of either the flood risk or the range of alternative flood adjustment measures.

Randall Diehl's thesis "Evaluating Public Decision Making: The Squamish Flood Management Case" (1983) concluded that the primary reason for governments not considering alternative responses to the flood hazard was the inadequacy of hazard information distribution as part of the decision-making process. The study noted that government officials involved in the development of flood management policies were not required to interact with other agencies, thereby the limited views and specific ideals of those involved tended to dictate the nature of the information techniques that were used in selecting a flood adjustment approach.

Gordon Shank's thesis "The Role of Perception in Flood Plain Management" (1972) showed that the development of floodplain policies may be studied by examining the decision-making process with respect to perception of the flood hazard and alternative adjustments to the hazard. The study showed that government officials are aware of the hazard but do not adequately consider non-structural adjustments (e.g. public relief funds, flood insurance, floodplain zoning). The study also showed that the general public is poorly informed and thus shows little concern about the flood hazard situation. The results indicated that perception of the hazard is a major factor in the adjustment adoption process. It

concluded that change in decision-makers' perceptions will be necessary to bring about a change in the planning practice with respect to floodplain management.

Clearly, if better decisions are to be achieved, government officials need to be more discerning about the quality and distribution of information provided as part of any flood management program. Although available in many forms and from many sources, such information unfortunately is neither of uniform quality nor available for all areas. Improved flood hazard information can translate into understanding of not only the nature of the flood risk but also the full range of flood adjustment measures to respond to that risk. Better information on the risk of flood hazard and on the alternative approaches to deal with that risk can also help to translate the hazard into terms that stimulate appropriate local understanding, support and action.

This thesis extends previous research by examining the public (government) and the private (resident) perceptions about flood risk in a local area planning program that evolved as a means of ensuring resident wishes are carried through to policy decisions. The research points to methods for improving the quality and distribution of public decision-making and further research in the formulation of floodplain management decisions.

1.3 RESEARCH OBJECTIVES

The objectives of this study are:

- to determine whether a relationship exists between the awareness of flood hazard and the consequent adoption of flood hazard adjustment measures;

- to describe and explain the floodplain management policies practiced by the various levels of government operating in British Columbia and compare these with the range of possible adjustments that are available to deal with a flood hazard situation in North America;

- to identify the decision-making scheme that is utilized by government officials in developing a strategy to resolve the floodplain hazards in the Southlands Local Area Planning Program;

- to assess the quality and distribution of information presented in the Southlands Local Area Planning Program in developing floodplain management policies; and

- to recommend changes in policy for improving the effectiveness of hazard advisory information in future flood management programs.

1.4 RESEARCH OUTLINE

The first chapter introduces the research focus, the problem, the objectives and outline of this study.

The literature on natural hazard research is reviewed in Chapter 2 to determine first, the available evidence on the relationship between hazard awareness and the consequent adoption of adjustment measures, and second, the general principles that should be followed in developing a successful hazard advisory program.

Chapters 3 through 5 provide information necessary to understand the specific area and program studied in this thesis. Chapter 3 describes the full range of responses currently being used by governments to deal with flood hazard. The formal legislative and institutional framework and government programs that affect flood management decisions in the Province of British Columbia and the City of Vancouver are described in Chapter 4. Chapter 5 introduces the study area, Southlands, in terms of its location and geography, flood hazard, history of flood management, and the planning program used to develop floodproofing measures.

The empirical research associated with the thesis is presented in Chapters 6 and 7. Chapter 6 describes the flood-related perceptions of the government officials directly involved with floodplain management, as defined by personal interviews. Chapter 7 focuses on the results of a questionnaire which established the perceptions of the affected

floodplain residents in Southlands, including those involved in the Southlands Local Area Planning Program. The findings are integrated, demonstrating the perceptions of the government's and community's awareness of flood risk and responses through the information that has been provided as part of the Southlands floodplain management program.

Chapter 8 draws conclusions from the study findings by identifying areas where improvements in information approaches can be made in future flood management programs.

CHAPTER 2

HAZARD AWARENESS AND RESPONSE: A LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews the literature on natural hazard research in order to:

- determine the available evidence on the relationship between hazard awareness and response, and the consequent adoption of adjustment measures; and

- identify the general principles that should be followed in developing a successful hazard advisory program.

2.2 HAZARD AWARENESS AND RESPONSE

It is considered by many natural hazard researchers that by far the most effective method of influencing responses to the threat of natural hazards is by providing information to the public on the hazard risk and on possible adjustment measures. Clearly there are two causal links in this argument: first, that information leads to awareness, and second, that awareness leads to behavioural change (action). This link is not perfect and must be realized in designing any hazard advisory program.

Unfortunately, in reality, the principal problem in dealing with natural hazards is that information does not necessarily lead to learning, nor to the awareness of a risk and the subsequent adoption of adjustment measures. There are a number of studies that have revealed failed connections between education and awareness, and between awareness and behaviour. Two such reviews were undertaken by Saarinen (1979) and Mileti et al. (1975).

There are a host of other studies which not only explore the efficacy of education efforts in raising awareness, but go on to consider the further link to behaviour. Here too, the results are negative. Baker (1980) reported the futility of public awareness programs in increasing hurricane evacuations. Handmer (1979) -- studying the effects on residents' perception of flood hazard through the public distribution of maps delineating flood zones for increasing hazard awareness -- indicated that the effort had no effect on people's attitudes towards floods, and no success in heightening flood awareness. Similarly, Palm (1979) surveying the condition of earthquake hazard awareness on house purchases, and Motz (1983) studying the development of housing on floodplain lands, found that the disclosure by sellers of hazards such as earthquakes or floods had no effect on home selection. This was because other considerations such as size, architectural style, and location are seen to be much more important. In a competition with such factors, hazard risks, even if known, are dismissed as immaterial.

However, it should be noted that sometimes, under certain conditions, and if properly executed, information may lead to awareness and

awareness may influence behaviour. There is a developing sophistication in determining the circumstances under which the causal sequence of information, awareness and resulting behavioural change holds real promise.

Waterstone (1979), in a study to determine the effectiveness of informational brochures on increasing awareness of natural hazards and changing behaviour, reported that prior flood experience, as well as having received information, seemed to influence both hazard awareness and hazard adjustment behaviour. In a study on hurricane awareness and protective responses, Ruch (1978) undertook to assess the effectiveness of the Texas Hurricane Awareness Program which has used radio, television and mailed brochures. He reported finding both significantly increased knowledge of hurricanes and higher response in those who had received the brochure.

It is clear from these examples that there are important variables which influence the effectiveness of any awareness program (ie. hazard experience and hazard education). While evidence exists supporting the link between hazard awareness and responses, there is also evidence documenting the failure of such educational efforts. The following sections on hazard experience and hazard education identify the factors that may influence behaviour change in coping with natural hazards.

2.3 HAZARD EXPERIENCE

As the literature indicates, hazard experience is only sometimes effective in evoking subsequent adjustment measures, and usually only for short periods. There is a considerable literature to support this conditional relationship between experience and preventative response.

The following studies on response to hurricanes document the range of findings. Baker and Patton (1974) investigated the relationship between attitudes towards hurricanes and hurricane adjustments in three cities with different hurricane histories. They found that experience with the hazard was strongly related to preventative actions. On the other hand, Carter, Clark and Leik (1979), in a study on hurricane warnings and preparedness, found that prior experience in hazard situations did not enhance either preparedness or evacuation under warning. Two further studies explain the evacuation finding just noted. Carter (1979), in a three year study on response to hazard warnings, discovered that people without hurricane experience will evacuate earlier than those who have experienced a hurricane. The latter group awaits total confirmation of the necessity for evacuation. Clark and Carter (1980) support this finding, noting that experience with hurricanes will raise threshold levels, that is, the point in time when one is satisfied with the information dictating evacuation, and thus delay action.

The same range of results is found in research throughout the natural hazard literature. Moline (1974) in a study on flood perception and

local planning, found no significant differences in the perception of the flood hazard between 1970 and 1971 even though a flood had occurred in the early months of 1971. Yet Waterstone (1979), studying hazard mitigation behaviour of urban floodplain residents, reported that, "the single factor identified as an important predictor of hazard awareness in all three populations was prior hazard experience " (p. 39). Even more important, it was prior hazard experience that was also one of the two most successful predictors of flood protection behaviour. Those who have been seriously flooded are more likely to take individual floodproofing action than those who have been less seriously flooded (Preston, Taylor, and Hodge 1983). This finding was supported by Preston et al. (1983) and Laska (1986) in their study of homeowners taking floodproofing action.

In his discussion of the link between prior hazard experience and subsequent protection measures, Saarinen (1979) speculates on the unevenness of the findings. Because severe natural hazards such as hurricanes, earthquakes or floods are rare, it is unlikely that even those who have hazard experience have enough knowledge to serve as a basis for effective decision-making. To quote Saarinen's example of this point:

"...in investigations following Hurricane Camille, which struck the Mississippi coast in 1969, it was found that many people assessed their safety according to memories of an earlier smaller storm which struck in 1947. This may have been a fatal mistake for many ... trying to ride out the storm in a residence near the waterfront". (p. 2)

The point is that people can be misled by their experience because that experience is limited or biased; it does not constitute an adequate sample of the real hazard risk.

The frequency of an experience is also important in determining its influence. Thus, Dexter (1977), attempting to discover why some floodplain residents adopt floodproofing while others do not, found a major reason to be the frequency of flood experience the homeowners had suffered. Research by McPherson and Saarinen (1977) on the potential for homeowner participation in flood adjustment suggested that residents are apathetic and unwilling to assume responsibility for solutions, especially after longer periods have elapsed since the most recent flooding (Sheaffer and Roland 1979). Disasters were found to be low on the agenda of everyone involved, including the homeowner (Burby and French 1980; Rossi, Wright, and Weber-Burdin 1982; Drabek, Taminga, and Kilijanek 1983). Kates (1962) concluded that where flooding was so common as to convince residents of its inevitable future occurrence, adjustments were almost certain to be adopted. But in areas where floods were rare and less predictable, adjustments were unlikely to be adopted.

Research by Sheaffer and Roland (1979) and Kreps (1984) noted that residents during the first year or so after being flooded were clearly interested in adjustment measures. After that, however, their interest quickly declines. Laska (1986) added that residents who experienced a second flood tended to be less likely to take emergency action and pay

more taxes toward flood adjustment measures, such as dyking. They were more willing to undertake floodproofing of their houses.

It is clear that the link between experience and behaviour is not clear. Sometimes it does not exist, and in other instances, the experience can result in a mistaken assessment of risk. Man is educable and experience can teach, but as the studies reviewed in this section emphasize, the process is involved and complicated. It can, however, be concluded that experience with severe natural hazards, such as flooding, motivates residents to take protective action, but does not raise anticipation of future risk. The more severe natural hazards which do not occur often are less likely to be known. Therefore, experience usually underestimates longer term risk.

2.4 HAZARD EDUCATION

What influences the response to natural hazards? This section attempts to answer this question by briefly documenting the importance of hazard information, and then illustrates important facets of an effective education program design.

A number of studies indicate that residents who are at risk from natural hazards and are considering actions to reduce future damage have scant knowledge about the causes of hazards (Turner et al. 1980) and that their view of solutions is restricted mostly to structural measures (McPherson and Saarinen 1977). Several disaster researchers have advocated increasing education and information about flood hazards, both

to inform residents about future risk and give them a basis for taking action (Goddard 1986; Cross 1985; Turner 1983). Burby (1986) found that the existence of education and information programs is the second strongest predictor (after flood experience) of property owner compliance with floodplain management policies. Increased information would also give residents a greater sense of efficacy in coping with hazards (White 1972) and promote more rational behaviour. It has been pointed out by Sheaffer et al. (1979) that the lack of information about possible measures works against flood adjustment or mitigation.

The issue of what influences the response to natural hazards, revolves around the factors in an education program that convince people of the reality of the threat. A review of the literature indicates that there are a number of important points raised by disaster researchers, scattered throughout the natural hazard field, that should be considered in the design of a hazard advisory program. First, information must be clear. There are several studies on hazard awareness and protective measures, that found people using those sources which give information clearly and easily (Clark and Carter 1980; Saarinen 1979; Laska 1986). Second, information should not only warn, it should spell out the desired response. Davenport and Waterstone (1979), in a useful guide book for awareness efforts recommended that the effective message is one that provides a positive solution to the problem. In a major study of flood evacuation and emergency preparedness, Perry et al. (1980) demonstrated a significant relationship between compliance with an evacuation warning and the presence of an evacuation plan.

Third, information (or an education program) must be perceived as emanating from a credible source (Goddard 1985; Saarinen and Sell 1985). In his study on Hurricane Eloise, Baker (1979) reported that a credible person making the announcement would have improved the evacuees' relocation rate. Perry et al. (1980) concluded that potential flood evacuees perceive a flood threat as more significant if the warning is given by a credible authority. Fourth, information effectiveness is increased if reinforced socially and locally (Kartez 1984). In Dexter's (1977) work on floodproofing, he found that efforts to promote floodproofing were enhanced if a person knew other residents, friends, and family members were making such adjustments. Kunreuther et al. (1978) reported that the knowledge that others have flood insurance is a factor in raising the probability of someone buying insurance. Through local word of mouth, actions are repeated. This was found to be particularly true in Phillips' study (1979) examining the process of information diffusion concerning the Residential Rehabilitation Assistance Program within an ethnically mixed inner city neighbourhood of Vancouver. Finally Young et al. (1979) in research on the response to earthquake threat, reported that while people get information from the media, that information is given meaning and importance through it being processed by friends and neighbours.

Fifth, information effectiveness depends upon the medium of communication used (Wenger et al. 1980). Disaster researchers have argued that more attention should be paid to the role of mass media in hazard planning and response. Davenport and Waterstone (1979) stated that for hazard information, television is more effective than radio and

that, as with commercials, prime time is the best time. In the Mount St. Helens disaster, public information meetings and face to face communication were effective means of presenting the full implications of this particular geological event to the affected residents (Saarinen, Seamon and Sell 1984). Kartez (1984) reported that information to affected residents was much more accurate where government representatives were able to meet directly with media personnel. There is agreement that a variety of media should be used as each has its own impact (Christensen and Ruch, 1978).

Sixth, the type of appeal made by the information must be assessed. The use of threat (or fear), so common to hazard messages (both educational and advisory), is often misguided. For example, Higbee (1969) reviewed 15 years of studies on the effect of threat appeals. He reported that the effectiveness of hazard information depends upon a number of factors including the characteristics of the people being threatened, the nature of the recommendation being made after the threat and whether the threat is of a high or low level. Christensen (1979) suggests that hazard campaigns should take a two-step approach:

"The general ongoing media campaigns should be positively oriented and designed to enhance public awareness about disasters including such items as specific appropriate responses to ... provide the added motivation to take the appropriate action." (p. 18)

Seventh, information effectiveness is increased if it is undertaken on a cooperative basis between all the levels of government (Laska 1986). Natural hazards, such as floods, cross many jurisdictions. Most times local governments are ill-suited geographically, fiscally and legally to implement adjustment measures beyond their corporate boundaries. Inter-governmental information programs will increase the effectiveness of communication in determining the appropriate floodplain management policies for an area or a region (Burby 1986). This conclusion was reinforced by Saarinen and Sell (1985) in their survey of public officials involved in the emergency response to the Mount St. Helen's eruptions. Eighth, the information should be specifically targeted to the population-at-risk (Saarinen and Sell 1985). Burby and French (1981) noted that because the local context has a major impact on the effectiveness of floodplain management policies, care must be taken to use those methods that work best in each local circumstance. They suggested that a good understanding of the area affected is essential before any discussion on possible adjustment measures is initiated.

Lastly, the role of government officials can greatly determine the extent to which hazard information programs are effective (Carter, Clark and Leik 1979; Torry 1978; Anderson 1969). This includes the capabilities and qualifications of the officials responsible for implementing programs, as well as their perception of the risk, the range and effectiveness of hazard adjustment measures, and their relationship with other government agencies. In all types of flood-prone communities there is a clear need for more floodplain management training in flood hazard adjustment measures (Burby 1986).

Hazard location, adjustment alternatives and emergency information response should all be included in such a program.

It can be concluded that more residents might support flood adjustment measures in the desired area, if an education and information program about flood hazards were initiated by government. It is evident from the literature that support has not been forthcoming where residents have not been informed or where they have not seen adjustment measures as being relevant to them. It is clear that planning programs that emphasize resident involvement become more viable, because they can better accommodate local needs and problem-solving styles and their actions can be more timely. Because the development of floodplain policies requires the cooperation of all three levels of government, it is unlikely that one level of government can succeed alone in getting residents involved. All levels of government will have to work together to develop mutually supportive efforts to involve the affected floodplain residents.

2.5 CONCLUSION

The preceding literature review has shown that the factors involved in efforts to get residents to take protective measures against natural hazards are many and their interrelationships complex. Clearly much can be accomplished if the work is sophisticated and well-informed, but it should be acknowledged that the possibilities of hazard education are limited. There is convincing evidence that some factors involved in determining public response will continue to be uncontrollable. Man's

rationality is constrained, not only by the innate weakness of processing information, but also by human personality, values, attitudes and beliefs (Slovic et al. 1980).

Contrary to conventional wisdom, the fact that an individual is aware of the risk of a natural hazard and the range of possible adjustment measures is no guarantee that an individual will act upon that information. Based upon a review of the literature, the available evidence is mixed on the relationship between awareness of knowledge and the consequent adoption of hazard adjustment measures. It can only be concluded that information may lead to behaviour change under highly specified conditions if properly executed with specific targets. Although the research on hazard education covers a range of natural hazards (i.e. hurricanes, tornadoes, earthquakes and floods), it is possible to identify the following general principles that should be pertinent to any flood hazard advisory program:

- Information should specifically identify the target population, their attitudes, beliefs and values, as well as the socio-economic characteristics of the population-at-risk.

- Information should be specific to the resident's particular situation. The more personal the information, the higher the likelihood of adoption.

- Information dissemination should be considered as an important factor affecting the adoption and implementation of flood adjustment measures.

- Information on the risk of the hazard and the range of possible flood adjustment measures should be provided.

- Information must be clear, every effort should be made to reduce the ambiguity in the message.

- Information content should not only be clear, informative, and provide direction, but serious consideration must be given to the type of appeal (eg. to what extent should the program emphasize fear or positive action?).

- Information programs should be designed to encourage social reinforcement especially at the local level.

- Information must emanate from a credible source.

- Government officials involved in the development of floodplain policies should be trained in hazard identification, alternative adjustment measures and emergency response.

- Information distribution should be undertaken in cooperation with all levels of government.

It is evident from this literature review, that a comprehensive program of flood hazard information is a prerequisite to sound floodplain management. The purpose of the subsequent chapters will be to evaluate the effectiveness of the City of Vancouver's hazard advisory program in Southlands in informing the public on flood hazard and alternative adjustment measures, based on the above noted education principles.

CHAPTER 3

FLOODPLAIN MANAGEMENT ADJUSTMENTS

3.1 INTRODUCTION

This chapter presents the range of responses currently being used by governments to deal with flood hazard. In subsequent chapters, these measures will be compared to:

- floodplain policies as adopted by the various levels of government in British Columbia; and
- the range of choices being discussed by the Southlands Local Area Planning Program in its development of floodplain policies.

3.2 FLOODPLAIN MANAGEMENT

Floodplain management seeks to reduce the damaging effects of floods, preserve and enhance the natural environment, and provide for balanced use of land and water resources within the floodplain (U.S. Water Resources Council 1981). Balanced use of floodplains is rarely attained because of the difficulties in measuring the benefits and costs of floodplain uses and in quantifying the flood hazard. Floodplains cannot be developed while avoiding exposure to flood losses and maintaining the value associated with their natural state.

In North America, the extent of development on floodplains varies. Some floodplains are developed intensively, particularly in large population centers along the coasts. Other floodplain lands are developed for agriculture or remain in a relatively natural state. The trend in most urban areas, as in the Lower Mainland, has been toward further and more intensive development of floodplains to meet the needs of a growing population.

There are many ways to reduce flood losses and protect the natural values of the floodplain. They differ with respect to how they work, what they cost, and the type of problem for which they are suited. According to Burby (1986), successful management of the floodplain generally requires the coordinated use of several approaches, selected according to the specific needs of the community. The range of adjustments that have been utilized as a part of floodplain management can be divided into two broad categories. First, structural measures, which are engineering works designed to control the physical characteristics of flood waters. Second, non-structural adjustments, the essentially behavioural measures which rely on some form of pre-planned action by floodplain residents. The range of structural measures and non-structural adjustments are outlined below. The source of the following information on flood management measures is from the U.S. Federal Emergency Management Agency, U.S. Water Resources Council, American Society of Planning Officials, and U.S. Corps of Engineers.

3.3 STRUCTURAL MEASURES

The most common response to flooding problems has been the construction of large-scale structural measures, such as dams and dyking systems, which confine flood waters to certain areas. This approach was followed to such an extent, particularly in the United States during the 1930s, that structural measures became a synonym for flood protection. Before summarizing these measures, it should be made clear that complete control of flood waters is impractical. Even with tremendous capital investment, it is virtually impossible to provide total protection from flooding. Instead, structural measures alter the frequency and magnitude of flood events. The degree of protection offered by a structure is normally determined during the design and planning stages of the project. Naturally, if a storm frequency or surface water runoff rate of greater magnitude than anticipated by the design standards of the project occurs, the structure will be either partially over-topped or it will fail completely and flooding will result. As a consequence, there is a general tendency for structural measures to create a false sense of security among "protected" residents because the concept of "design standards" is seldom widely communicated or generally understood. The design standard term is commonly used to mean the magnitude of flood used for design and operation of flood control structures.

Structural measures can be organized into three sub-groups:

- engineering schemes, which depend on specific flood control works constructed on a variety of scales;
- abatement schemes, which attempt to control flood flows by land-use management during the upstream phase of run-off; and
- floodproofing schemes, which offer protection to individual buildings on the floodplain.

Each of these sub-groups can be utilized individually or in combination. They are outlined below.

3.3.1 Engineering Schemes

Engineering schemes to alleviate flood problems are of four basic types. They include: dams and storage reservoirs; dyking; channel alterations; and storm sewer systems.

Dams and storage reservoirs capture and temporarily hold floodwaters upstream of flood-prone areas. Excess water is gradually released after the flood threat has passed. This measure is most frequently used on small and moderate sized streams. The protection afforded by this measure is greatest in the area immediately downstream, and its effectiveness is reduced further downstream by flows from tributaries and by runoff from lands draining directly into the stream. Dams are also used in the management of coastal floodplains by preventing storm surges from travelling upstream and flooding inland areas. The high

tide barrier located at the mouth of the River Thames in England is such a structure.

Dyking (or levee) systems restrict water to well-defined limits within the floodplain using artificial banks. Controlled flooding of areas outside the dykes allows relative safety for those areas inside the levees up to the design standards of the project. This standard is measured in terms of the recorded high water levels or storm frequency in the specified floodplain area (eg. 200 years). For example, a 200 year flood recurrence interval is used in British Columbia to define the flood design level, based on historic flood records. The dyking approach is flexible in that it can offer protection for either a specific area or a large area. This measure has tended to be the popular approach to deal with flood hazard in British Columbia, especially in the Lower Fraser River basin.

Channel alterations reduce flooding by increasing the flow carrying capacity of a stream's channel. These alterations may include: straightening, deepening, widening or diverting the stream; installing culverts in strategic locations to restrict flow; and removing dams (or debris) that interfere with the waterway. All of these channel improvements contribute toward reducing the height of a flood. It is sometimes possible, by extensively reconstructing a stream channel, to contain major floods within its banks.

Storm sewer systems connected to other drainage devices along an area's street network, are a means of directing rain runoff away from

vulnerable areas. Lines and access points are sized and distributed to accommodate the runoff likely to be associated with a site or an area, to reduce water backup and the resulting overspill of flash flooding.

3.3.2 Flood Abatement Schemes

Flood abatement schemes do not depend on engineering technology. Instead, the basic aim of abatement policy is to reduce flood peaks downstream by a series of land-use treatment measures upstream that alter the runoff and the frequency of floods. Examples include: reforestation, crop rotation, construction of terraces, contour strip cropping, slope stabilization, and grass waterways. These measures reduce water flow by improving infiltration of rainfall into the soil, slowing and reducing runoff, and reducing the sedimentation that can clog stream channels or storage reservoirs. While the effect of any individual measure is small, extensive land treatment can effectively reduce flooding in small headwater areas. Abatement schemes are less effective in downstream areas subject to larger floods.

3.3.3 Floodproofing Schemes

Floodproofing schemes, the third group of structural measures, have only recently been accepted as a viable alternative to the more conventional methods. In essence, floodproofing consists of adjustments to building structures, and the contents of buildings, designed to reduce flood damage. Floodproofing techniques are primarily for use in flood fringe areas where flood waters are expected to be shallow and slow moving

(Federal Emergency Management Agency 1984). Most floodproofing measures cannot withstand deep flooding. The residents, therefore, should always be evacuated from floodproofed structures to avoid being trapped in case the floodproofing fails. These measures can be either temporary or permanent.

Temporary floodproofing measures (or wet floodproofing) include the blocking-up of seldom used entrances to buildings, the stocking of suitable shields to be placed in position at doors and windows prior to a flood and the use of heavy sliding doors to protect other entrances. Further interior adjustments may include the greasing and covering of mechanical equipment prior to a flood, or the use of flood-prone areas for storing non-damageable goods. Although this list is virtually endless, the effectiveness of all these measures relies entirely on the individual property owner being aware of the flood hazard and receiving a flood warning so that such schemes can be implemented.

Permanent floodproofing measures (or dry floodproofing) do not necessarily depend on the receipt of a flood warning and include more structural alterations, such as the raising of buildings above the flood level (eg. earth fill, elevated foundations, posts, piles or piers), the permanent use of lower storage for car parks, or the inclusion of pumping facilities in basements. The selection of the appropriate technique depends on a number of variables, including hydrologic factors, physical conditions at the site, and cost. In some cases it can be advantageous to use a combination of methods. For example, a building raised on fill at one end and piers or posts at the other could

provide ground floor access at the end of the building away from the floodplain while minimizing obstruction of flood waters at the end nearer the stream channel. Permanent floodproofing measures can be effective in reducing flood losses.

In summary structural measures, apart from floodproofing, endeavour to reduce flood losses by changing the magnitude and frequency of flooding by the control of excess water. These measures do provide reliable flood protection up to the design standards of the project. However, structural measures are, for the most part, fairly expensive to implement.

3.4 NON-STRUCTURAL ADJUSTMENTS

Non-structural adjustments to the flood hazard are less well known than the structural measures, although in recent years some of these adjustments have become more widely used. There are a variety of reasons for this situation. In some cases, technological improvements have made certain adjustments more efficient, for example, flood-warning systems.

However, one of the prime reasons for this trend is the prohibitive cost of implementing large-scale structural schemes. Added to this, the growing realization that structural measures fail to totally eliminate flood losses has encouraged floodplain planners to consider new techniques. Eight types of behavioural adjustments are described in the remaining portion of this chapter. They include: information and

advice; flood forecasting and warning schemes; land acquisition and relocation; government incentives; capital improvement policies; floodplain regulations; flood insurance; and public relief.

The provision of information and advice about the flood hazard is one of the oldest non-structural techniques for discouraging the development of flood-hazard areas. A number of approaches for informing the public have been devised. They include educational programs, publication and dissemination of flood-hazard area maps, and posting of warning signs. In addition, some communities require that builders, developers, real estate agents, and others involved in the real estate industry disclose the flood hazard before property is sold. Moreover, subdivision regulations often require that the flood-hazard area boundary be delineated on maps, so that prospective lot purchasers know of the hazard.

Flood forecasting and warning schemes work on the principle of reducing flood losses through remedial action by floodplain residents prior to a flood. Forecasting, warning, and flood preparedness measures are integral parts of a well-balanced floodplain management system. Local flood warning systems, normally established on a community, area or watershed basis, provide for collecting data, making flood predictions, and disseminating warnings. Flood preparedness measures describe and assign responsibility for carrying out pre-planned actions for minimizing loss of life and property during a flood. These plans usually provide for evacuation, emergency flood protection and flood fighting. They also include arrangements to care for evacuees and speedy

recovery of the community. Preparedness plans customarily are drawn up for use by a specific city or regional area and linked to the area's flood warning system.

Land acquisition and relocation schemes involve government purchase of floodplain lands, and relocation of structures and occupants to hazard free locations. The acquired lands are utilized for recreation, fish and wildlife, and other public purposes (eg. undeveloped open space, etc.), thus facilitating the reestablishment of the natural setting on the floodplain.

Government incentives are an approach to discourage the development of flood hazard areas. One type of incentive provides for preferential taxation to maintain agricultural or open space uses of the floodplain. Another incentive, density exchanges, allows developers to build at higher densities than normally allowed in non-hazard areas in return for maintaining lower-than-required densities in the floodplain. Subsidizing property owners to flood-proof their properties or to relocate them from hazardous areas have also be used.

Capital improvement policies advocate that public facilities and improvements be located outside of flood hazard areas, not only to protect those facilities from flood damage, but also to avoid inadvertently increasing the attractiveness of floodplains for urban development. The location of roads, utility lines, offices, and other public facilities should stimulate and support development activities away from the flood-hazard areas. This adjustment induces land

developers and builders to locate on the flood-free sites where public facilities will be provided, particularly if flood-hazard areas will not be served with public infrastructure. Besides policies regarding the location of facilities, the incentives from public investment may also be reduced by changing the scale of facilities, their design, and conditions related to their use.

Floodplain regulations (eg. zoning, subdivision, etc.) designate flood-prone areas and limit their uses and parcel sizes to those compatible with the degree of flood risk. For example, typical zoning regulation usually involves the designation of two zones, a "floodway" and a "flood fringe". A floodway consists of those portions of the channel and floodplain required to pass flood flows, and is usually limited to agriculture, recreation and other open space uses or uses that require a waterside location. A flood fringe is the portion of the floodplain outside of the floodway or coastal high hazard area but still subject to flooding. Structures and other developments are normally permitted in the flood fringe area. This adjustment can prevent unwise development on the floodplain.

Flood insurance, similar to other property insurance schemes, provides an opportunity for owners and renters of flood-prone properties to insure against flood damage, and minimize future flood risks. The insurance usually covers only the house and its contents. The cost to policyholders depends on the amount of coverage purchased and the degree of flood risk. This alternative serves to partially place some

of the costs of risk on the property owner, as well as informing the residents about the significance of residing on a floodplain.

Public relief aims at providing financial aid and other types of support (eg. grants, credit) to residents following a flood. This scheme is particularly beneficial to those individuals who could not themselves afford to replace damaged property. It also provides funding proportional to the scale of the disaster. Public relief is usually made available, after the government has made a disaster declaration on the basis of information about the type and extent of damage in an area.

In summary, there are a variety of non-structural adjustments that can be employed to deal with floodplain problems. As presented in this section, these adjustments range from government relief approaches and regulatory measures to warning preparedness and information programs in order to reduce flood losses. Because of the high cost of implementing large scale dams and dyking systems, and their increasing failure to reduce floods, there is an increasing acceptance by communities and governments to utilize non-structural adjustments .

3.5 CONCLUSION

The full range of measures to deal with flood problems has been presented in this chapter. They include both structural measures and non-structural adjustments. While the basic options have changed little in the last fifty years, our attitudes towards flood alleviation have

changed. Rather than simply attempting to control the flooding, more attention is now being given to man's adaptation to his flood environment. This trend is reflected in the growing significance of non-structural measures. Unfortunately, many floodplain management programs are still piecemeal, muddled and ineffective. Two characteristic problems remain. First, specific structural measures or non-structural adjustments are still being adopted without any consideration of the whole spectrum of alternative measures. Second, responses to flood threats continue to be implemented, sometimes in combination, without a full appreciation of the importance of educating and involving the affected residents in the decision-making process.

The presentation of the alternative approaches available for dealing with flood hazard makes it clear that a comprehensive program of flood hazard information is an important part of sound floodplain management. The development of a public education program, especially by or for the officials and planners who will have the major task of interpreting and applying it, is essential. The next chapter describes the formal institutional framework affecting flood management decisions.

CHAPTER 4

INSTITUTIONAL DECISION-MAKING FRAMEWORK FOR FLOOD MANAGEMENT DECISIONS

4.1 INTRODUCTION

This chapter describes the formal institutional and legislative framework and government programs that affect flood management decisions in the Province of British Columbia and the City of Vancouver.

4.2 INSTITUTIONAL FRAMEWORK IN CANADA

The Canadian Constitution establishes the division of powers and responsibilities between federal and provincial jurisdictions over matters involving flood management. The management of water and land resources is the responsibility of provincial jurisdictions. However, the federal government has jurisdiction in water management decisions which affect federal, inter-provincial or international waterways (e.g. navigation and fish habitat). Agreements are often made between the two senior governments regarding the funding of specific flood improvement projects, disaster relief, data collection, and floodplain mapping.

In British Columbia, flood management has traditionally been a cooperative responsibility of provincial and municipal governments. Municipal governments have had the role of initiating and adopting flood management policies, while the provincial government has provided funding support for major flood adjustment measures, technical expertise

on environmental studies, and legislative guidance through province-wide floodplain policies and standards. Provincial authorities also influence local governments in the course of approving, upgrading, reviewing and implementing flood management plans, subdivisions, bare land stratas, floodplain designations, official community plans and zoning by-laws.

4.3 FEDERAL REGULATIONS AND PROGRAMS

4.3.1 Federal Regulation

There is no federal legislation outlining general federal functions in flood control or any aspect of floodplain management. The total extent of federal jurisdiction has been and continues to be based upon ad hoc federal-provincial agreements. The major role of the federal government is to contribute to the safety of individuals residing and working on the floodplain and to minimize the damage costs in the event of a flood.

Like the provincial government, the federal government became involved in flood management activities in British Columbia as a direct result of the 1948 Fraser River flood. This natural disaster led the federal government to participate with the provincial government in establishing a number of flood control projects. This role was formalized through the Canada Water Conservation Assistance Act (1953) which gave federal authorities a technical say on how flood control funds were to be used (Environment Canada 1987).

In the late 1960s, environmental and resource conservation matters were placed high on the political agenda. With multiple-purpose planning, the federal and provincial governments had to join together to meet their respective responsiblities to monitor, plan and manage the Fraser River (e.g. dyking, flood monitoring, forecasting and warning, and regulating floodplain land use). To fulfill this role properly, the federal government enacted the Canada Water Act in 1970 (Environment Canada 1987).

The legislation provided for joint consultation between federal and provincial governments in matters related to water resources in general. It enabled the federal government to participate in comprehensive river basin planning and water quality management in major river basins (eg. Fraser River Estuary Study). The primary responsibility for administering the Canada Water Act was vested in the Department of the Environment, which was established in 1970. Many federal-provincial shared-cost programs have been developed since 1970 under the Canada Water Act. These programs are outlined further in the next section.

The primary federal legislation affecting provincial or municipal flood management has been the Fisheries Act. Under this act, the Department of Fisheries and Oceans and/or the Ministry of Environment and Parks may prevent or halt any activities which are harmful to the normal passage or habitat of fish. Flood control projects must be reviewed by the Department of Fisheries and Oceans, when a proposed project is expected to have impact on stream flow and fish habitat.

4.3.2 Federal Programs

The federal government administer several flood management programs. These include

- collection of stream flow and water quality data;
- Fraser River Flood Control Program;
- Federal Disaster Assistance Program; and
- Canada Mortgage and Housing Corporation Floodproofing Guidelines.

Although the collection of stream flow and water quality data is normally a provincial responsibility, it has been delegated to the federal government's Department of Environment, Inland Water Directorate, under an agreement with the province. The data provide meteorological and hydrological information as well as tidal flows and river level monitoring for estimating the degree of protection required for preventing the occurrence of a future flood event.

The Fraser River Flood Control Program provides funds for dyking improvements and bank protection necessary to prevent major flood damage. The federal and provincial governments equally share the costs of the required improvements, while the municipal governments agree to provide dyke right-of-ways and ongoing maintenance of the new dyke system. This program has been in place since 1968, and was recently extended to 1995 (Ministry of Environment and Parks 1987).

The Federal Disaster Assistance Program (Department of Environment), provides for 50% funding of those flood damage costs which exceed the population total of the province. This means that with a population of 2.7 million in British Columbia (1981 Census) the first $2.7 million of flood costs are covered by the province and any amounts exceeding this total are equally shared with the federal government.

Finally, Canada Housing and Mortgage Corporation has regulations which require approval for National Housing Act (NHA) mortgage insurance (or high ratio loans) to be granted for dwellings in designated flood prone areas only when specified floodproofing requirements are met. There is no such similar requirement by private banks or mortgage lending institutions.

Since 1977, the federal government has been in the process of negotiating a new cooperative agreement entitled the "Federal Damage Reduction Program" (Ministry of Environment and Parks 1987). This program would provide for an agreement between the two governments not to finance or approve any further projects/developments liable to flood damage in designated flood-risk areas. As part of this program, additional funds would also be made available to the provincial governments for floodplain mapping and the development of a public information program. This agreement was signed in December, 1987 (Ministry of Environment and Parks 1988).

4.4 PROVINCIAL REGULATIONS AND PROGRAMS

4.4.1 Provincial Regulations

In keeping with its constitutional power the province maintains a policy of scrutinizing development on the floodplain. The major piece of provincial legislation that affect the flood management policies of the City of Vancouver: Section 82 of the Land Title Act (1985). It should be noted that because the City of Vancouver has its own Charter, provisions of the Municipal Act which apply to other jurisdictions in the Lower Fraser Valley do not apply to Vancouver. As such, it may be much more difficult for senior governments to undertake a pro-active role in Vancouver's floodplain policy formulation. The Federal Fisheries Act, as previously indicated, delegates some measure of influence to provincial conservation officers over municipal flood management activities when fish and wildlife habitat is threatened.

There is question by the provincial officials as to whether Section 187(1) of the Municipalities Enabling and Validating Act is applicable to the City of Vancouver in view of its Charter. Confirmation of this interpretation is presently being sought from the City of Vancouver legal counsel (Ministry of Environment and Parks 1987). This act requires that all proposed adoptions, amendments or repeals of community plans or zoning by-laws involving lands located in a designated flood hazard area must be submitted to the Minister of Environment and Parks for approval.

Section 82 of the Land Title Act stipulates that the subdivision of lands is subject to approval by the provincial government. Under this provision, the Minister of Environment and Parks may designate floodplain areas, or approve subdivision within designated floodplain areas. Such approval normally requires covenants against the titles to all proposed parcels alerting owners to the flood hazard; prescribing building elevations, setbacks from water bodies, and slope treatment; and addressing the limits of public liability. Under this Act, the Minister of Environment and Parks also stipulates that all residential and commercial buildings on subdivided land be constructed no lower than the Flood Construction Level (FCL). The Flood Construction Level is defined as the designed flood level plus an additional vertical distance above the designated flood level (freeboard), to allow for wave run up, storm surges and other open water conditions, as a factor of safety (City of Vancouver 1987). The current standard FCL along the Fraser River in Vancouver is 3.5 meters Geodetic Datum or 102.9 feet Vancouver Datum. Both these datums translate to 7.9 feet above mean sea level.

Presently as part of a discussion paper entitled "Floodplain Management in British Columbia", the Ministry of Environment and Parks is in the process of developing floodplain management policies, programs and procedures under current legislation, on a province-wide basis and in full cooperation with the municipalities. As part of this discussion paper, the Ministry is proposing options for floodproofing standards based on the proposed use of the floodplain lands, and delegating subdivision authority to local approving officers. These discussions

are presently underway with the various municipal governments in the province, including the City of Vancouver.

4.4.2 Provincial Programs

The provincial government through the Ministry of Environment and Parks, Water Management Branch, is responsible for administering the Floodplain Development Control Program, the River Bank Protection Program, and the Major Dyking Program.

The Floodplain Development Control Program is similar to the Federal Flood Damage Reduction Program. The primary aim of the program is to reduce flood damage by encouraging municipalities to control the extent of floodplain development. The provincial program generally involves the identification of flood risk areas, floodplain mapping, designing and evaluating flood protection plans, reviewing the community plans and floodplain zoning by-laws, and supervising the implementation of structural adjustment measures (e.g. construction of a dyke). Most municipalities voluntarily request the Ministry of Environment and Parks' services because they do not have the technical expertise and financial capability necessary to design and implement a flood management plan. The discussion paper "Floodplain Management in British Columbia" as mentioned in the previous section, is a part of this program.

The River Bank Protection and the Major Dyking Programs are intended for river bank and dyking projects not covered by the Fraser River Flood Control Program. The funding arrangement provided under these programs is the provincial share, 75%, and local government, 25%.

4.5 CITY OF VANCOUVER

4.5.1 City Regulations

The City of Vancouver has the delegated authority under the Vancouver Charter (formerly the Vancouver Incorporation Act, 1921) to govern regulations involving the management of floodplain lands. The city currently relies principally on the Subdivisions By-law No. 5208 (Section 292(4) Vancouver Charter) and the Zoning and Development By-law No. 3575 (Section 565A(i) Vancouver Charter) to control development of the floodplain to reduce future flood damage.

The Subdivision By-law provides for subdivision approval subject to the registration of a covenant against the land title alerting the owner of the flood hazard, and that a prescribed level of earth fill for raising a building above the flood level (i.e. floodproofing) be placed on the subdivided land. This requirement was only recently approved by the Vancouver City Council to meet the Provincial Flood Construction Level of 102.9 Vancouver Datum (7.9 feet above sea level).

The Zoning and Development By-law provides for the approval of land use, building construction and occupancy, subject to standards regarding public safety, amenity, sanitation, water supply and drainage.

4.5.2 City Programs

Until recently, Vancouver's approach to flood management has been to place the responsibility of flood protection on the private property owner. As a result, most of the flood protection to date, especially in Southlands, is provided through privately financed and built dykes. In 1984, the city initiated a public program to develop floodplain policies for Southlands. This effort resulted in the adoption of floodproofing measures for new construction in 1986, and ongoing discussions toward the upgrading and maintenance of the existing dykes. The discussion about floodplain management in Vancouver will be the focus of a more detailed review in Chapter 5.

4.6 CONCLUSION

This chapter has presented the government regulations and programs that influence floodplain management decisions in the Province of British Columbia and the City of Vancouver. It is evident from this review that there is no clearly defined floodplain management program in place in the province, although a policy paper is presently in the developmental stages. This review also suggests that structural adjustment measures

(dyking and floodproofing), as represented by the various senior government programs, appear to be the preferred response to the flood hazard.

Many floodplain management decisions to date have followed an ad hoc approach, primarily consisting of negotiations between the provincial and the city government, and in certain cases, the federal government. These negotiations have determined the type of strategies required to resolve the problem, the procedures for evaluating and implementing the measures and the division of labour and necessary financing. The provincial government has assumed the responsibility for evaluating the engineering and economic feasibility of structural adjustments, while the local government has assumed the responsibility of acquiring the land or right-of-ways, as well as the ongoing enforcement and/or maintenance of the implemented measures. The financing of these measures has to a large extent depended upon several factors: responsibility of flood protection (public or private), type of flood adjustment measure, and the availability of senior government funding assistance and/or property owner support.

The next chapter will begin the examination of the development of floodplain policies in Vancouver's Southlands area.

CHAPTER 5

SOUTHLANDS: THE CASE STUDY

5.1 INTRODUCTION

This chapter introduces the study area, Southlands, in terms of its location and geography, flood hazard, history of flood management, and program to develop floodproofing measures.

5.2 LOCATION AND GEOGRAPHY

The Southlands study area is located in the southwest corner of the City of Vancouver, bounded by Angus Drive, the North Arm of the Fraser River, the University Endowment Lands, and South West Marine Drive (Fig. 1). The area is almost entirely in the Fraser River floodplain (Fig. 2). Southlands covers 1,286 acres with a population of 2500 residents (City of Vancouver 1987). It consists of four neighbourhoods including Musqueam Village (an Indian Reserve), West Southlands, Blenheim Flats, Angus Lands and S. W.Marine Drive (Escarpment) (Fig. 3). The area also contains five golf courses: Shaughnessy, Musqueam, Point Grey, McCleery and Marine Drive, totalling 470 acres (City of Vancouver 1987). This major land use demonstrates that Southlands serves a significant regional recreation role. Aside from golfing, Southlands is also an attraction for equestrian and cycling activities.

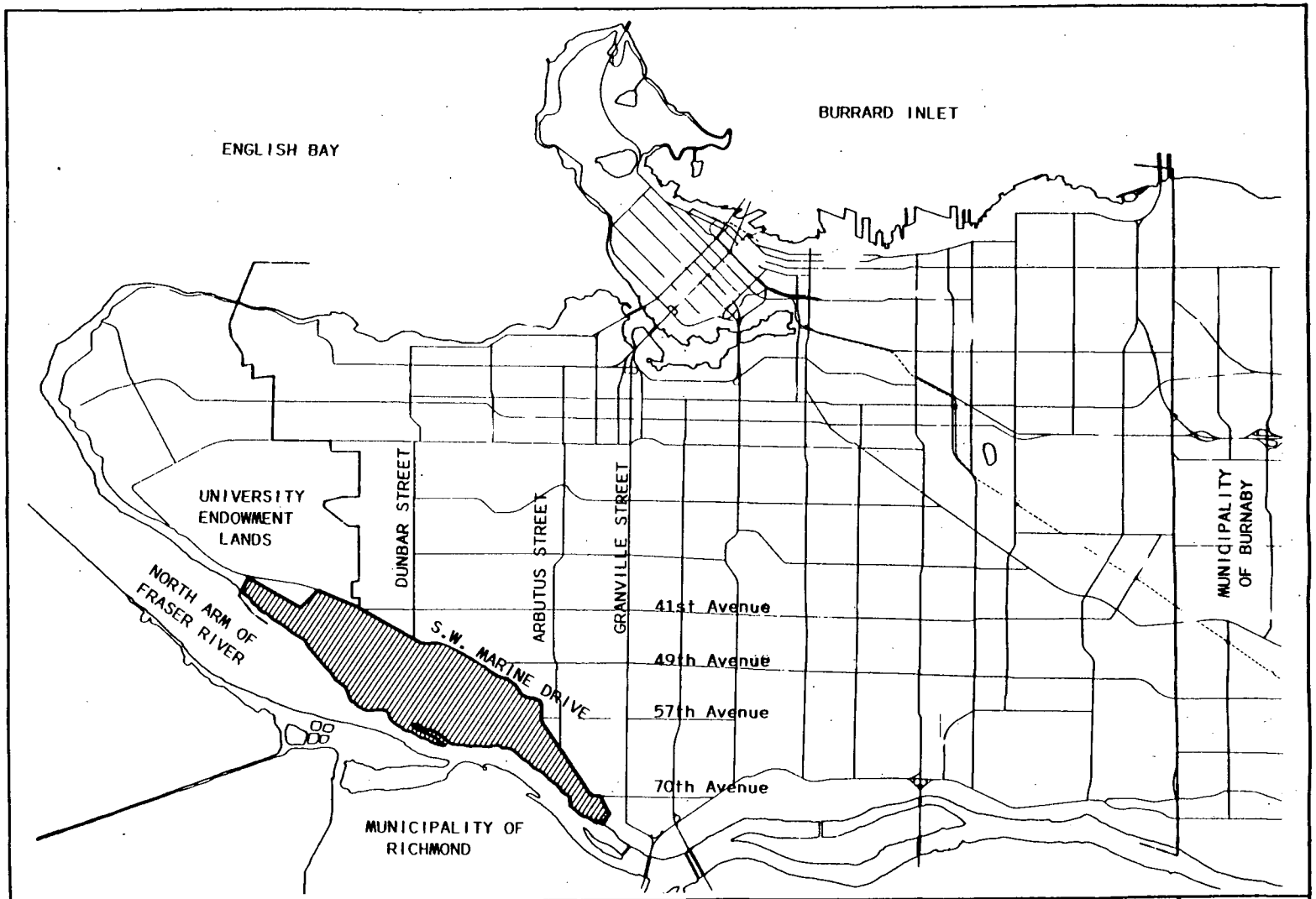

FIGURE 1: SOUTHLANDS LOCAL AREA

City of Vancouver Planning Department

Date	May, 1987
Drawn	I.G.Castle
Scale	
No.	

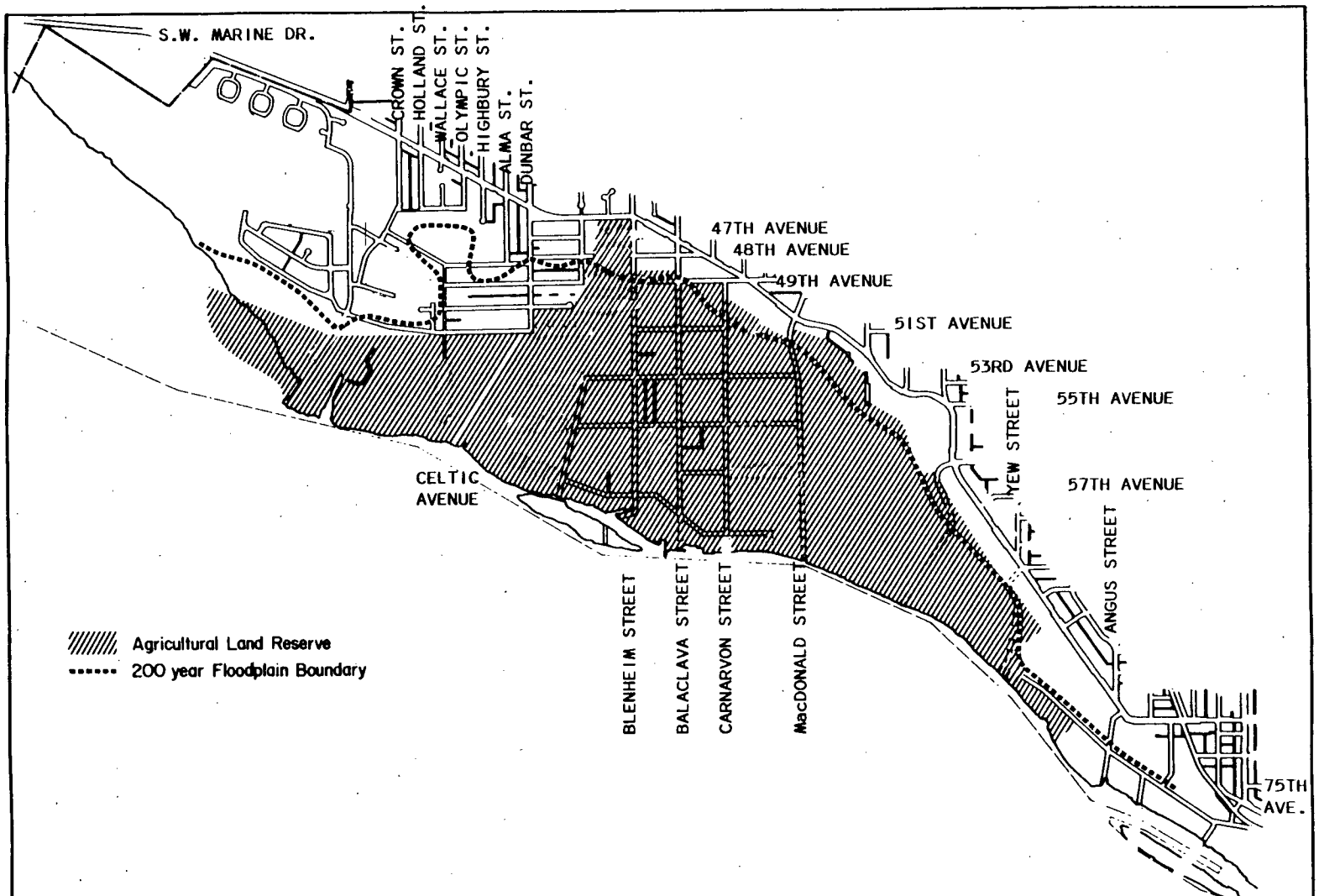

FIGURE 2: SOUTHLANDS: ALR AND FLOODPLAIN	Date May, 1987 Drawn I.G.Castle	↑
City of Vancouver Planning Department	Scale	No.

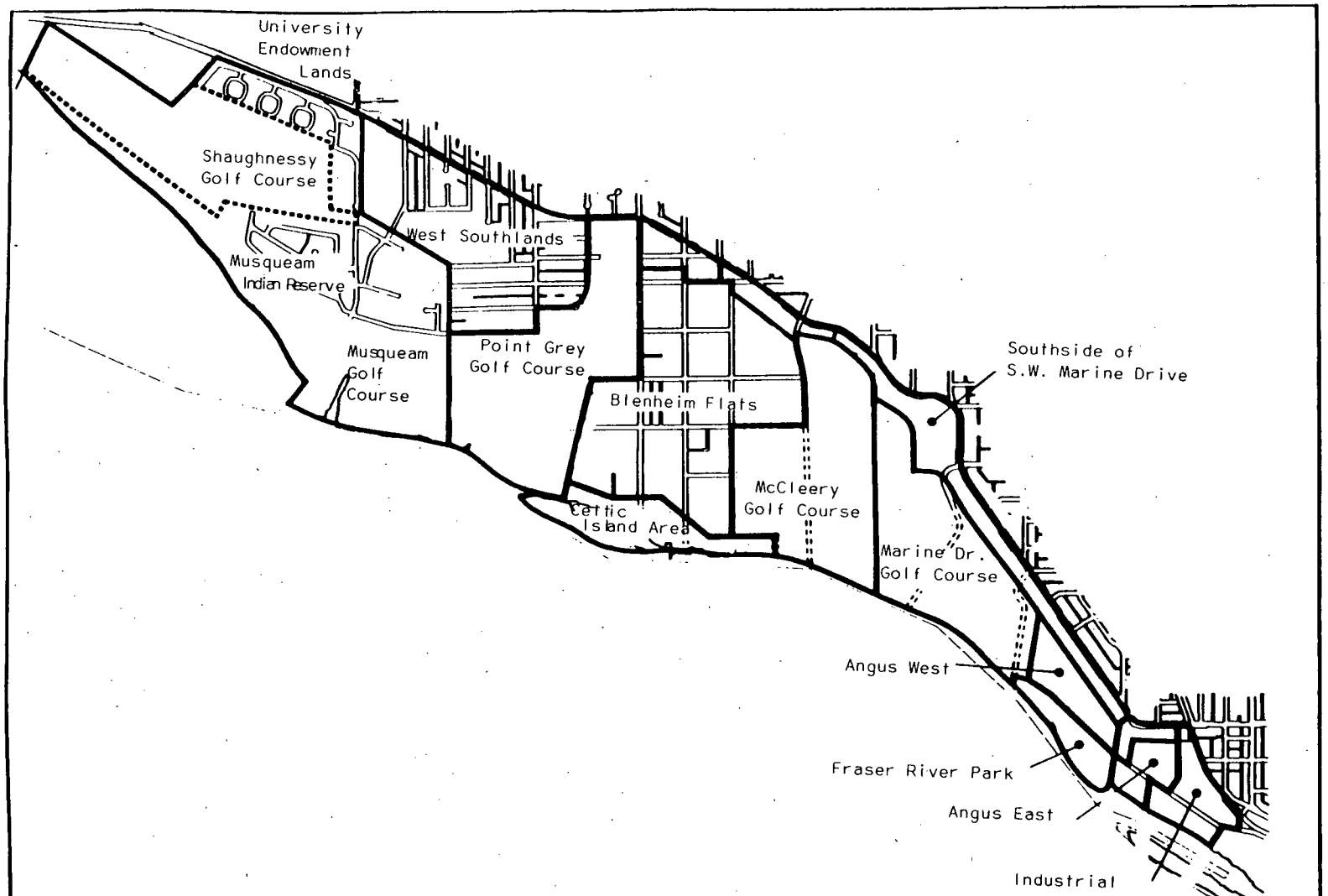

FIGURE 3: SOUTHLANDS SUB-AREAS

City of Vancouver Planning Department

Date	May, 1987
Drawn	I.G.Castle
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No.	

The RA-1 Zoning District Schedule introduced in 1956, maintains a minimum parcel size of 2.25 acres, and recognizes the area's predominant land uses which include golf courses, equestrian properties, and nurseries (Fig. 4) (City of Vancouver 1987). These uses are felt by city staff to be appropriate in a low-lying floodplain environment, which is not protected by a standard dyke nor serviced with a comprehensive sanitary and storm water sewer system. Although the Southlands floodplain has been predominantly used for agricultural activities and is still in the Provincial Agricultural Land Reserve (ALRT), it is becoming increasingly used for residential, recreational, and hobby farm activities. Today, there are approximately 160 homes on the floodplain lands (City of Vancouver 1986). The uniqueness of this semi-rural area within Vancouver has been maintained to date through a combination of local activism, the existing low-density zoning (RA-1), and the absence of standard city sewer services and road improvements. In recent years, however, the proximity of Southlands to downtown Vancouver has attracted increasing construction of single family dwellings, especially those that represent very significant building and land investments (eg. $500,000). The present assessed value of the properties (land plus improvements) in Southlands have been estimated to be about $100,000,000 (City of Vancouver 1986). The pressure for new residential development and increasing applications for rezoning encouraged the city to undertake a Local Area Planning Program to develop a comprehensive neighbourhood plan for the area. One of the priorities identified early in the planning program, was the need to establish floodplain policies to deal with the flood hazard.

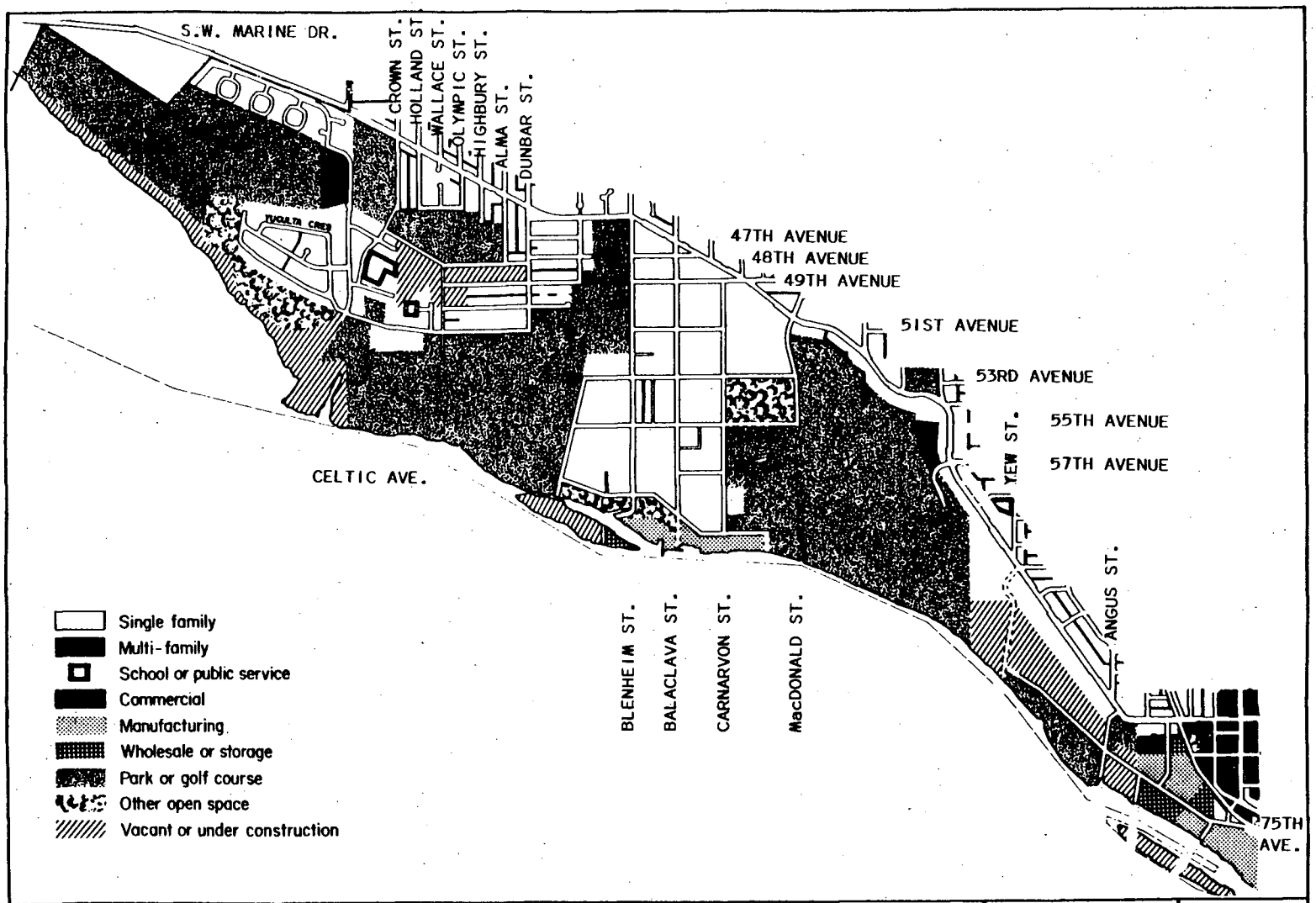


FIGURE 4: SOUTHLANDS LAND USE

City of Vancouver Planning Department

Date	May, 1987
Drawn	I.G.Castle
Scale	
No.	

5.3 THE FLOOD HAZARD

In Southlands, the major two sources of flooding are from high tides combined with winter storms, and intense rain runoff.

5.3.1 High Tides/Winds

Tidal effects combined with onshore winds, produce the major cause of high water levels and flooding in Southlands. Historically, the flooding problems occur in the months of November-December, when the tides from the Georgia Strait influence the water levels of the Lower Fraser River (Ministry of Environment and Parks 1987). Although spring freshet has not been a major source of flooding in Southlands, it may cause flooding if combined with high tides, and winds. It should also be noted that high tides, or winds alone have not resulted in flooding to date.

In the Southlands area, the normal recorded high tide level is approximately at an elevation of 98 feet (Vancouver City Datum) or 3 feet above the mean sea level. Unusually high tide levels have been recorded in 1948, 1951, 1967, 1968, 1972, and 1982 (City of Vancouver 1986). The greatest Fraser River flood recorded in the past century occurred in 1894 as a result of a spring freshet (Simmons 1980). The water levels reached an elevation of 102 feet (Vancouver City Datum) or 7 feet above the mean sea level. Flooding of the Musqueam Indian Reserve in 1951 prompted construction of the Wallace Street dyke

to protect Southlands from flooding (City of Vancouver 1987). The 1951 flood, like those of 1967, 1968 and 1972, were caused by a combination of winter storms and high tides. The last major storm surge occurred on December 16, 1982 when water levels reached an elevation of 101 feet (Vancouver City Datum) or 6 feet above the mean sea level, resulting in the water overtopping the existing dikes in some areas of Southlands inundating lower areas (City of Vancouver 1986). Because the large tracts of land remained either undeveloped or have accessory buildings utilized solely for equestrian and agricultural purposes, only minor property damage resulted from the 1982 flood.

5.3.2 Runoff

Potential flooding due to rainfall and runoff, although more frequent, is less severe than potential flooding from the storm surges and high tides. However, the water level, as a result of rain runoff, has been known to rise up to 98 feet (Vancouver City Datum) equal to the normal high tide level, but 3 feet above the existing street elevation (City of Vancouver 1986). Presently, storm drainage in the area is provided by a system of open ditches and culverts which discharge the rain runoff through flood gates to the Fraser River. However, the discharge of water from the area becomes a problem when the river level reaches, and exceeds the water level in the ditches. The existing drainage system (including pumps and flood gates) has proven not to function properly during 1967 and 1982, when the combination of rainfall, wind, and high tide has resulted in minor flooding of the area.

5.3.3 Environmental Factor - Flooding Probability

While high tide levels are continually monitored by Environment Canada and the Provincial Ministry of Environment and Parks and can be predicted years in advance, there is limited short and long term certainty in forecasting weather disturbances that can create potential flood conditions. This situation was very evident during January 1987, when the alignment of the moon and sun (called a proxige) created a high tide alert in Southlands and along the southwest coast, that would have resulted in extensive flooding if combined with heavy winds and rainfall. Although the tides were as high as predicted, a flood did not occur in Southlands because of the relatively calm weather conditions.

Environment Canada and the Provincial Ministry of Environment and Parks estimate that flooding can occur in Southlands, equivalent to a 1894 flood level or greater, once every sixty years. This flood level which is 102 feet (Vancouver City Datum) has been approached or exceeded six times since 1894 on the Fraser River (Fraser River Estuary Study 1978). This estimate of potential flooding by the senior governments has been primarily based on the 1985 Transport Canada Sea Island Dykes Report (Ministry of Environment and Parks 1987). The report confirms that there is a high probability that storm surges combined with high tides and rainfall can cause serious flooding at the mouth of the Fraser River. The report presents statistical data on the high tide levels and storm surge cycles, which the Ministry of Environment and Parks has reviewed and as a result established the present Provincial Flood

Construction Level of 102.9 (Vancouver Datum). The report also suggests that it would be desirable in the future to prepare a more detailed and refined analysis of the flood risk in the area. Added to this concern has been the potential impact of an earthquake on the existing agricultural dykes as increasing flood risk in the area..

5.4 HISTORY OF FLOOD MANAGEMENT TO 1984

5.4.1 Early Responses to the Flood Hazard

The first settlers in Southlands were the McCleery family who came to the area in 1862 to farm the meadows where the golf course now bearing their name is located (Park Board 1982). In 1894, the first major recorded flood occurred. Damage estimates for this flood in Southlands are lacking, but losses would have been comparatively small and local in nature. Subsequent flooding was tolerated by the Southlands residents due to the agricultural use of the lowlands. However, during the 1920s and 1930s, they did begin to construct agricultural dikes along parts of the North Arm of the Fraser River to limit the flooding frequency. Those dykes were of varying quality and subject to frequent failure and seepage. Nevertheless the early structural response to the flood hazard set a pattern of flood adjustment that would be repeated in future years.

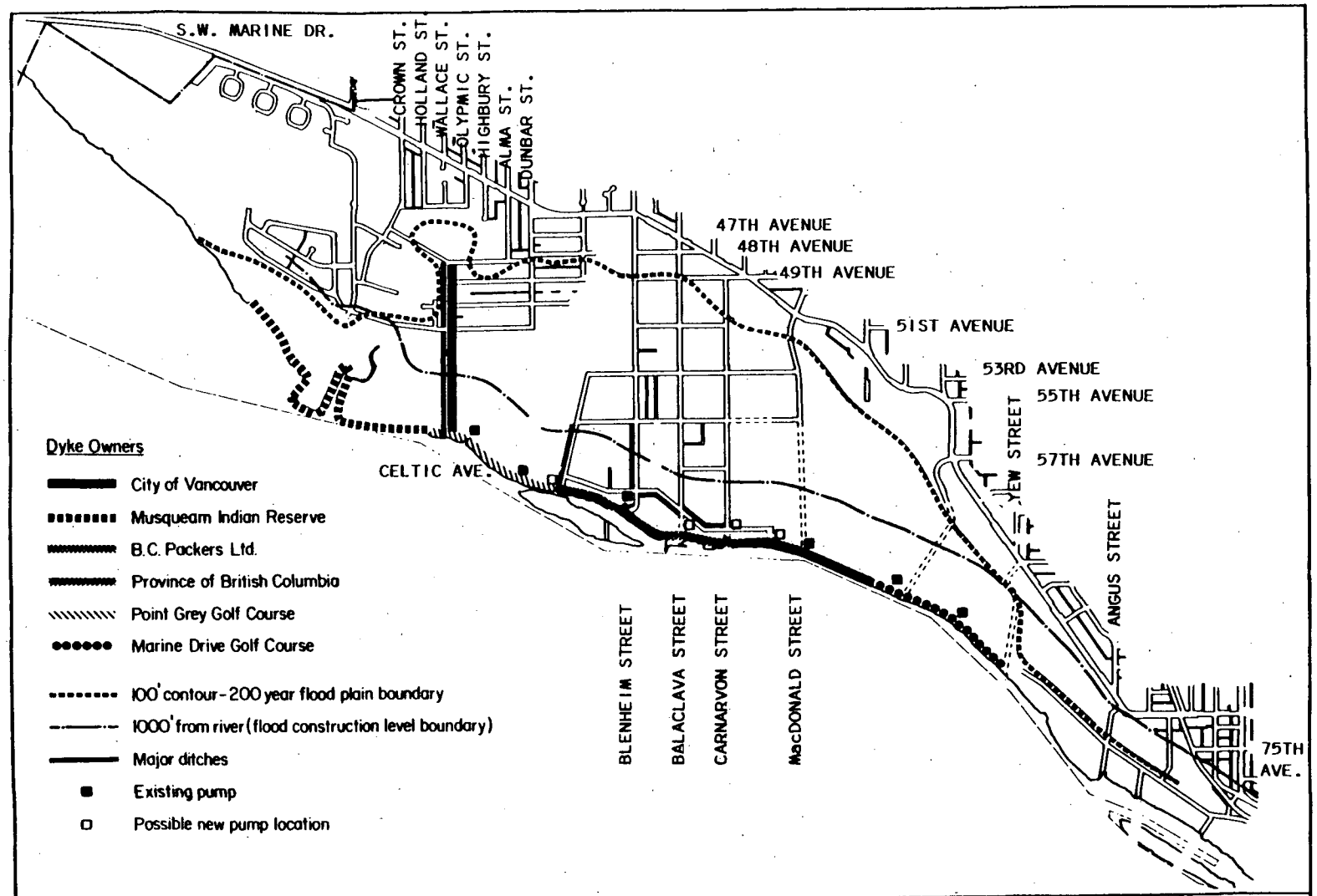


FIGURE 5: OWNERSHIP OF THE DYKES IN SOUTHLANDS

City of Vancouver Planning Department

Date	June, 1987
Drawn	I.G.Castle
Scale	
No.	

5.4.2 The 1948 Flood

In 1948, with increasing residential use of the lowlands coupled with a forecast of a major river flood, speedy construction of most of the existing 3.5 kilometre dike system was initiated (City of Vancouver 1987). Because the agricultural dykes were primarily built by private property owners (Fig. 5), they varied in construction standards and heights. As a result, the present dyke system over much of its length does not meet current provincial government design for height or river slope protection. The 1948 flood level was recorded, at the then Fraser Street Bridge, at 98.23 feet (Vancouver City Datum) or 3 feet above mean sea level. Although a part of the flood surge led to extensive flooding up river, when the spring runoff finally reached the mouth of the Fraser River only nominal flooding occurred in the Southlands area, as the dikes provided protection.

The 1948 flood experience moved the city to adopt a policy that placed the responsibility for flood protection and maintenance of dykes on the private property owners. City involvement in flood protection measures would only occur on city property (ie. street ends).

5.4.3 1965 Landfilling (Floodproofing) Policy

In 1965, the Vancouver City Council established two landfilling policies to guide development in the Southlands floodplain. These were:

- "Where the ground level is below 100 feet a building permit will not be issued unless the ground around the dwelling is at least one foot above the level of the adjoining street."

- "To protect the amenity of the low-lying area, and at the same time not to deny adequate flood protection, the maximum height of filling will be limited to the elevation of 100 feet city datum." (Cooper 1985)

While these policies did meet the Provincial Flood Construction Level in 1965, they did not set minimum filling standards or floor elevations to provide adequate flood protection for homes. In fact, the 1965 Council policy prohibited land filling above an elevation of 100 foot (Vancouver City Datum). This policy was to become an obstacle to new home builders in the 1980s, who tried unsuccessfully to raise the houses through filling above the one foot requirement to reduce the risk of future flood damage. The policies were not amended until 1986, resulting in most of the homes in Southlands being built at one or two feet above the mean sea level. The maps on Figures 6 and 7 show the elevation of the roads and the first floors of houses (in feet) in the West Southlands and Blenheim Flats areas of Southlands.

5.4.4 1972 Waterfront Walkway and Dyking Study

In 1972, a study was initiated by the Engineering Department to review

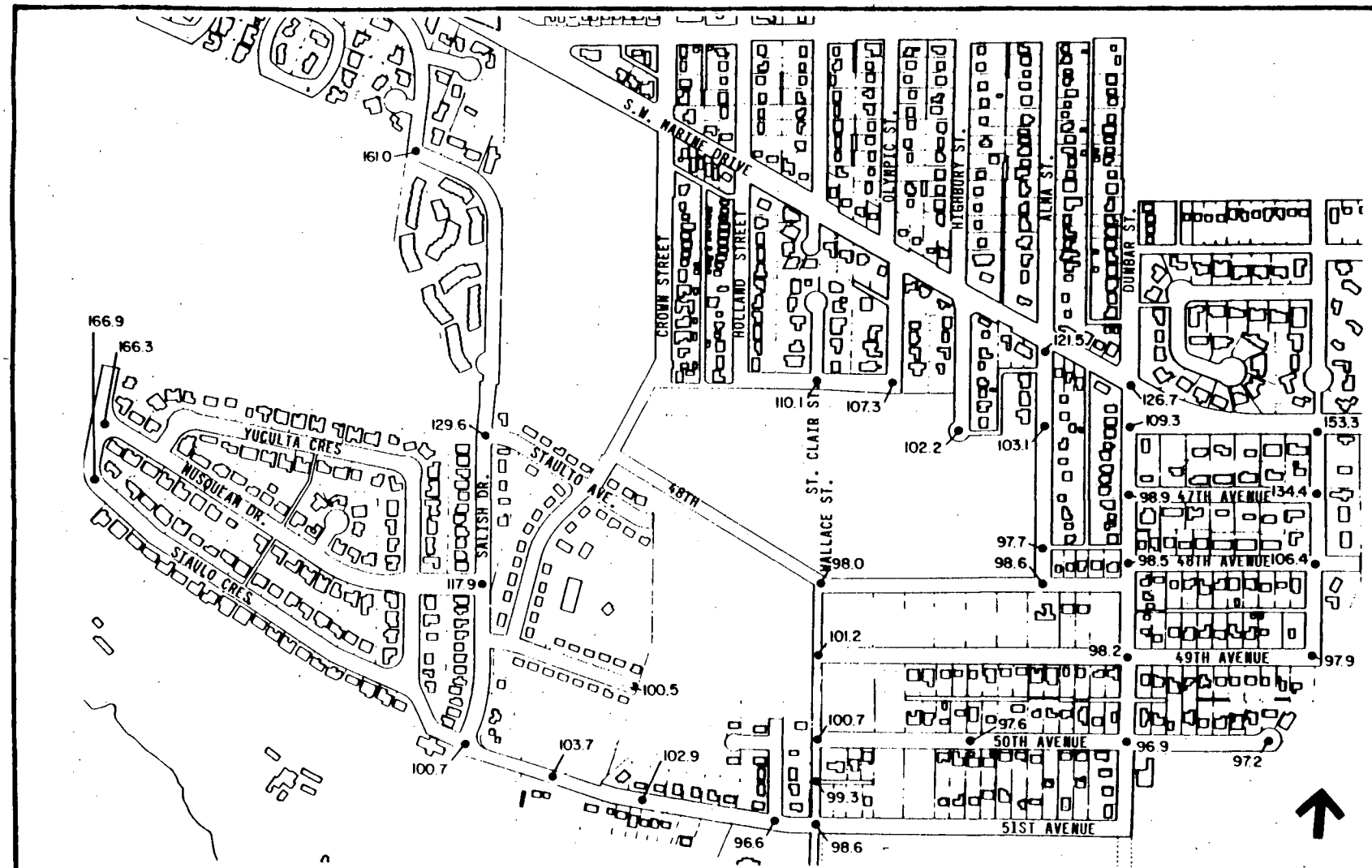


FIGURE 6: STREET ELEVATIONS WEST SOUTHLANDS (ELEVATIONS IN FEET)

City of Vancouver Planning Department

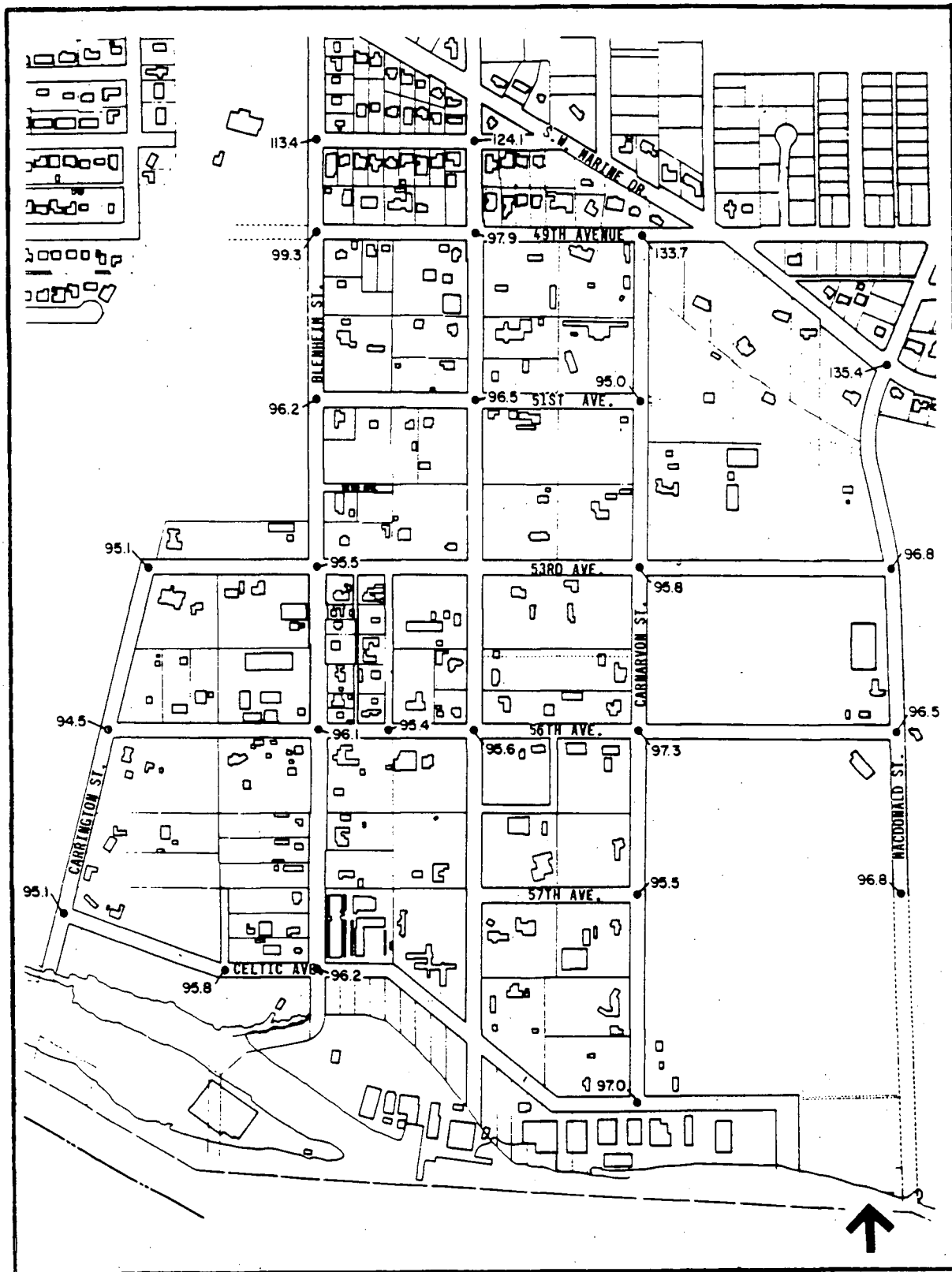


FIGURE 7: STREET ELEVATIONS BLENHEIM FLATS
(ELEVATIONS IN FEET)

City of Vancouver Planning Department

means of providing land for a waterfront walkway along the north shore of the Fraser River, west of Angus Drive (City of Vancouver 1972). As part of this review, the city's existing flood protection policy was examined, as was the implication of participating in the 1968 Federal-Provincial Cost-Sharing Program for dyking improvements. The Program provided funding assistance for the construction and improvement of surface drainage works and dyking. The precise cost sharing depended upon the type of work being done, but the municipal share of costs was estimated at 10%. However, a condition of the cost-sharing was that the municipality must obtain access to dykes and carry out all dyking maintenance after construction. The Engineering Department concluded that costs to the city for dyke maintenance would increase substantially (estimated between $20,000 to $30,000 per year), as would its share of dyke construction costs (estimated at about $100,000), plus unspecified costs associated with obtaining access to dykes in the industrial zoned lands (City of Vancouver 1972).

Although other municipalities in the region, such as Richmond, agreed to participate in the program, the City of Vancouver did not. The city's decision was based on the belief that its existing dyking policy provided adequate protection against flooding, and that there was no need for further city investment in flood protection measures. City officials also felt that a change in dyking policy to take advantage of senior government cost-sharing would increase maintenance costs and could place the city in a position of being liable for future flood damage.

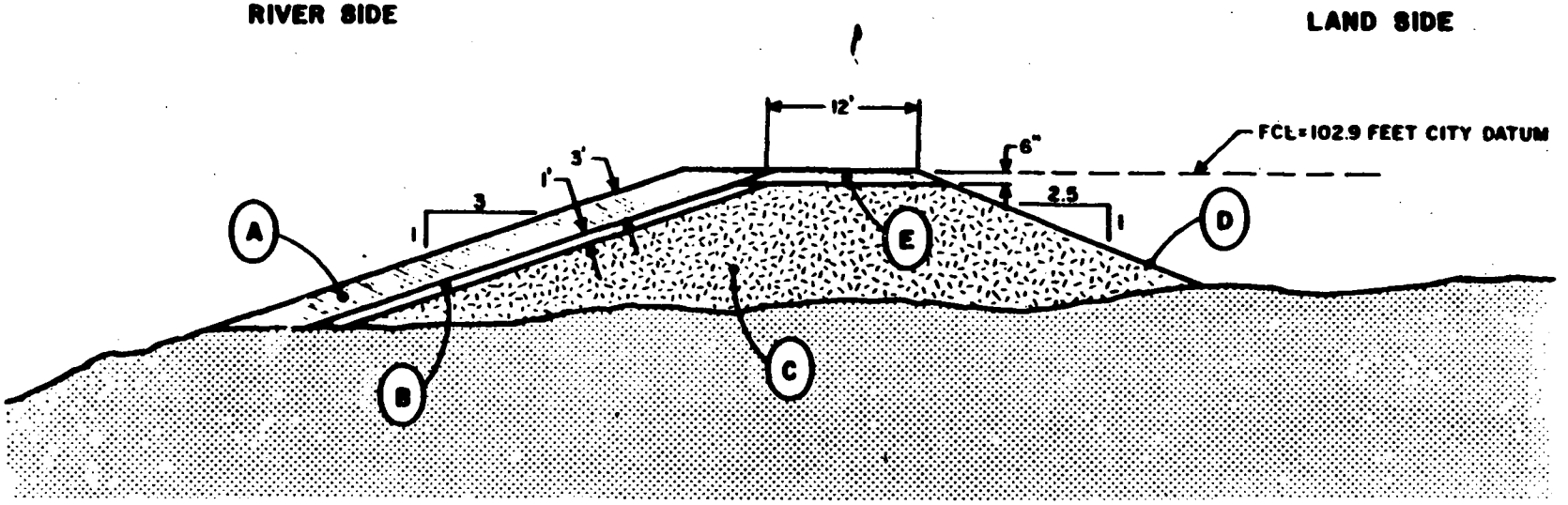
The 1972 decision reaffirmed Vancouver's existing dyking policy. First, that private property owners are responsible for the construction and maintenance of their dykes to protect themselves against flooding; and second, that the city only maintains dykes on city property. Under this policy, the city assumed no responsibility for the soundness of the private dykes.

5.4.5 1974 Provincial Floodproofing Policy

In 1974, the provincial government began a policy of floodplain management designed to reduce flood damage. The Land Titles Act was revised to require all subdividers to comply with their policy:

"82.(1) Where land within a plan of subdivision is subject, or could be reasonably be expected to be subject to flooding, no approving officer shall approve the subdivision without the prior consent of the Deputy Minister of Environment and Parks who may require, as a condition of his consent, that the subdivider enter into such covenants registrable under Section 215 as the Deputy Minister considers advisable" (City of Vancouver Technical Report on Flood Protection in Southlands 1986).

The provincial policy required that subdivisions of land be floodproofed to the "Flood Construction Level" whether or not the land is protected by a "Standard Dyke". The Flood Construction Level is defined as " the flood level which has a statistical frequency of occurrence of once every 200 years plus an allowance for freeboard [normally 0.6 metres (2 feet)] and is used to establish the elevation of the underside of a



A	RIP RAP
B	FILTER
C	FILL
D	TOPSOIL AND SEEDING
E	CRUSHED ROAD SURFACING

CITY OF VANCOUVER ENGINEERING DEPARTMENT	
FIGURE 8: IMPROVED DYKE	
SOUTHLANDS FLOODPROOFING STUDY	
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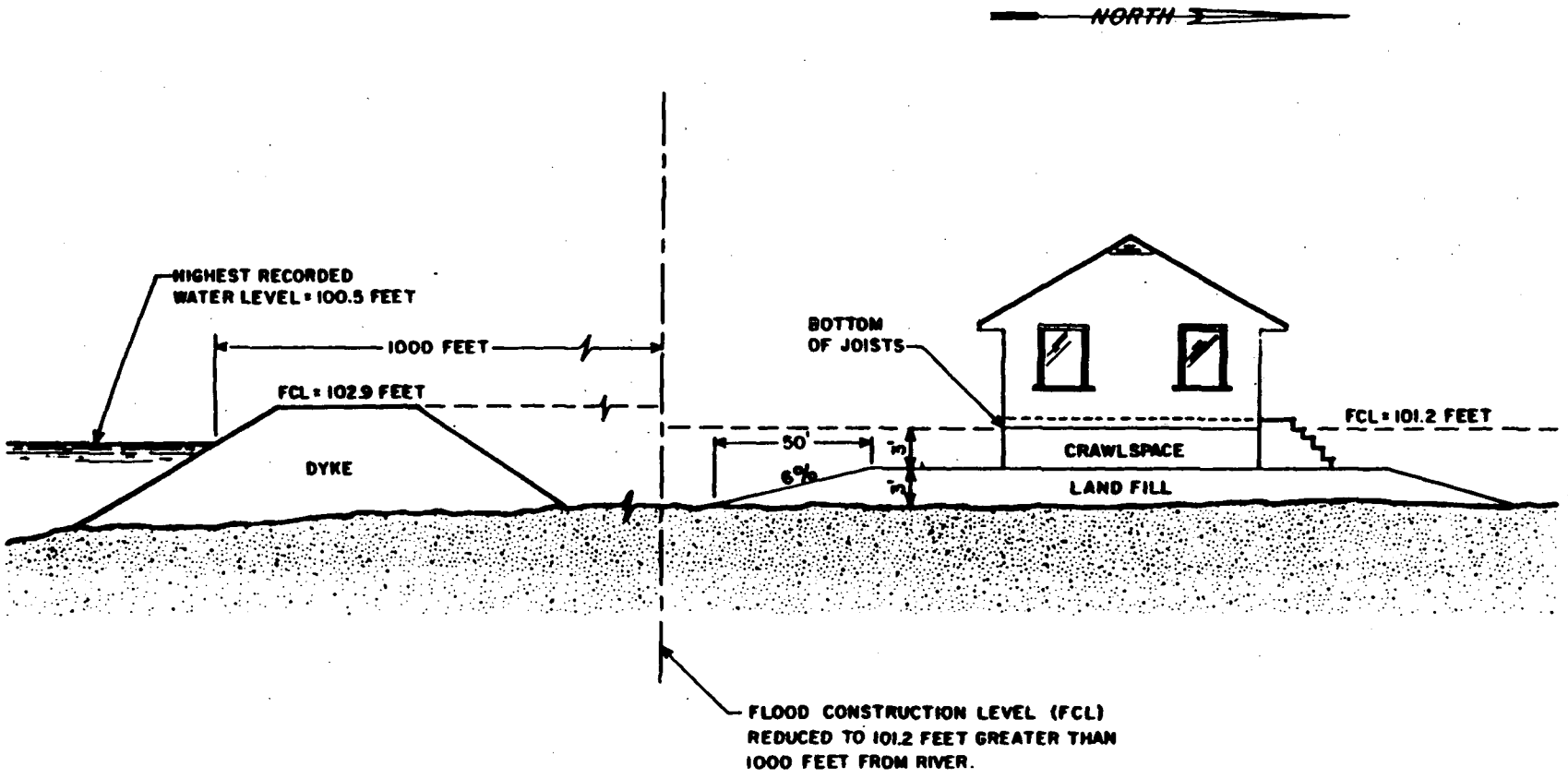

CITY OF VANCOUVER ENGINEERING DEPARTMENT
FIGURE 9: PROPOSED FLOODPROOFING
SOUTHLANDS FLOODPROOFING STUDY

wooden floor system or top of concrete or asphalt pad upon which a mobile home or unit rests" (City of Vancouver Southlands Floodproofing and Servicing Study 1986). A Standard Dyke is defined as "those built to a minimum elevation equal to the Flood Construction Level and meeting standards of design and construction approved by the Ministry of Environment and Parks and maintained by an ongoing authority such as a local government body" (City of Vancouver Southlands Floodproofing and Servicing Study 1986). Figures 8 and 9 show these regulations in diagram form.

The Provincial Flood Construction Level for the Southlands area is 102.9 feet (Vancouver City Datum) or 7.9 feet above mean sea level (City of Vancouver 1986). This level can be reduced to 100.4 feet (Vancouver City Datum) or 5.4 feet above the floodplain at a distance greater than 1000 feet from the river (City of Vancouver 1986). With dykes built to less than the Provincial Flood Construction Level (or 200 year flood standard), no basements, living areas, and electrical and heating systems can be located below the minimum floor level (Cooper 1985). With dykes built to the 200 year flood standard, only an unfinished basement, carport and entrance can be located below the minimum floor level. Implementation of the provincial standard in Southlands would in some cases result in new homes being built up to six feet higher than a neighbour's house.

The standards outlined above have, however, varied since implementation of the new policy in 1974 (Cooper 1985). Until 1978, no land fill requirements were placed on the subdivider. Between 1978 and 1982

the province required all properties in Southlands to be filled to 102.2 feet (Vancouver City Datum) without regard to whether or not they were within 1000 feet of the river. Since 1982, the province has allowed a lower fill standard for properties more than 1000 feet from the river. Finally in 1985, the Provincial Flood Construction Level was raised from its previous level of 102.2 feet (Vancouver City Datum) to 102.9 within 1000 feet (300 metres) from the natural river boundary, and 101.2 beyond the 1000 feet threshold (City of Vancouver 1986).

Exceptions to the provincial policy are areas that were designated Established Urban in the province's 1966 Official Regional Plan and protected by Ministry of Environment and Parks standard dykes (as of August 29, 1966) (City of Vancouver 1986). The West Southlands is one such area where, because of its Established Urban designation, houses could be constructed below the Flood Construction Level provided that a standard dyke is in place.

Either through oversight or lack of interest in flood protection, the city ignored the provincial policies on flood protection for many years. It was not until 1984 that the city's Director of Legal Services noted "there is a potential for liability to be found by a court where it might find the City Engineer was negligent in setting a particular standard be it above or below the provincial datum" (City of Vancouver Inter-Departmental Memo 1984). Currently, no standard dyke exists in Southlands, therefore, construction on all newly subdivided lands must meet provincial floodproofing standards regardless of any prior Official Regional Plan designation.

5.4.7 The Liability of the City of Vancouver

City officials quickly realized that buildings on properties in existence prior to 1966 were constructed below the provincially established flood level with the city's approval. Since two differing standards existed, the question of which standard is appropriate could be relevant in terms of liability should loss or damage result from flooding. Even where the standards do not directly conflict, the existence of the tougher provincial standard may cast doubt on the appropriateness of the city standard. Furthermore, the City of Vancouver did not at the time regulate the building level with respect to flood hazards. This, the city officials felt, needed to be rectified.

5.5 SOUTHLANDS FLOODPLAIN MANAGEMENT

Accordingly, the Engineering Department in 1983 initiated a review of its policies to establish safe floodproofing levels for new construction in floodplains. Until this time, the City of Vancouver had not paid much attention to the question of flood hazard or to the management of floodplain lands. Many city officials felt that flooding was a serious problem in other Lower Fraser Valley municipalities, but not in Vancouver. This attitude was apparently based on poor information and knowledge about the issue, which was fueled by the history of minimal property damage as a result of flooding. A good example reflecting this attitude is a recent statement from the city's Emergency Program Officer, who indicated that there are no floodplain lands within the City of Vancouver, nor is there any chance that flooding will ever occur

(telephone conversation March 10,1987). This indicates that studies since 1983 have not permeated the city administration, despite intensive action over the past few years.

5.5.1 The Beginning

Starting in 1983, the Engineering Department in its draft reports proposed land filling and floodproofing options as the most effective means to deal with flood problems in the city, including adoption of the Provincial Flood Construction Level. The department wanted to present these recommendations directly for City Council consideration with little or no public consultation.

The Planning Department felt that as these measures represented major changes to existing city policy, there needed to be discussion with the affected Southlands residents prior to any consideration and adoption by City Council. These differences in departmental decision-making approaches led to two years of extensive discussion and debate, and more draft reports. The Planning and Engineering Department inter-office correspondence also indicate that the lack of expertise and understanding about floodplain matters was an added factor in prolonging this inter-departmental debate before a final approach was finally agreed upon.

5.5.2 Southlands Local Area Planning

On May 29, 1984, in response to numerous development enquiries and community objection, City Council approved a Local Area Planning Program (LAP) in Southlands to prepare a comprehensive neighbourhood plan, covering such topics as land use, zoning, open space development, and equestrian activities (City of Vancouver 1984). This plan was to be undertaken in consultation with local residents, through the formation of a local area citizens advisory committee (Southlands Citizens Planning Committee). After further departmental discussions about floodproofing, it was decided that this issue should also be resolved as part of the Southlands planning process.

The Southlands LAP Program's approach to flood hazard represented two basic flood adjustment responses: floodproofing and dyking. The Engineering Department supported floodproofing because the option was particularly close to the land filling policy, which the city had adopted in 1965 and implemented in several areas facing flooding problems. They felt that this was the only viable means of eliminating the flood problem once and for all. The dyking option, on the other hand, represented an approach which the city had for years tried to ignore, and had been successful. The Engineering staff believed that if the city took on the responsibility of upgrading and maintaining the dykes in Southlands, the city acknowledged flood risk and would be potentially liable if property damage and personal injury occurred as a result of flooding.

Although the Planning Department relied extensively upon the technical expertise of the Engineering Department to respond to the flooding issue in Southlands, they were not convinced that the floodproofing approach should be the only adjustment measure considered to reduce the flood threat. The planning staff believed that considering only the floodproofing response placed the 160 existing homes at risk to flooding. The department also recommended that upgrading of the existing dykes should also be considered as part of the city's floodplain management strategy to reduce the flood threat in Southlands.

The neighbourhood residents who had lobbied the city for years for dyking improvements, believed that the dyking approach represented the most efficient and effective way to provide flood protection for both existing and new homes. A majority of the residents were opposed to floodproofing, because the approach represented a piecemeal solution to the flooding problem, and only resolved the city's liability issue. To the surprise of no one involved in the Southlands LAP, these two structural measures were to encompass the city's approach to flood management in Southlands and in the city as a whole. As no other alternative flood adjustment responses to flood hazard were to be presented or discussed, questions can be raised as to the adequacy of public information and education provided as part of the Southlands local area planning process.

5.5.3 The Floodplain Management Program

The formal decision-making process to review and formulate flood protection measures for Southlands involved the creation of a Task Force on Floodproofing made up of community and city representatives (Planning and Engineering staff), under the auspices of the Southlands Citizens Planning Committee (SCPC) (SCPC Minutes of July 31, 1985). Terms of reference were adopted that included:

- the Engineering Department's concerns relating to flood problems, and their solutions (Appendix A); and

- the Task Force's non-engineering agenda in floodplain management, consisting of information on the preservation of the area's character, environmental impacts on wildlife and vegetation, and responding to the Engineering Department's floodplain study findings (Appendix B).

Between July, 1985 and April, 1986, regular meetings were held with progress reported at each Southlands Citizens Planning Committee meeting. The Task Force presented findings on dyke ownership, history of drainage and flooding problems, existing building and street elevations, and the present provincial floodplain regulations (SCPC Minutes of September 25, 1985). Representatives from various senior government agencies and private consulting companies attended Task Force meetings and forums on such topics, as: storm water discharge; floodproofing; sanitary sewers; and dyking (SCPC Committee Minutes of

October 9 and November 6, 1985). They also discussed the causes and probability of flooding in Southlands, the condition of existing dykes, and possible sources of funding assistance for dyking improvements (eg. Fraser River Flood Control Program).

In early 1986, the Engineering Department presented their draft findings to the Southlands Citizens Planning Committee (SCPC Minutes of February 19, 1986). Their report recommended that the city should proceed with implementation of new floodproofing requirements to meet the new Provincial Flood Construction Level. On the subject of dyke improvements, the Engineering Department recommended to undertake further study to assess costs and options for improving the dykes all along Southlands.

The Southlands Citizens' Planning Committee disagreed with the Engineering Department's recommendations noting "that dykes should be sufficient to protect the entire area without requiring filling" (Committee Minutes of March 19, 1986). They were concerned that there would be no protection for the existing 160 residential houses on the floodplain. They felt that the dyking option provided better long term protection for all the residential houses in the area, instead of flood protection for newly constructed homes. In response, the Southlands Citizens Planning Committee adopted the following motions:

"The Engineering Department accept the premise that dykes and pumps are adequate floodproofing measures"; and

"The SCPC urge the Engineering Department to take urgent consideration of the matter of dyking and pumping and not rely on the good will of those who have pumps on their property."

However, the citizen's committee chose not to voice its objections to the Engineering Department's recommendations too strongly at City Council, in the hope that further consideration will be given to improving the dykes in Southlands in the foreseeable future.

On April 17, 1986, City Council approved standards for floodproofing of residential structures in Southlands (City of Vancouver 1987). The method recommended by the City Engineer involves a combination of fill and structural means to elevate habitable areas of dwelling units to the Provincial Flood Construction Levels. These recommendations regarding floodproofing in Southlands, are attached as Appendix C. City Council also instructed staff to further investigate and report back on the possibility of upgrading the existing dyking system in Southlands.

In the following year, after further discussion and debate between the various city departments and the community on the topic of dyking, the City Engineer reported back recommending that City Council could either:

- reaffirm the city's existing policy of leaving the responsibility with the property owners to maintain their dykes; or

- support the upgrading of all Southlands dykes, subject to funding assistance from the existing senior government dyking programs.

City Council on April 28, 1987, chose to approve in "principle a comprehensive dyking program for Southlands area only, subject to obtaining senior government sharing and property owner approval for a local improvement such that the total city cost does not exceed $425,000 for capital expenditure" (City of Vancouver 1987). This shift in city policy on dyking was facilitated by the Director of Planning and the community who were interested in investigating whether senior government funding assistance was still available for improving the dykes in Southlands. These recommendations, which are presently being investigated by city staff for a report back to Council in 1988, are attached as Appendix D.

5.6 CONCLUSION

Southlands is a narrow strip of land located along the North Arm of the Fraser River in Vancouver, between the University Endowment Lands and Angus Drive. Most of the area is located in the Fraser River floodplain, which contains approximately 160 houses. The record since 1894 shows that the Southlands area is at risk from flooding. The principal source of flooding is from high tides combined with winds and rain runoff. As a consequence, the area residents have over the years financed and built most of the dykes to meet and reduce this flood threat. The city has built dykes only on the street-ends. Although the environmental departments of senior governments have estimated that Southlands is susceptible to serious flooding, serious flood damage has been avoided because of the area's low residential density.

For years the City of Vancouver regarded flood protection in Southlands as adequate considering the low density agricultural nature of the area and the available evidence that indicated a relatively low risk of flooding. In the last decade, two factors emerged that stimulated city action to protect the area from flooding. One factor was the increasing residential investment in the area, which could be at risk to serious flooding. The other factor was the increasing technical knowledge of the flood risks and the current interest from the area residents to upgrade present standards for flood protection. Added to these factors was the city's concern about potential liability, if it did not act to meet the provincial government's floodplain standards.

Through the Southlands local area planning process, the city developed and adopted floodproofing measures for new construction and undertook further evaluations regarding the financing and improvement of the existing dykes. The flood adjustment measures that were considered were limited to floodproofing and dyking. The city's approach, as outlined in this chapter, raises as we shall see, certain questions as to the quality and distribution of information provided to increase public knowledge about either the flood hazard or alternative flood adjustment measures.

The recent decisions made in Southlands combined with an ongoing planning process provide a rare opportunity to examine the quality and distribution of information and education provided as part of the decision-making process and its impact on the floodplain management decisions. Chapters 6 and 7 make use of interviews of decision-makers

and a questionnaire administered to residents to establish the participants' understanding of the flood hazard and the alternative measures to deal with that hazard. Chapter 8 draws conclusions about appropriate approaches which would improve upon the system used in Southlands.

CHAPTER 6

FLOOD-RELATED PERCEPTIONS OF GOVERNMENT OFFICIALS

6.1 INTRODUCTION

This chapter presents the perceptions of government officials that were involved in the floodplain management decisions affecting Southlands and is based on interviews conducted during 1987.

6.2 BACKGROUND

The floodplain management decisions that have recently been made in Southlands provide a rare opportunity to examine the perceptions of government officials and to evaluate the impact of these perceptions on the information which was provided as part of the decision-making process. The literature review established the important role played by government officials in determining the extent to which hazard information programs successfully change the awareness of risk, the range and effectiveness of hazard adjustment measures, and the communication with other government agencies. This chapter describes the perceptions of the key government employees who developed, implemented, and influenced the Southlands hazard advisory information program. By examining these perceptions, it is possible to understand some of the reasons behind the recent policy decisions in Southlands and to recommend approaches that would improve the effectiveness of other hazard advisory programs.

The subsequent chapter takes the next logical step by examining the flood-related perceptions of the floodplain residents in Southlands, including those involved in the Southlands Local Area Planning Program. From the study of government and public perceptions, an evaluation of the Southlands approach is presented in Chapter 8.

6.3 METHODOLOGY

An unstructured interview format was used to examine the flood-related perceptions of government officials. Ten professional planners and engineers representing senior positions in the three levels of government (two federal officials, four provincial officials, and four city officials) were selected in consultation with the Southlands Local Area Planner as having played key roles in affecting floodplain management decisions in Southlands. The identified candidates were invited by letter to participate in the survey (Appendix E) and all agreed to be interviewed.

Although senior government officials are the most removed from the day-to-day flood management decisions at the municipal level, the division of powers and responsibilities under the Canadian Constitution allows senior governments to play an important information and advisory role in the development of local floodplain policies. It is with this in mind that the identified senior government officials were included in the survey. It should be noted that all the survey participants, including those representing the city, have work responsibilities that

include issues other than floodplain management and/or geographic areas other than Southlands. They are however the key individuals in the government organizations addressing floodplain management in Southlands.

The topics covered in the interviews included flood hazard, flood adjustment measures, quality of information, and method of information distribution. The interviews were undertaken during the months of February and March, 1987. Each interview followed a general discussion format that focused on the specific topic areas listed in the questionnaire. The same questions were presented to each participant in the same order. In some cases, the officials were encouraged to elaborate further on their thoughts regarding a topic. At no time in the interviews were the names of the other participating government officials mentioned.

6.4 PRESENTATION OF INTERVIEW RESULTS

The interviews made it clear that the level of government represented by the officials was a more important determinant of flood-related perceptions than the specific agency or department. The results presented below emphasize this general finding and maintain the confidentiality of the individual respondents by highlighting the areas where perceptions differed only between levels of government. It should be noted that the government officials' responses to the various topics represent their views at the time of the survey. These responses are presented in summary form and incorporate some interpretation by the author.

The participants in the survey are personnel in the following agencies and departments that address floodplain management decisions in Southlands:

- Federal Government: the Planning Division of the Water Planning and Operations Branch, Department of Environment;

- Provincial Government: the Water Management Branch and the Inspector of Dykes, Ministry of Environment and Parks, Province of British Columbia; and

- City Government: the Engineering Department and the Department of Planning, City of Vancouver.

The perceptions are summarized for each of the topics examined:

1) TOPIC:

Flood hazard in Southlands

PERCEPTION:

The federal officials noted that any low lying lands along the sea or major rivers are at serious risk from flooding. Although the record

of flooding in Southlands does not yet include serious floods or damage, the hazard is viewed as being "serious".[1]

The provincial officials agreed that there is a flood hazard in Southlands. They acknowledged there exists a potential for serious floods and damage in the area, however the record to date tends to lessen the perception of that hazard. As a result, they ranked the hazard as ranging from "moderate" to "serious".[1]

The city officials felt that there was a potential for some flooding in Southlands. Most of the respondents ranked the hazard as "nominal", "negligible", or "not serious"; however, one estimated it to be "moderate".[1] All the respondents based their assessments on the record of small floods and limited damage in the area.

2) TOPIC:

Potential causes of flooding in Southlands

PERCEPTION:

All the officials noted that a combination of tides, winds, and rain could be the main causes of flooding.

[1] Quoted terms represent the words used by the government officials to describe the degree of flood hazard in Southlands .

3) TOPIC:

Level of protection being provided by the existing dykes in Southlands

PERCEPTION:

All the officials agreed that the level of protection against flood hazard provided by the existing dykes was well below the Provincial Flood Construction Level (i.e. 102.9 Vancouver City Datum), and needed to be brought up to standard. They were also able to cite the specific level of protection contained in these standards.

The provincial and city officials noted that if a major flood resulting in water levels of the 1894 Fraser River flood were to occur, there would be flooding in Southlands resulting in major flood damage.

4) TOPIC:

Probability of the dykes being overtopped

PERCEPTION:

The officials did not know the probability of the existing dykes being breached. To their knowledge, a flood risk analysis had not been undertaken on the dykes in Southlands. Some city officials noted, however, that such an analysis should have been undertaken as

part of the Southlands program. No explanation was given as to why this analysis had not been done. However, not including such an analysis may indicate that the city was interested in responding to a possible concern about liability, rather than the flood hazard.

5) TOPIC:

Alternative flood adjustment measures to reduce the flood hazard

PERCEPTION:

Given the range of adjustments currently being used by governments to deal with flood hazard (Chapter 2), the federal officials were aware of the largest number. They noted: dyking, floodproofing, flood insurance, emergency plans, information, and zoning.[2]

The provincial officials were aware of the second largest list of possible responses to flood hazard. They noted: dyking, floodproofing, information, zoning, and flood insurance.[2] Floodproofing appears to be the preferred option of provincial officials. Although they did not refer to it directly, the Ministry

[2] These flood adjustment measures were volunteered by the government officials during the interview; there is no significance to the order of presentation.

of Environment an Parks' recent report entitled "Floodplain Management in British Columbia--A Discussion Paper" (1986) indicates this to be a departmental policy.

The city officials were aware of the fewest alternative measures to flood hazard. They noted: dyking, floodproofing, and zoning[2]. This response may reflect their perception of low flood hazard in the area or their possible concerns regarding the liability issue.

6) TOPIC:

Building in the Southlands floodplain

PERCEPTION:

Federal officials felt that no new development should be allowed on the floodplain.

Provincial and city officials noted that some new development should be permitted in the urban areas under stricter flood protection standards (ie. floodproofing and dyking).

7) TOPIC:

Upgraded dykes or floodproofing

PERCEPTION:

All the officials agreed that upgraded dykes or floodproofing represent a satisfactory solution to the flood hazard. It seems that because these flood adjustment measures are the most widely used and promoted in the province, public officials have had limited experience with other flood management approaches.

The federal officials added that a long term strategy for reducing the flood hazard should be through non-structural flood adjustment measures, such as floodplain regulations (ie. zoning). They noted that for years they have been trying to persuade the provincial officials through federal-provincial agreements to adopt a greater land-use emphasis to floodplain management. However, to date no formal agreement has been achieved.

City officials noted that storm water management should be considered an important part of a flood management program.

8) TOPIC:

Public interest about flood hazard and ways to respond to that hazard

PERCEPTION:

Although the federal officials felt that the public is generally interested and concerned about flood hazard and appropriate

responses, they noted that these issues are more a provincial and municipal responsibility because of their day-to-day involvement with floodplain residents. The federal government usually plays a direct role in a specific area only if the proposed local flood management plan has a potential impact on fish habitat or a major shipping waterway. The federal officials appeared reluctant to become too closely involved in Southlands, where they felt they may be over-stepping their jurisdiction.

The provincial and city officials acknowledged that the public is interested and concerned about floods and possible responses, and that "they try to provide as much information as is available as part of a flood management program".[3] This type of comment is usually interpreted as a purely public relations response, because government officials usually determine the amount of available information that is presented to the public as part of a decision-making process. The practice allows the government to maintain control during this process and protect itself against unforeseen situations or circumstances (possible court action, political difficulties, inter-governmental differences, etc.).

[3] This comment represents a quoted response from the interviews.

9) TOPIC:

Information held by the public about the flood hazard

PERCEPTION:

All the officials agreed that information held by the public about flood hazard needed to be improved.

10) TOPIC:

Increasing public knowledge about the flood hazard

PERCEPTION:

All the officials stated that they did not know what methods to use to better inform the public about the flood hazard. They did, however, provide a number of suggestions.

Federal and provincial officials felt that more informational literature should be made available to the public. They said that to do this, more public funds should be allocated for informing and educating those residents potentially affected by floods.

Several federal and provincial officials noted that brochures about flood hazard and responses have been prepared and published. These brochures covered such topics as the flood emergency program, flood precautions for homeowners, and self-help advice about responding to floods. They also said that there is available a publication on floodproofing. However, there is some uncertainty as to whether this information has been made accessible to local governments or affected residents. A few samples of these brochures are attached (Appendix F).

The city officials confirmed that they had received copies of the floodproofing information; however, they had neither heard nor received copies of the other information.

11) TOPIC:

The Southlands program to develop floodplain policies

PERCEPTION:

All the officials were aware that the City of Vancouver was developing floodplain policies in Southlands.

12) TOPIC:

City of Vancouver's report entitled "Policy on Flood Protection in Southlands"

PERCEPTION:

Neither of the two federal officials had received a copy of the report.

Two out of four of the provincial officials had received a copy of the report and had read it.

All four of the city officials were well acquainted with the report and its contents.

13) TOPIC:

Distribution of flood protection information to Southlands residents

PERCEPTION:

Although the federal officials were invited to attend a meeting in Southlands, they chose not to attend. They felt that the flood hazard issue in Southlands was a provincial and municipal responsibility. Again, there appeared to be some reluctance to get involved in another government's jurisdiction. They said that no

information by the federal government had been distributed to the community about the flood problem. Aside from three provincial officials attending two community meetings (out of an approximate total of 15 meetings) as speakers on the flood problem, no information on the topic had directly been made available to the Southlands residents. The officials said that they only attended those community meetings to which they were invited. However, it should be noted that the Southlands program represented the first time that provincial officials had been asked by a local government to attend public meetings prior to the formulation of floodplain policies.

The city officials said that their recommendations for reducing the potential flood problem only considered the dyking or floodproofing options, and these recommendations were only made available to the Southlands floodplain task force and the citizens' planning committee, primarily at meetings and through committee minutes. No information was directly made available to the general Southlands community about the topic. Many of the officials assumed the affected residents would be informed through normal community networking, such as ratepayers associations, riding and golf clubs, and other local groups.

A city official noted that the city's only direct communication with community residents about the topic of flooding was a single hazard advisory letter warning about a possible high tide and storm threat (Appendix G). Even though the city's floodplain program was close to

completion including recommended policies and although city staff were presumably aware of ways that individual property owners could reduce property damage as a result of flooding (e.g. temporary floodproofing - Chapter 3), this letter did not elaborate on how the local residents could respond to that threat.

This event clearly contradicts the earlier comments made by the government officials, particularly the city, in question 8, about the extent and availability of public hazard information. It shows that governments tend to determine the quality and distribution of public information provided. In this case, the city officials did not want to alarm the residents that there is a flood hazard in Southlands, possibly because of their concerns about liability.

14) TOPIC:

Communications with other levels of government (provincial, federal or city) on the topic of floodplain management in Southlands

PERCEPTION:

The federal and provincial officials noted that there is regular communication between their respective Departments of Environment about provincial stream flow and water quality data. However, representatives from both governments said that until very recently, there had been very little communication or discussion with the city of Vancouver about flood matters. In fact, the provincial officials

stated that the city had tended to be a hold out among the lower mainland municipalities in getting involved in managing its floodplain areas.

City officials acknowledged that until the last two years, there had been little reason to contact the senior governments about the topic. They had assumed that the city did not have a flood problem that required attention, communication, or discussion with the senior levels of government. A change in city attitudes was prompted by its legal department (1984) advising that the city could be liable for property damages and personal injury as a result of flooding, because no minimum Flood Construction Levels had been established on the floodplain lands.

15) TOPIC:

The knowledge of Southlands residents about flood matters and alternative ways to deal with the flood hazard

PERCEPTION:

All the officials felt that the residents in Southlands had increased their knowledge about the topic, especially since the Southlands local area planning program had been initiated.

16) TOPIC:

Government performance in communicating information about flood matters

PERCEPTION:

Most of the officials' responses indicated that the performance of government in conveying flood hazard information has improved substantially in recent years. They also noted that there still needs to be further improvement in public information and education about flood matters.

However, the earlier responses by the government officials (question 10, 13 and 14), demonstrate that government has done a particularly poor job in communicating flood hazard information to the local government officials or the public. Their comments suggest that the senior governments have contributed very little direct information in the Southlands floodplain management program. As a result, the major policy maker affecting floodplain decisions in Southlands has been the city. Given that the city officials' perception of the flood hazard in Southlands has been low (question 1), and that they were prompted to focus on the area's flooding issue only because of their concern about liability (question 14), it is understandable that the city's floodplain management program would only provide enough flood hazard information to the public (question 13) to support their recommended flood adjustment measure (i.e. floodproofing) as a

response to the flood problem as outlined in Chapter 5. This conclusion strongly suggests that the city was interested in responding to the liability issue and not the flood hazard.

17) TOPIC:

Government performance in preventing flood damage in Southlands

PERCEPTION:

The federal officials felt that the city was generally doing a capable job in reducing the flood hazard in Southlands. They did note that this question could be better answered by the provincial and city officials, who had more direct involvement in the area. Their comments did suggest some uncertainty as to how much the federal officials knew about the city's approach to the flood problem in Southlands.

The provincial officials were quite pleased that the city was finally responding to the potential flooding problem in Southlands. As noted earlier, the provincial government is a proponent of the floodproofing approach to floodplain management, which the city had adopted in the community. They believed that floodproofing was an effective response to flood hazard, especially in areas that faced possible increases in development activity, such as Southlands.

The city officials believed that floodproofing and dyking would provide an effective response to the flooding problem. This response was expected from the city representatives, because it was they who participated in the planning process that developed these responses to the potential flood hazard.

18) TOPIC:

Government knowledge about flood matters and ways to respond to flood hazard

PERCEPTION:

All the officials, except those representing the city's planning department, indicated that they believed themselves to be well informed about appropriate responses to flood hazard.

Most officials said they had gained the knowledge either through work, education, literature, or experiences from other parts of North America.

The planning officials noted that they had little experience in this area, and therefore relied on the expertise of the city's engineers in guiding them through the technical issues relating to the development of city floodplain policies supported by the community.

19) TOPIC:

Type of training or experience in floodplain management

PERCEPTION:

Two out of ten government officials interviewed said that they had taken courses as part of their formal education in flood management techniques. These individuals were employed by the provincial government.

All others said that they had gained their experience or expertise in the field or on the job, and from literature.

Several officials noted that they were not aware of any training or education sessions to keep practicing professionals up to date about new advances in the field.

Others said that there were some opportunities for learning through conferences and various reports. No specific conference or report was mentioned.

6.5 ANALYSIS OF GOVERNMENT PERCEPTIONS

The literature review (Chapter 2) demonstrates that the available evidence is mixed on the relationship between awareness of hazard risk and the consequent adoption of hazard adjustment measures. However, the

review highlighted several studies that show that information has led to behaviour change under specific conditions when properly executed and carefully targetted to those facing the threat. Ten general information principles have been identified that should be pertinent to any flood hazard advisory program (see page 19) and which should ensure a sound floodplain management plan.

As noted in the literature review, an underlying factor vital to any hazard advisory program is the perception of those government officials who influence the development and implementation of the program. Their perceptions of the flood hazard and possible responses have been found to have direct and major impact on the design and delivery of any information program to the affected residents and on their perceptions about flood risk and appropriate responses.

However, as stated in the literature, this causal relationship between information and awareness is not perfect, and this must be realized in the design and implementation of any hazard advisory program. There are numerous outside factors that influence both its design and delivery. These outside factors can take the form of governmental jurisdictions, differences in departmental philosophies, and concerns about future precedents, or policy impacts. An analysis of the perceptions of government officials involved in Southlands provides an understanding of the City of Vancouver's hazard advisory program and areas where improvements may be made. This understanding includes the officials' awareness about the flood hazard, range of flood adjustment measures, and the method which they chose to communicate that knowledge to the

public. The author's observation of the Southlands program in terms of the general hazard information principles is also presented as part of this analysis.

The analysis of the perceptions of government officials is therefore based on the following criteria:

- Awareness of the flood hazard;
- Understanding of flood adjustment measures;
- Delivery of flood hazard information; and
- Observations in terms of the general hazard information principles.

6.5.1 Awareness of the Flood Hazard

The interview results indicate that the senior government officials who are the most removed from the implementation of floodplain policies view the flood hazard as the most serious. Their perception of the flood risk appears to reflect a greater awareness and knowledge about the high probability of flooding caused by high tides combined with storm surges and rainfall. City officials, who are the most involved in day-to-day floodplain management decisions, regard the hazard as being the least significant. Their perception, on the other hand, appears to be based on little experience and exposure to flood management matters. The low recorded level of flood damage in the area over the last thirty years has also appeared to have had a significant influence their perception of the hazard.

There is also support for the notion that the perception of flood hazard has a direct bearing upon perception of adjustment to the hazard. Those officials who perceive the problem to be significant, are also aware of more alternative responses to the hazard, and those who perceive the hazard as less significant have a reduced perception of possible alternative responses.

6.5.2 Understanding of Flood Adjustment Measures

There exists a definite bias towards structural flood adjustment measures at all levels of government. Dyking and floodproofing are perceived as the most common responses by government officials at all levels of government. This result may be because these measures are promoted through funding assistance or in government policy papers by the senior governments. The survey suggests that there appears to be little understanding, interest, and knowledge of non-structural approaches to flood management, especially at the local government level. Information about other floodplain management experiences throughout North America does not seem to be applied to local circumstances.

6.5.3 Delivery of Flood Hazard Information

Although the senior government officials' responsibilities are specifically focused on water management issues (as indicated by the agencies they represent), there exists little evidence in the findings

that suggest that their perceptions about flood matters were presented or evaluated as part of the Southlands decision-making process. They attended only a few meetings in the community, and presented little information about the flood hazard or possible responses to the Southlands Citizens' Planning Committee that differed from the city's information. To their knowledge, no information about the topic had been distributed by the senior governments to the Southlands residents.

The results indicate that the level of flood hazard information provided in Southlands, tended to reflect the flood hazard perceptions of the local officials. This information included their views on the flood hazard in Southlands, as well as their solutions to the problem. Although the city officials attended all of the community meetings on the topic, aside from floodproofing and dyking no other flood adjustment measures were presented or discussed. There was no risk analysis undertaken to estimate the probability of flooding in the area. All estimation of area flooding appeared to have been taken from historical data, which basically represented the last thirty years (Chapter 5). Except for one public notification about a possible flood threat, there was no general distribution of information to the area residents describing the problem or suggesting possible solutions. The limited attendance by the senior government officials at these community meetings suggests that the city was not interested in involving the senior governments, beyond adoption of the provincial floodproofing standards. On the other hand, the senior officials appeared to be satisfied that the city was finally developing flood management policies.

Given that the awareness among city officials of the flood hazard is low, their understanding of available flood adjustment measures is limited, and that they were motivated to undertake the process of reviewing their floodplain policies because of liability concerns, the findings strongly imply that the city's adopted floodplain polices in Southlands are largely a response to the liability issue rather than the flood hazard per se. Because they attended all the community meetings, it is reasonable to expect that their limited perception of the flood risks and responses would be communicated to the area residents.

6.5.4 Observations in Terms of the General Hazard Information Principles

As the general hazard information principles were identified from the literature as being a prerequisite to a sound floodplain management plan, it is important to this research that the following observations be made about the Southlands hazard information approach. To assist the reader, these principles are underlined in this section in summary form (from page 19).

The hazard information appeared not to be specific to the target population, or to the resident's situation. While the officials noted the potential causes of flooding, there was no analysis done on the risk of the hazard in the area, especially since the prime threat came as a result of tides, winds, and rains from Georgia Strait, very different from the flood threat faced by most other lower mainland municipalities (spring freshet). There seemed to be very little attempt to make the

information more applicable to the area residents, to solicit their support for the city's response to the hazard, or to other flood adjustment responses.

In fact as noted in Chapter 5 and by the survey findings, the dissemination of information on the flood hazard and the range of possible adjustment measures appeared to be restricted to the adoption of floodproofing and dyking measures, which the city had recommended prior to initiating the consultation process in the community. As part of the community consultation process, no attempt was made to contact the general community at large through the use of letters, brochures, or leaflets to explain the flood hazard and recommended responses. The presentations and discussions that took place on these measures were limited to the Southlands Citizens' Planning Committee meetings. The officials did assume that hazard information would disperse in the area through various community groups. However, because no information was distributed to the area residents, it appears that little action was undertaken to consider the need to reinforce the recommended responses to the hazard, socially and locally in the community. It appears from this process that city only wanted to provide that information that supported its preferred flood adjustment measures (floodproofing and dyking).

A significant question is also raised about the clarity, content, and direction of the hazard information, and the type of appeal that the Southlands program promoted in the area. As evidence, the city's hazard advisory letter about a possible flood threat in early 1987,

demonstrates that the communication did have a clear civic purpose. However, the warning did not provide any information about the hazard and an appropriate response, and it did not motivate the residents to take action to reduce property damage as a result of flooding. This information should have been known to the city officials, because they had just completed developing the floodproofing policies in Southlands. As Chapter 3 shows, there are several basic temporary floodproofing measures that a property owner can take to protect a house and its contents.

The findings show that there appears to be little inter-government cooperation among the various departments and agencies in the distribution of hazard information. This is evident in their varying perceptions about the risk of flooding and the alternative ways to respond to that risk, and also in their knowledge regarding local floodplain policy decisions in Southlands. The dissemination of general information, including published documents about flood matters also appears to be confined predominantly between the various government departments. Most or all the information that was presented to the community, was provided by the city in the form of reports and presentations at various public meetings. As a result, this information about the hazard and appropriate responses tends to represent the city's views on the subject matter.

It is evident from the survey responses, that training in flood hazard identification, alternative adjustment measures and emergency responses is either very limited, non-existent or poorly communicated among the

various governmental participants surveyed. The participants noted that much of their hazard education and information is based upon on-the-job training, voluntary attendance at conferences, and availability of reports. Only a few government officials indicated that they had taken courses as part of their formal education in flood management techniques.

6.5.5 Summary

The information obtained from the interviews with key officials involved in floodplain management decisions in Southlands indicates that there is a varying perception of the flood hazard and about ways to deal with that hazard, especially at the local government level. The findings suggest that there remains an inadequate understanding or awareness of non-structural flood adjustment measures by all levels of government. A soon to be released risk analysis on the existing dykes around the Vancouver International Airport (Sea Island) by Transport Canada, should reinforce the senior or local government officials' perceptions of the flood hazard in Southlands. Unofficial reports by Transport Canada staff are that the flood hazard is serious (Transport Canada 1987).

The survey suggests that hazard information delivery as part of the Southlands' program reflects the perceptions of the local government officials. As a result, the city's approach to flood management in Southlands has not been specifically based on developing an effective response to the flood hazard. Instead, it appears that the city's concern about liability has had a greater influence on its floodplain decisions. Therefore, much of the city's hazard information presented

was specifically intended to support the adoption of a flood construction standard (floodproofing) for the City of Vancouver. The result is that the city officials have had significant influence in determining the quality and type of flood hazard information presented in Southlands.

The author's observations regarding the general hazard information principles reinforce all the findings from the survey responses, because the responses clearly show that the Southlands program has not utilized these or similar principles in the delivery of information to the affected residents. The survey findings also indicate that as long as there remains a strong perception among government officials that structural adjustment measures are the most suitable response to flood hazard, there appears little likelihood of change in floodplain management practice in British Columbia. Similar conclusions were drawn by Gordon Shanks in his 1972 research on government perceptions into the floodplain management process in Richmond. In his research, he states that public officials at all levels of government tend to perceive structural flood adjustment measures as the only effective means to reduce the flood hazard. Shanks' results show that perception of the hazard is a major factor in the flood adjustment adoption process. "It appears that a change in decision-makers' perceptions will be necessary to bring about a change in the planning practice with respect to floodplain management" (Shanks 1972). However, it should be noted that floodplain management practice has come a long way in the Province of British Columbia since Shank's thesis on the topic (i.e. planning, floodproofing).

6.6 CONCLUSION

The survey findings in this chapter show that there is a lessening of awareness and understanding about the flood matters from the senior levels of government to the local level. The senior government officials are more aware of the flood hazard and the range of flood adjustment measures than the local officials. If this information flow holds true, the Southlands residents' awareness of flood matters should be less, or similar to the perceptions of the city officials. The adoption and implementation of the identified general hazard information principles suggest that the perception of knowledge about flood matters would greatly increase at all levels of government, including the perceptions of those community residents involved in a local floodplain management program.

The following chapter will demonstrate how aware the local residents in the Southlands local area planning program are of the flood hazard and the ranges of responses, and whether their attitudes are reflective of the city officials' perceptions about floodplain management.

CHAPTER 7

FLOOD-RELATED PERCEPTIONS OF SOUTHLANDS RESIDENTS

7.1 METHODOLOGY

A structured written questionnaire was used to examine the flood-related perceptions of the floodplain residents in Southlands. The residents were identified by property address from the City of Vancouver's Property Tax Records. The result was that all the recorded residential addresses in the Southlands floodplain (totalling 160 households) would receive one questionnaire. No judgment was made whether the floodplain resident was a tenant or property owner. To ensure confidentiality, the names of participants in the survey were not requested nor their addresses recorded.

Prior to distribution of the survey, the author met the members of the Southlands Floodplain Task force, and attended a regular meeting of the Southlands Citizens' Planning Committee to explain the objectives of the thesis project and an upcoming community questionnaire. The questionnaire was also pre-tested by a representative group to determine appropriate wording, spacing, flow and order of questions, and formating. Because the questionnaire would be self-administered, the pre-test group were also requested to note specific problems with the questions and answers, as well as suggested areas for improvement. The final survey was reviewed by the Chairmen of the Southlands Citizens' Planning Committee and the Southlands Floodplain Task force.

The questionnaire was distributed to only those residents who were residing at the recorded address on the floodplain. The initial contact with the residents was made by a letter of introduction, accompanied by the questionnaire (Appendix H) and a postage paid return envelope. To encourage participation in the survey, the letter was distributed under the letterhead of the Southlands Citizens Planning Committee, and signed by its Chairman. The letter urged the participants to fill in the survey as soon as possible, and use the postage paid return envelope as provided. The letter also noted that the author would be in the area on certain days to pick up the completed surveys.

Out of a total of 160 questionnaires distributed, 104 were returned by mail or picked up by the author. This result represents a 65% return of the distributed questionnaires.

7.2 QUESTIONNAIRE RESULTS

A summary of the questionnaire results is presented in this section, with some interpretation by the author. These resident responses represent their views at the time of the survey. To highlight the effectiveness of the hazard information program in Southlands, the results provide comparisons between the perceptions of those residents who are members of the Southlands Citizens'Planning Committee, and those who are not. The Southlands Citizens' Planning Committee responses are noted by "SCPC", while all the other comments are presented under "non-committee" responses. The questionnaire responses are presented

under the following sub-headings which, when possible, correspond to the categories used to analyze the perceptions of the government officials:

- Profile of the respondents;
- Flood experience;
- Hazard evaluation prior to home purchase;
- Flood hazard perception in Southlands;
- Knowledge about floodplain management in Southlands;
- Perception of alternative flood adjustment measures; and
- Government information about flood matters.

7.2.1 Profile of the Respondents

The questionnaire responses represented a larger percentage return from the non-committee group than from the Southlands Citizens' Planning Committee members. However, only about half of the non-committee group had attended any of the citizen planning committee meetings, and/or read the literature (ie. minutes, reports, etc.) on the floodplain management program. The remaining non-committee group respondents said that they had no contact with the government officials or the Southlands Citizens' Planning Committee.

TABLE 1: Committee Membership/Area Representation

	SCPC	NON-COMMITTEE
• Respondent	37%	63%
. Attended Meetings	100%	32%
. Read Committee Literature	100%	34%
. No Committee Contact	0%	34%

A majority of the respondents (in both groups) were in the 45 years or older age group. The respondents were well educated with a majority having a university degree or higher and a significant portion having completed a masters or a doctoral degree. The occupations noted were primarily in the managerial or professional fields. According to the 1981 Canada Census for the Southlands local area (age, education, occupation), the statistical profile of the respondents is generally representative of the area population. The profile also suggests that because of their high levels of education, these residents would be well informed about about community matters.

TABLE 2: Age, Education, and Occupation

	SCPC	NON-COMMITTEE
• Age		
. Under 24 years	3%	7%
. 25 to 44 years	22%	37%
. 45 to 64 years	43%	37%
. Over 65 years	32%	19%
• Education		
. University	78%	76%
. Masters	32%	27%
. Doctorate	13%	14%
• Occupation		
. Managerial	25%	27%
. Professional	32%	38%
. Clerical	5%	3%
. Sales	5%	8%
. Services	7%	8%
. Other (retired, housewife, etc.)	26%	12%

7.2.2 Flood Experience

About half of the of committee respondents indicated that they had experienced a flood, while a much smaller percentage of the non-committee group said that they had. When asked about where the flooding took place, a majority of the respondents noted Southlands.

However, only a small percentage said that they had experienced some damage to their garages, basements, pool decks, or workshops. The noted dollar cost of the damages were also listed as minor (between $200 to $5000), as compared to the assessed property values in the area ($150,000 to $500,000).

TABLE 3: Flood Experience

	SCPC	NON-COMMITTEE
• Flood Experience	49%	23%
• Of Which:		
Southlands	56%	81%
. Property Damage	15%	5%

7.2.3 Home Purchase in Southlands

Less than half of the respondents said that they had taken steps to evaluate the flood hazard in Southlands prior to purchasing a house in Southlands. These evaluations primarily consisted of talking to the area residents. However, a majority said that they would have still gone ahead and purchased a house in the area, even if they had been explicitly made aware that the area might be subject to flooding.

TABLE 4: Home Purchase in Southlands

	SCPC	NON-COMMITTEE
• Evaluation of Hazard Prior to Home Purchase	36%	48%
• Of Which: Talked to Area Residents	60%	56%
• Still Purchased A House	77%	77%

7.3.4 Flood Hazard in Southlands

Although a significant number of the respondents (50% SCPC; 73% non-committee) were not aware of the causes of flooding in Southlands (i.e. a combination of high tides with winds and rains), a majority believed that the risk of flooding in Southlands was not serious. Much of this belief appeared to have been based on the record of low flood damage that has occurred in the area over the past thirty years. Both groups noted that there was zero to a slight chance that their house or property would be flooded within the next year or within five years. Although a smaller response, similar perceptions were held about the chance of flooding within the next twenty years, or within their lifetimes.

TABLE 5: Flood Hazard Perception In Southlands

	SCPC	NON-COMMITTEE
• Not Serious	76%	86%
• Serious	24%	14%
• Zero Probability Of Flooding		
. Next Year	84%	89%
. Within 5 Years	79%	82%
. Within 20 Years	66%	69%
. Lifetime	62%	64%

It is therefore not surprising, that a small percentage of the respondents acknowledged that they had undertaken some private measures to reduce possible damage to their houses in the event of a flood. These private measures included structural improvements (e.g. added a second floor, or crawl space) on their house, or installing pumps/ditches in their yard.

TABLE 6: Resident Measures To Reduce Flood Damage

	SCPC	NON-COMMITTEE
• Respondents	39%	21%
. Structural Improvements	41%	30%
. Install Pump/Ditching	59%	70%

On the matter of home insurance, a significant percentage of the respondents (especially in the non-committee group) were not aware whether their insurance policy covered against flood damage to their home and contents. On the other hand, a noticeable percentage (in both groups) did believe that they had such coverage, even though flood insurance is not available in the Province of British Columbia. It should be noted that only industrial property owners in British Columbia may obtain such an insurance policy, if they contact an insurance company in the United States (Ministry of Environment and Parks 1987).

TABLE 7: Home Insurance

	SCPC	NON-COMMITTEE
• Home Insurance	100%	97%
• Flood Damage Coverage		
. Yes	20%	20%
. No	56%	38%
. Don't Know	24%	42%

When asked whether there was a warning system to alert community residents against flooding, over half of the respondents indicated that either there wasn't one or that they did not know. Most of the respondents who marked yes to the question, stated that the only warning that they can remember receiving, was a hazard warning letter from the City Engineer in early 1987.

TABLE 8: Flood Warning System

	SCPC	NON-COMMITTEE
• Yes	31%	36%
• No	49%	20%
• Don't Know	20%	44%
• City Engineer's Letter	59%	83%

7.2.5 Knowledge about Floodplain Management in Southlands

Well over half of the committee responses indicated that they were aware that community discussions about flood protection had taken place in Southlands, while less than half of the non-committee group made the same response. When asked what those actions might be, most of the committee respondents noted pumping, dyking, or floodproofing.

It should be noted that dyking and floodproofing were the only flood adjustment measures that were discussed in the Southlands Citizens' Planning Committee meetings by city staff, and that the floodproofing regulations were subsequently adopted by City Council.

TABLE 9: Knowledge About Floodplain Management In Southlands

	SCPC	NON-COMMITTEE
• Aware of Floodplain Discussions	67%	47%
• Possible Actions		
. Pumping	50%	36%
. Dyking	33%	56%
. Floodproofing	7%	21%

Yet both dyking and particularly floodproofing received the least amount of recognition by committee members. The low response to dyking may be a result of limited city support for the option as a means to protect the area against flooding, while their low response to floodproofing seems to be based on the approach not providing flood protection for the existing homes in Southlands. These low committee responses may also be based on varying meeting attendance, level of understanding of the topic, or that the discussions about the topic were limited to only certain meeting dates. Pumping, on the other hand, may have been rated quite high in the responses because the residents had recently agreed to fund additional community pumps through property taxes in the Blenheim Flats area.

The non-committee group showed a similar response to the flood hazard. However, a high response was noted for dyking, which appears to reflect

the general community's preferred measure to reduce flooding. This finding was supported in a subsequent question, where support for dyking was high on both group's responses, while floodproofing options received significantly less support.

TABLE 10: Support For Floodplain Management Measures

	SCPC	NON-COMMITTEE
• Dyking	87%	70%
• Floodproofing	47%	37%

7.2.6 Perception of Alternative Flood Adjustment Measures

A majority of the committee respondents indicate that they are aware of the different types of protective measures that could lessen the impact of floods, while a noticeably reduced level of the non-committee responses were as confident in their comments. However, when asked to list these measures, about the same percentage in each group listed dyking and floodproofing as the primary responses to reduce flood damage. Only a very few responses from either group listed dams, flood insurance, and storage as possible other flood adjustment methods to reduce flood damage. No other flood adjustment responses were noted.

TABLE 11: Perception of Flood Adjustment Measures

	SCPC	NON-COMMITTEE
• Aware of Flood Adjustment Measures (Said Yes)	82%	48%
• Types of Measures		
. Dyking	76%	72%
. Floodproofing	21%	25%
. Dams	0%	1%
. Flood Insurance	1%	1%
. Storage	1%	
. Other (pumps, sandbagging)	1%	1%

These findings show that resident perceptions about alternative flood adjustment responses are as limited as those perceived by the city officials. There is little awareness about other adjustment measures, in particular those noted by the senior government officials in the previous chapter.

7.2.7 Government Information about Flood Matters

Most of the committee respondents (98%) were aware that there had been community discussion about flood protection, while a smaller share of the non-committee group (45%) had this response. Of these responses, a majority (79% SCPC; 71% non-committee) noted that it was the government and a local community organization (SCPC) that were participating in

these discussions. However, when asked whether this discussion had influenced them about the flood hazard in Southlands, about half in both groups (49%) indicated that there had been no noticeable change in their perception. The remaining responses were divided between those respondents who noted that they thought about the topic less (34%), or those who said they thought about it more (16%).

When asked if they were aware that a report had been written on flood matters in Southlands, a greater percentage of the committee respondents knew that a report had been written. Of those responses, a high percentage of committee respondents also said that they had read the report. Although the committee responses do represent a noticeably low percentage of the entire committee membership, again varying meeting attendance, level of understanding of the topic, or the number of times the topic was discussed at the meetings may have resulted in not all members being aware of the report and subsequent government decisions. Also, the city's interest in only pursuing the implementation of the floodproofing measures may have resulted in decreasing numbers of committee members in being interested in the topic, or continuing to attend further committee meetings. A much smaller response by the non-committee group indicated that they were aware of such a report, and had read it.

TABLE 12: Awareness of City Report on Flood Management in Southlands

	SCPC	NON-COMMITTEE
• City Report On Floodplain Management		
. Yes	56%	28%
. No	12%	5%
. Don't Know	32%	68%
• If yes, did you read the report		
. Yes	94%	41%
. No	6%	59%

Regarding the question about flood hazard information, a majority of respondents in both groups noted that they had received no such information. A good example from the survey is that most residents do not know the approximate boundaries of the Southlands floodplain, when asked to locate it on a map. A majority of the respondents in both groups (69% SCPC; 66% non-committee) were able to approximate the floodplain boundaries in Southlands. To this question, the author determined which responses were generally acceptable, and which were not. The slightly higher committee response is possibly a result of the floodplain maps being presented at the meetings .

TABLE 13: Information On Flood Protection

	SCPC	NON-COMMITTEE
• Did You Receive Any Information On Flood Protection		
. Yes	30%	22%
. No	70%	78%
• If yes, what		
. Leaflet/Brochure (Engineering Letter)	9%	54%
. Personal Contact (Engineering staff member, who delivered the letter)	27%	23%
. Public Meetings (SCPC)	64%	23%

On the question of what flood hazard information they had received from government, a majority of the respondents (76% SCPC; 80% non-committee) indicated little information. Some of the committee respondents did note that attendance at the Southlands Citizens' Planning Committee meetings was an important source of information about flood protection. However, a majority of these respondents also noted that the information that they had received was of little use to them (69% SCPC; 60% non-committee). This response clearly reflects their dissatisfaction with the city's floodproofing approach for Southlands, instead of upgrading the existing dyking system (SCPC Committee Minutes of March 19, 1986).

When asked to rate the government's performance in communicating information about flood matters, a large majority in both groups said that it generally had done a poor job. The lower committee response may represent their displeasure with the City Engineering Department and their interest to establish floodproofing standards in Southlands. The Engineering Department was not considered to be a part of the Southlands Local Area Planning Program, but more in the category of government (general). However, they noted that the Local Area Planning Program has done a relatively good job in raising awareness about flood matters. This latter response is likely a comparison to the little information that the community had received about the topic prior to start of the

TABLE 14: Government Performance in Communicating Flood Hazard Information

	SCPC	NON-COMMITTEE
• Government (General)		
. Good Performance	9%	14%
. Poor Performance	91%	86%
• Southlands Local Area Planning Program		
. Good Performance	76%	61%
. Poor Performance	24%	39%

local area planning program. Also, the Southlands program was perceived by the residents as responding more effectively to other community issues (i.e. land use, density, equestrian activities, park lands, etc.) besides floodplain management, and as a result received a favourable response on its performance.

A significant portion of the respondents (69% SCPC; 71% non-committee) did note that they were well informed about the flood hazard in Southlands. When asked about the source of that information, most indicated personal observation and experience in the area, and not information from government. This finding suggests that the city's flood hazard information was not the source of the community's knowledge about flood matters in Southlands.

7.3 ANALYSIS OF RESIDENT PERCEPTIONS

To provide comparisons to the perceptions of the government officials, the analysis of the resident perceptions is based on the following criteria:

- Awareness of the flood hazard;
- Understanding of the flood adjustment measures;
- Delivery of flood hazard information; and
- Observations in terms of the general hazard information principles.

7.3.1 Awareness of the Flood Hazard

Although the responses show that a significant percentage of the area residents had experienced a flood, a majority of the respondents viewed the flood hazard in Southlands to be nonexistent or low. As was the case with the city officials, much of this perception is based on the record of low flood damage in the area. This low flood hazard perception is supported by the high degree of resident responses that indicated that there will be no flooding in Southlands within the next year, decade, or their lifetimes. Also, those respondents who did consider the possibility that the area might be subject to flooding indicated that the flooding problem was not serious enough to influence their decision about purchasing a house in Southlands.

Other indicators that are consistent with these resident perceptions about the flood hazard are: the lack of knowledge about home insurance coverage regarding floods; the little interest in undertaking home protection measures to lessen flood damage; the lack of awareness about a neighbourhood flood warning system; limited knowledge of local discussions about floodplain management or recent reports on the subject presented to Council. In terms of neighbourhood perception about flood hazard, there appears to be relatively little difference between the committee and general community attitudes. As a result, the Southlands Local Area Planning Program was either not successful in increasing resident knowledge about the topic, above from what was already

generally known in the community; or the city officials focused on the established local perceptions about the topic to ensure the likelihood that the floodproofing approach would be adopted by the committee (or community) and City Council.

These findings suggest that there was little interest or effort by the government officials to influence a change in resident perceptions about the flood hazard by undertaking other methods of information dissemination to the community. After all, the residents' perceptions of the flood hazard were similar to the city officials' perceptions, who were playing the major role in determining floodplain policy in Southlands.

7.3.2 Understanding of Flood Adjustment Measures

The residents, like the city officials, perceived dyking and floodproofing as the only familiar measures to respond to the flood hazard. As noted earlier, the findings demonstrate that no other measures were discussed as part of the Southlands floodplain management program. There were only a few respondents that indicated any knowledge about other types of flood management approaches (eg. dams, flood insurance, etc.). However, the evidence suggests that this information was not provided by the government officials. The resident responses did, however, show that they preferred dyking to floodproofing, as a response to the flood hazard. This finding shows that the floodplain policy decisions in Southlands were based only on a choice between two

traditional flood management approaches. The finding also suggests that a discussion of a broader range of flood adjustment measures as part of the decision-making process may have achieved more effective long term floodplain policies for the area and the city, and greater community support for the adopted flood adjustment measures. The questionnaire results suggest that little effort has been undertaken by the government officials to inform the community about alternative ways to respond to the flood hazard. What information is known by the floodplain residents, appears to have been already known prior to the start of the floodplain management program in Southlands.

7.3.3 Delivery of Hazard Information

On the whole, the resident responses confirmed that on the topic of flood protection, little information had been distributed by government to the residents. In terms of resident awareness about flood management discussions, the responses showed that those who were members of the Citizens' Planning Committee were more aware about flood matters and decisions made by government in the area, because that information had been made available only to them and not the general community. However, most of the committee responses did indicate that important sources of flood hazard information were their own observations and experiences about flood matters in the area as well. This response suggests that the residents perceived the flood hazard in Southlands to be low, and that the flood hazard information provided by the city officials tends not to be the source of that view.

Except for the city's hazard advisory letter, there was no mention by the committee members or the residents at large, about receiving any written information on flood matters, particularly those flood management brochures that had been prepared by the senior levels of government. What information was provided, was provided at the community meetings only, and primarily by the city officials who supported the adoption of the floodproofing regulations. There was little or no discussion about the flood hazard, the probability of flooding, or other flood management strategies. In general, the survey findings show that the government's performance in communicating flood hazard information to the community represented a token effort to achieve the city's objective of establishing minimum Flood Construction Levels on its floodplain lands.

The findings do clearly show that the perceptions of the floodplain residents about flood matters, closely represent the perceptions of those key city officials who were involved in the floodplain management decisions in Southlands. There is little evidence to show that the perceptions of the senior government officials about flood matters had influenced the Southlands Citizens' Committee members.

7.3.4 Observations in terms of the General Hazard Information Principles

The relatively low understanding of the causes of flooding by all the resident responses, including those who are members of the committee,

demonstrates that the hazard information appeared not to be specific to the target population or to the resident's situation. In fact, a high percentage of the respondents did not know the approximate location of the Southlands floodplain, when questioned. As with the city officials, the resident responses showed that their estimation of the flood risk was based on the record of flood damage in the area. This perception of risk was similar whether they were members of the committee or not.

The resident's low perception about the flood risk and responses shows that the dissemination of information on the flood hazard and the range of possible adjustment measures were both restricted and limited to the city's information on the topic. The findings show that no attempt was made to inform the general community about the flood management discussions and recommendations that were being considered by the committee. For instance, only a small percentage of non-committee responses indicated awareness about a floodproofing report or flood management discussions that had taken place with government officials. They noted that the only written information that they had received on the topic from any level of government was a letter from the city warning about a possible flood. This response in itself demonstrates the success of the letter and that this type of information delivery to the general community can be an effective form of hazard education and information.

The results show that hazard information was not dispersed to the general community, but only presented at committee meetings. However,

the general community did appear to be as well informed about flood matters as was the committee. There was no evidence to suggest that any alternative effort had been undertaken to contact the area residents, aside from what was presented and discussed at the meetings. This clearly indicates that the city was not particularly effective in seeking community reinforcement to the city recommended responses to the hazard, either socially or locally in the area.

In terms of clarity, content, direction, and the type of appeal being promoted by the Southlands program, it is clear that the city wanted to discuss floodproofing and dyking as the only methods to respond to the flood hazard. There is little evidence from the questionnaire to suggest that other options or directions were pursued. However as noted in the previous chapter, the city's hazard advisory letter raises serious question about the quality of hazard information provided, especially since the Southlands Local Area Planning Program had recommended flood protection policies for City Council adoption. If the city was concerned about the hazard, then it should have recommended temporary flood protection measures as part of the letter giving the regional high tide alert.

Most of the residents did acknowledge that the government officials who attended the Citizens'Planning Committee meetings were viewed as a credible information source. It should also be noted that it is to the credit of the city that it initiated discussions and undertook a program to develop floodplain policies with the affected residents. However,

much of the hazard information communicated by the officials tended to only reflect the community's long standing perceptions about the hazard. The findings suggest that the city was not seriously interested in responding to the hazard and primarily based its floodplain management on the bias of its professional staff.

The findings show that there appears to be little inter-government cooperation among the various departments and agencies as evidenced in their distribution of flood hazard information. The questionnaire reveals no evidence to suggest that any flood hazard information was provided by the senior government officials that differed from what was being presented by the city.

7.3.5 Summary

The questionnaire findings show that although the Southlands community is represented by a well educated and informed group of residents, much of their knowledge about flood hazard and appropriate responses is a result of limited hazard information. For example, whether they are members of the citizens' committee or from the general community, their perception of flood hazard in Southlands is based on the record of low flood damage and not on a flood risk analysis.

The similar responses to questionnaires from committee members and non-committee members suggests that the quality of hazard information

was limited to what was already known in the community to ensure that the city's proposed floodproofing policy would be adopted for the area. After all, the city's objective was to maintain its long standing policy on floodplain management that the financing and construction of flood protection in Southlands should continue to be the responsiblity of the individual property owner or the private developer. The similar group responses also showed that the Southlands Local Area Planning Program was successful in diffusing flood hazard information to the community, first to the community leaders, and then to the general community; or that the program diffused no new information above what was already known in the neighbourhood.

It is therefore not surprising that the findings show that the residents' view about the flood hazard is nonexistent or low, and the range of possible adjustments limited. What hazard information has been provided as part of the Southlands floodplain management program appears to represent the equally limited flood related perceptions of the city officials. There is no evidence to suggest that other hazard information by the senior levels of government was made available during the decision-making process. Except at the Southlands Citizens' Committee meetings, no attempt was made to contact the general community-at-large through newsletters, reports, or notices to raise their knowledge about the flood risk and possible responses. The results support the conclusion made in the previous chapter, that the city officials have had significant influence in determining the quality and type of hazard information presented in Southlands.

The survey findings also support Shanks' (1972) research conclusions on government perceptions into the floodplain management process in Richmond. In that research, he states that "citizens themselves are not well informed about the flood situation. With few exceptions, they do not exhibit any real concern about the flood problem. As a result one should not expect the general public to stimulate planners to consider other adjustments to the flood hazard. In short, one should not expect additional adjustments to be seriously explored until there is a flood which breaches or tops the dykes" (Shanks p. 114). The suggestion is that since the public does not perceive the hazard to be significant, there is no public pressure to consider other flood management approaches.

7.4 CONCLUSION

The conclusion is that the questionnaire findings show that the community perceptions about the flood risk and responses are congruent with the perceptions of the city officials only. No knowledge about the topic as understood by the senior government officials was presented, or made available as part of the decision-making process in Southlands to develop flood management policies. If there are varying perceptions about the hazard and ways to respond to that hazard, then there is question whether the most appropriate or suitable measures have been adopted in Southlands. For government and the public to gain an opportunity to make more effective floodplain policies, more appropriate

information about the hazard and responses is required in any flood management program. Not only will the product of such hazard information raise the awareness of those government officials involved in floodplain decisions, it will also increase the awareness and understanding of those residents affected by the hazard and subsequent policy decisions.

This concludes the evaluation of flood hazard information as provided as part of the Southlands Local Area Planning Program. The final chapter will recommend changes aimed at improving the flow of hazard information between all levels of government and those residents affected by the hazard.

CHAPTER 8

CONCLUSIONS AND RECOMMENDATIONS

8.1 INTRODUCTION

The research on the development of floodplain policies in Southlands, has revealed information deficiencies at various points in the decision-making process. This final chapter first identifies the major weaknesses in the Southlands hazard information program, and second recommends ways of improving the delivery of hazard information in other communities and their flood management programs.

8.2 RESEARCH CONCLUSIONS

The underlying theme of this research project has been that better information about the flood hazard and adjustment measures leads to more informed flood adjustment decisions on the part of governments and individuals. Although the literature indicates that the relationship between awareness of knowledge and consequent adoption of hazard adjustment measures is mixed, it does state that much can be accomplished if the quality and distribution of information as part of a floodplain management program is sophisticated and informs those affected by the hazard. However, there is no guarantee that an individual will act upon that information.

The literature review concluded that information may lead to behaviour change under highly specified conditions if properly executed with specific targets. Although the research on hazard education covered a range of natural hazards, it was possible to identify specific conditions (information principles p. 19) in which information can lead to awareness and awareness to the adoption of flood adjustment measures. As a result, the research was able to examine the quality and distribution of hazard information in the development of floodplain policies in Southlands, Vancouver. It is acknowledged that there is no easy solution to improving the manner with which flood management decisions are made, however, this thesis suggests that any improvement in the quality and delivery of hazard information during the decision-making process correspondingly improves the opportunity for better management decisions.

Although there has been a noticeable improvement in the development of floodplain management policies in the Province of British Columbia since the 1948 Fraser River flood, this thesis shows that there continues to be an inadequate awareness of the flood hazard and a lack of understanding of non-structural flood adjustment measures by officials charged with the responsibility of developing flood management policies, specifically at the local government level. The research concludes that this situation arose because the quality and delivery of hazard information as part of the decision-making process was poor since little

information interchange occurred between the various government levels and between government and the residents potentially affected by the hazard.

To support this conclusion, the review of the Southlands floodplain management program shows that there were a number of information delivery weaknesses in the decision-making process.

- Although the senior government officials were more concerned about flood hazard, and more aware about the range of possible measures available to reduce the flood threat, there was no evidence that their views or ideas were presented to the local officials or the affected residents;

- The dissemination of flood hazard information and alternative flood adjustment measures appeared to have been blocked because of inter-government jurisdictions;

- No risk analysis was undertaken by the City of Vancouver to determine the probability of flooding. Instead the record of low flooding and flood damage over the last thirty years was used as the basis to assess the flood risk;

- There was little interaction between the senior levels of government and local officials in the development of the floodplain decisions. As a result, the local officials tended to pursue only their views

and perceptions about the flood risk and appropriate responses, as well as the information techniques used to select their flood adjustment approach;

- Aside from the flood management presentations and discussions that took place at the Southlands Citizens' Committee Meetings, there was no attempt to undertake an organized program to either inform the community or to solicit opinions about the hazard, the selection of flood adjustment options, and the final recommendations;

- There was not a significant difference in awareness about the flood hazard or possible flood adjustment measures between residents who attended the Southlands Citizens' Committee meetings, and those who did not; and

- Government officials involved in developing and administering flood management policies may not have had sufficient opportunity to obtain pertinent flood hazard information to keep them informed about the latest developments in the field.

These weaknesses in the Southlands decision-making process raise considerable concern about expertise of the city officials or local governments in floodplain management, and the role of senior governments in this field.

8.3 RESEARCH RECOMMENDATIONS

Although local governments are the workhorse of land use regulation and management in the province, because of jurisdiction, funding, and expertise in environmental issues, municipalities are not well set up to assume major responsibility in floodplain management without assistance from the other levels of government. The management of flood hazardous lands should be a shared responsibility between all three levels of government. Any strategy to reduce flood losses therefore depends on a coordinated action by all these participants, none can do the job alone.

To improve the flood hazard information exchange and interaction between governments levels, and between governments and residents, this thesis recommends that a "Provincial Hazard Advisory Program" be established that provides flood management services specifically oriented to the needs of local governments/communities subject to flood hazard. This program would require:

- That the provincial government undertake a strong leadership, coordination, and assistance role as part of any local program to develop floodplain management policies/adjustments/emergency evacuation plans;

- That all pertinent information (flood forecast data, risk analysis, floodplain mapping) be collected and analyzed prior to the consideration of any floodplain policy options;

- That all levels of government be consulted on a regular basis, including the local residents, during the decision-making process;

- That all government officials involved in developing and administering flood management policies be trained/upgraded about current practices and procedures in the field (ie. hazard identification, range of flood adjustment measures, emergency preparedness plans, hazard information dissemination);

- That an ongoing cost-shared public information and education program be developed to increase community awareness (including developers, builders, real estate agents, financial institutions) about the flood hazard and responses and government initiatives (ie. technical information, emergency plans, and temporary flood adjustment measures) in those areas potentially affected by a flood hazard; and

- That local emergency officers and natural hazard experts be invited, consulted, and informed during the development of local flood management plans.

In the meantime, it is recommended that the hazard information principles identified as part of the literature review be adopted as interim information guidelines in developing future flood hazard advisory programs.

Flood management is an evolving field and this research has strived to increase the understanding of the relationship between better and more effective decisions. The recommendations proposed should improve the current approach to flood management for British Columbia and the City of Vancouver, as well as other communities who will be planning to develop flood management decisions. This thesis also represents the history of a public decision and provides a gauge to measure future floodplain management decisions as well as further research into the topic of natural hazards.

As mentioned on a number occasions throughout this research, a suggested topic for further academic work would be in the area of liability and government risk management decisions. This topic is becoming of greater concern and importance among local authorities because of their increasing roles in risk management decisions and their implementation (ie. earthquake preparation, administration of floodproofing standards, subdivision approvals in natural hazard areas, etc.).

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APPENDIX A

SOUTHLANDS FLOODPLAIN MANAGEMENT PROGRAM TERMS OF REFERENCE: ENGINEERING DEPARTMENT'S CONCERNS RELATING TO FLOOD PROBLEMS, AND THEIR CONCERNS

SOUTHLANDS FLOODPLAIN STUDY

ENGINEERING ISSUES

TERMS OF REFERENCE

DRAFT FOR SUB-COMMITTEE COMMENT

1. Introduction

The purpose of this study is to analyze Engineering issues related to the Southlands Floodplain. The study is to be conducted by the City Engineering Department in consultation with the Southlands Citizens' Planning Committee and the City Planning Department.

The Southlands area contains many residential homes which are at or below the floodplain. In addition, much of the area has open ditches for storm drainage with septic fields and holding tanks for sewage discharge. These issues make the area a special case in Vancouver in which application of appropriate Engineering solutions needs to be evaluated carefully in the context of the local area.

2. Timing and Process

The study should be concluded by December 1, 1985. Regular reports will be made to the Southlands Citizens' Planning Committee; Task Force on Floodproofing. Other relevant agencies and experts will be consulted as required.

3. Scope

The report will analyze the cause, effect and probability of potential flooding; identify options for practical, cost effective flood protection within the context of existing development and future development potential; identify legal issues and areas of responsibility; assess environmental impacts of identified solutions; develop a plan for the short and long term provision of sanitary sewage service and storm water discharge for the Southlands area, consistent with the goals of the Southlands Planning Program.

4. History

This section of the study will cover a range of information to identify clearly the history on development of the area. Included will be information on existing dikes (elevations, size, ownership), elevation

...2

of existing homes, elevations of roadways, elevations of existing grades and locations of filled land, existing services and land uses, case history of flooding problems.

5. Source of Flooding

This section of the study will discuss the sources of possible flooding in the Southlands floodplain, and a best guess of the frequency of flooding recurrence. Information will be obtained from Provincial and Federal Government departments as well as the City records.

6. Legal and Regulatory Issues

This section will explore the legal requirements for flood protection in the Floodplain (including subdivision procedures and legal control over land filling). The intent is to discuss Provincial and Vancouver City applicable standards, and outline also the legal requirements in other municipalities in the GVRD and perhaps related experience in similar geographical areas in the USA.

7. Flood Protection Solutions and Implications

This section of the study will involve a technical evaluation of all of the options to provide flood protection. For example, raising level of land and streets, raising buildings, improving dikes and pumping, and increasing storage capacity for storm water. It may involve the division of the Southlands into separate areas as impacts of an option may be quite different because of variance in existing densities.

The options available to resolve the flood protection issue will be examined for

- cost implications (including sources of funding, i.e., Federal Diking Program)
- health and safety implications
- implementation time frame
- environmental impact with emphasis on existing development, land use and landscape features
- zoning scenarios which include existing zoning and one or two scenarios for changes where possible.

...3

8. Sanitary Sewer System

The existing sewage disposal method, particularly in the Blenheim Flats, will be reviewed and options, e.g., conventional, self contained or district sewage disposal systems evaluated to improve the system if required.

The study will provide a review of the existing system and analyze alternative methods and costs of installing services where none exist today. Both short and long term solutions and methods of financing will be discussed.

9. Storm Sewer System

This section will analyze the existing system which includes open ditches and pumping, and identify any needed improvements in the short term.

The report will examine also long term options to improve the existing storm drainage system and/or change the system to eliminate ditches (considering both gravity and pumping). The role of Southlands as a drainage area for a larger area to the north will be considered.

The report will consider the cost implications of each option and assess the time frame to achieve implementation.

10. Streets

This will include information on the condition of the existing street system in the area, and will evaluate alternative design standards for any possible future upgrading.

The method of financing street improvements through the local improvement process will be discussed.

11. Conclusions - Recommendations

The technical study will produce options for which advantages and disadvantages can be established clearly.

Recommendations will then be forwarded to the Southlands Citizens' Planning Committee and subsequently to City Council for their consideration.

APPENDIX B

SOUTHLANDS FLOODPLAIN MANAGEMENT PROGRAM TERMS OF REFERENCE: TASK FORCE'S NON-ENGINEERING AGENDA IN FLOODPLAIN MANAGEMENT

SOUTHLANDS CITIZEN PLANNING COMMITTEE

TASK FORCE ON FLOODPROOFING

DRAFT TERMS OF REFERENCE

A. Background

At its July 31, 1985 meeting the Southlands Citizens' Planning Committee passed a motion proposing creation of a Task Force on floodproofing. The overall objective of this Task Force is to formulate policies that will result in achievement of consensus preliminary goal #7 adopted by the SCPC, which reads "Resolve the issue of floodproofing in the study area (Southlands) without altering the character of the area".

The timing of the creation of the floodproofing Task Force coincided with the initiation of a study by the City Engineering Department on the engineering issues involved in the Southlands floodplain. In its initial meetings the Task Force worked with representatives from the Engineering Department in the writing of terms of reference for the engineering study. This study will examine engineering issues related both to flooding problems and their amelioration, and to sanitary sewage disposal. The Task Force will contribute to this study by collecting information on flooding history in the study area and by reviewing relevant literature obtained from other floodplain jurisdictions. Other types of information may be provided in the future if deemed

desirable by City Engineering and the Task Force. In addition, regular reports on the progress of the study will be received from the Engineering Department and conveyed to the full SCPC.

While the engineering study will deal largely with the technical aspects of flood protection and sewage disposal, an important role of the Task Force will be to consider these problems in a wider context. In particular, various non-engineering matters must be examined. In attempting to achieve flood protection for the area, while maintaining its character, at least two other draft goals must be kept in mind, namely goal #1 (maintain semi-rural character) and #4 (protect and enhance natural wildlife and vegetation of the study area). As a consequence of the presentation on semi-rural character to the full SCPC and numerous discussions within the full committee, elements that are important in maintaining semi-rural character have been identified. These will be used by the Task Force in evaluating various options for flood protection and sewage management. What is lacking at present is detailed information on wildlife and natural vegetation in the area and on the relationships between the study area and the Fraser River foreshore, particularly in regards to the drainage system in the Southlands area. This information is required to provide an accurate assessment of the environmental impact of various flood protection and sewage disposal options. Hence another objective of the Task Force is to collect such data.

B. Objectives

1. Develop policies on flood protection for the study area which maintain the character of the area.
2. Develop policies on sewage disposal for the Blenheim Flats region.
3. Obtain information on: wildlife and natural vegetation in the study area, particularly in regards to the drainage ditches; water quality in the drainage system (biological and chemical contaminants); impact of southlands drainage water on the Fraser River.

C. Work Required

1. Receive and evaluate reports from City Engineering on the Southlands Floodplain Study (Engineering Issues). (Whole Task Force)
2. Assist Engineering with submissions on first hand accounts of flooding in the area. (Whole Task Force)
3. Assist Engineering with review of relevant literature collected and distributed by Planning Staff. (Individual volunteers reporting to the Whole Task Force)

4. Invite relevant experts from the universities, the private sector, government agencies and any other areas who will enable citizens and staff to broaden their knowledge of floodplain management and sanitary sewage disposal. (Whole Task Force and in some cases, full SCPC)
5. Obtain information on the natural environment of the Southlands area and Fraser River Foreshore. (Task Group)
6. Obtain information on water quality in the Southlands drainage system, in relation to water quality in the north area of the Fraser River, and on the human health risks and environmental impacts of any contamination found. Identify major sources of any contaminants. (Task Group)
7. Report to the full SCPC on the progress of the above matters.
8. Upon completion of the Engineering Study (scheduled for Dec. 1), review the findings and conclusions and determine whether an independent review from qualified experts is warranted (as per section 11 of the Engineering Terms of Reference).
9. When the Engineering staff present their report to the SCPC and City Council, ensure that the Task Force and SCPC responses are also presented.

D. Products to be Reported to SCPC

1. Submissions on first hand accounts of flooding problems in the area.

2. Documentation of presentations from invited experts and agencies.
3. Report on the wildlife and natural vegetation in the study area.
4. Report on water quality in the drainage ditch system.
5. Review and analysis of Engineering Floodplain study.
6. Policies on flood protection, drainage and sanitary sewage management which are consistent with the draft goals of the SCPC. Include a chart showing land use and density options and the flood protection/sewage options and/or requirements for each.

E. Timing

Since the Engineering study is scheduled for completion on December 1, the Task Force should complete its work by December 31, 1985.

APPENDIX C

VANCOUVER CITY COUNCIL APPROVED RECOMMENDATIONS R$GARDING FLOODPROOFING IN SOUTHLANDS

Extract from the Minutes of the Vancouver City Council Meeting
April 15, 1986

The City Engineer Recommends:

A. THAT floodproofing requirements for Blenheim Flats (area shown on Appendix I) be established as follows:

1. Require landfilling to be a minimum of 36 inches above the existing street fronting the site. This required filling need only extend to 15 feet beyond the foundation wall and include an area sufficient to contain the required septic field.

2. Require all habitable floors or features subject to damage to be at the flood construction level of:
   - o elevation 101.2 feet City datum beyond 1000 feet from the river
   - o elevation 102.9 feet City datum within 1000 feet of the river.

3. To protect the amenity of the low-lying area, it is considered advisable to meet the flood construction level by structural means above elevation 100 feet. However, where adjacent streets are above elevation 99.5 feet, the full flood control level could be achieved totally by filling.

4. Runoff from development sites to be retained during rain storms and not to be discharged to adjacent lands at any greater rate than it was prior to development.

B. THAT floodproofing requirements for West Southlands or Dunbar Flats (area shown on Appendix I) be established as follows:

1. Require landfilling on any existing or subdivided lot to be a minimum of 18 inches above the existing street fronting the property.

2. Require all habitable floors and other features subject to damage by flood waters to be at the flood construction level of 101.2 feet Vancouver City datum.

3.(a) To protect the amenity of the low-lying area, it is considered advisable to meet the flood construction level by structural means above elevation 100 feet. However, where adjacent streets are above elevation 99.5 feet, the full Flood Construction Level could be achieved totally by filling.

C. THAT the Director of Legal Services be requested to prepare the necessary by-laws and to pursue Charter amendments (if necessary) to implement the policies outlined in A and B.

D. THAT Council direct the City Engineer to carry out the study of a comprehensive dyking policy for report back concurrent with the overall planning report.

E. THAT the City Engineer prepare storm water retention guidelines for developments in the RA-1 zoning district.

The Director of Planning supports Recommendations A (1-4), B (1-2 only), C, D and E. As an alternative to Recommendation B-3 (a) he Recommends the following:

8.3(b) To protect the amenity of the low-lying area, and at the same time not to deny adequate flood protection, require that the Flood Construction Level be met by structural means above elevation 100 feet. However, where adjacent streets are above elevation 99.5 feet, the full Flood Construction Level could be achieved totally by filling.

Further, the Director of Planning submits the following additional Recommendation:

F. THAT the City Engineer and the Director of Planning, in consultation with the Director of Permits and Licences, prepare guidelines for landfilling in those portions of the Southlands covered by the Agricultural Land Reserve and the Soil Conservation Act.

APPENDIX D

VANCOUVER CITY COUNCIL APPROVED RECOMMENDATIONS REGARDING DYKING IN SOUTHLANDS

Extract from the Minutes of the Vancouver City Council Meeting

April 28, 1987

Page 2

Southlands Progress Report #7

Fraser River Dyking (cont'd)

Report B summarized an attached report of the City Engineer on a Fraser River Dyking Policy in Southlands, wherein the City Engineer and Director of Planning submitted options for Council's consideration. However, instead of the staff recommendations A, B and C, the City Manager recommended:

D. (1) Council approve in principle a comprehensive dyking program for the Southlands area only, subject to obtaining senior government sharing and property owner approval for a local improvement such that the total City cost does not exceed $425,000 for capital expenditures.

(2) Council instruct the City Engineer to apply for cost sharing under any applicable senior government program, and consider options for distribution of cost to local property owners via local improvement.

(3) Council instruct the Director of Legal Services to seek Charter amendments for assessing a portion of those costs as a local improvement.

(4) Council instruct the Supervisor of Properties to negotiate for the required rights-of-way for dyke upgrading.

(5) The City Manager report back within six months on the results of the staff work.

MOVED BY Ald. Puil

THAT recommendations A, B, C and D, as contained in the Manager's Report dated March 25, 1987 (Southlands Progress Report #7) be approved.

- CARRIED

(Alderman Boyce opposed)

APPENDIX E

LETTER INVITING GOVERNMENT OFFICIALS TO PARTICIPATE IN THE SOUTHLANDS INTERVIEW SURVEY

February 20, 1987

Dear

Interview on Flood Awareness in Southlands

My name is Kari Huhtala, a graduate student at the University of British Columbia, presently conducting research for a thesis assessing the attitudes of government officials about all types of flood hazard and possible ways to deal with that hazard. The objective of this research is to develop and evaluate the most effective process to distribute information about flood protection options.

As government representatives involved in the development or administration of floodplain policies in Southlands, you are invited to participate in an interview. It is expected that the interview will take no more than one-half hour of your time. Because University of British Columbia Policy requires written subject consent for participation in interviews, a written consent form has been attached. If you agree to the interview, please fill in this form and use the postal paid return envelope as provided. Upon receipt of your response, I will contact you about an appropriate day and time for the interview. The individual survey responses will be kept confidential. You do have the right to refuse to participate in this interview or withdraw at any time.

A summary of the findings (not individual responses) will be made available to you upon request.

Thank you for your time and participation in this study.

Yours truly,

Kari Huhtala

APPENDIX F

SAMPLES OF PUBLISHED SENIOR GOVERNMENT HANDOUTS ON FLOOD HAZARD INFORMATION

Emergency Planning Canada
Planification d'urgence Canada

With the compliments of

FLOODS

SELF-HELP
ADVICE

pouvez vous adresser à CP 10,000 dans votre capitale provinciale ou contacter le bureau régional de Planification d'urgence Canada dans cette ville; ou contacter:

Planification d'urgence Canada,
3B, 125 promenade Sussex,
Ottawa, Ont.,
K1A 0W6
Tél: Code régional 613 992-3322
992-9988

Plans de demain pour aujourd'hui

MESURES INDIVIDUELLES

INONDATIONS

Gracieuseté de

Planification d'urgence Canada
Emergency Planning Canada

INONDATIONS

Habituellement, il est possible de prévoir une inondation locale en surveillant constamment le niveau de l'eau à la suite de fortes pluies, la condition de la neige dans les bassins de drainage et les observations et prévisions météorologiques.

Un inondation soudaine, qui ne laisse guère le temps d'avertir la population, peut être associée à d'autres causes, telles qu'un tremblement de terre, un raz de marée, un ouragan, une violente tempête ou l'enfoncement d'un barrage.

Quelle qu'en soit la cause, les autorités locales tiennent la population des secteurs menacés au courant de l'évolution du sinistre.

Au moyen de divers organes de diffusion elles recommenderont les mesures à prendre pour circonscrire ou prévenir le désastre.

Les autorités municipales ou provinciales émettent des instructions détaillées afin de répondre aux besoins immédiats.

Précautions générales à prendre en cas d'inondation

Courant électrique

Coupez le courant dans les locaux menacés, mais non si l'emplacement du commutateur principal est déjà inondé. Si le plancher est humide, tenez-vous sur une planche sèche et actionnez le commutateur au moyen d'un bâton sec. Tout appareil électrique exposé aux eaux de l'inondation devrait être examiné par un professionnel avant d'être remis en service.

Appareil de chauffage

Des précautions spéciales doivent être prises pour protéger les appareils de chauffage à l'électricité, au gaz naturel ou au gaz propane contre les dégâts, ou du moins pour réduire ces dégâts au minimum. Si vous en avez le temps, consultez votre fournisseur au sujet des mesures à prendre. Si votre appareil de chauffage a été exposé à l'eau, faites-le examiner par un expert avant de le remettre en service.

Contamination de l'eau

Si le goût, la couleur ou l'odeur de l'eau vous porte à croire qu'elle a été contaminée, purifiez-la avant d'en boire en la faisant bouillir ou en utilisant des comprimés appropriés ou du chlorure de chaux.

Dans le cas du chlorure de chaux, mettez de 1 à 2 gouttes par litre d'eau et laissez l'eau reposer pendant 30 minutes avant d'en boire.

Précautions générales

- Assurez-vous que votre radio à pile fonctionne et écoutez les instructions diffusées localement.
- Faites-vous une réserve d'aliments, d'eau potable et de fournitures médicales.
- Déménagez vos meubles et effets personnels à l'étage supérieur.
- Mettez en lieu sûr les polluants tels qu'insecticides, herbicides, etc.
- Après avoir enlevé la cuvette du cabinet, bouchez le conduit ainsi que le conduit d'égout au sous-sol au moyen d'une cheville de bois ou d'un sac de graine de lin.
- Assurez-vous que vos gouttières ne se déversent pas dans le système d'égout de la maison.
- Certains domiciles peuvent être protégés au moyen de sacs de sable ou de barrières en polyéthylène, mais l'emploi de ces matériaux exige des méthodes spéciales. Avant de les employer, consultez les agents locaux préposés aux mesures d'urgence.

Si l'inondation vous force à quitter votre domicile . . .

Apportez:

- Votre radio transistor et des piles de rechange;
- une lampe de poche et des piles de rechange;
- des vêtements chauds et des vêtements de dessus et des couvre-chaussures imperméables ainsi que des couvertures;
- les médicaments essentiels, les articles nécessaires au soin des bébés, des articles de toilette personnelle et tous les approvisionnements de secours possibles;
- un document quelconque d'identité pour chaque membre de la famille;
- vos documents personnels et familiaux.

Si vous conduisez votre voiture, faites-le avec prudence.

Pour avoir d'autres renseignements au sujet des tempêtes de vent, des tremblements de terre, des pannes d'électricité en hiver, la conduite en hiver durant les tempêtes, ou de la guerre nucleaire, vous

- Make sure your battery radio is in working order and listen to local instructions.
- Have emergency food, water and medical supplies on hand.
- Move furniture, electrical appliances and other belongings to upper floors.
- Remove weed killers, insecticides, etc. to prevent pollution.
- Remove toilet bowl and plug basement sewer drains and toilet connection. A linseed bag or wooden plug is ideal.
- Disconnect eavestroughs if they are connected to the house sewer.
- Some homes may be protected by using sandbags or polyethylene barriers, but special methods must be used for each. Don't attempt this type of protection without specific instructions from your local emergency officials.

If a flood forces you from your home . . .

Take with you:

- Battery-powered radio and spare batteries;
- flashlight with spare batteries;
- warm clothing, waterproof outer garments and footwear, and blankets;
- essential medicines, infant care items, personal toiletries and as many emergency supplies as you can;
- means of identification for each member of your family;
- personal and family documents.

If using your car, drive with extreme care.

For other self-help advice on what to do in windstorms, earthquakes, winter power failures, driving in winter storms, or nuclear war, please write Box 10,000 in your provincial capital or contact the Emergency Planning Canada regional office in that city; or contact:

Emergency Planning Canada,
3B, 125 Sussex Drive,
Ottawa, Ont.
K1A 0W6
Phone: Area code 613 992-3322
992-9909

Plan for tomorrow - TODAY!

FLOODS

Flood threats to particular areas can usually be forecast by constant evaluation of rising water tables resulting from heavy rain, surveys of snow conditions in river drainage basins, meteorological observations and forecasts.

Flash or sudden flooding, in which warning time is extremely limited, can result from other causes such as earthquakes, tidal waves, hurricanes, violent storms or bursting of dams.

In either case, local government authorities will keep residents of areas likely to be affected informed of developments. Through the media they will recommend actions people should take to limit or prevent disaster.

Detailed instructions by municipal or provincial authorities will be designed to meet immediate needs.

Checklist — should a flood threaten

Electricity

Shut off power in premises in immediate danger of flooding. Don't attempt to do so if the main switch is in a location that has already been flooded. If conditions are wet around the switch box, stand on a dry board and use a dry stick to turn the switch off.

Flooded electrical equipment should be checked by a qualified electrician before being used again.

Heating equipment

Special precautions should be taken to safeguard or minimize damage to electrical, natural gas or propane heating equipment. If warning time permits, consult your supplier for steps to be taken. If your heating equipment has been flooded, do not attempt to put it back into service until it has been thoroughly checked by a specialist.

Water contamination

If through taste, color or odor, you suspect that your drinking water has been contaminated, purify it before drinking by boiling, or adding purification tablets, or chlorinating it with a bleaching compound. If the latter is used, add one or two drops per litre and allow to stand for 30 minutes before drinking.

WHEN TO RETURN HOME

Do not return home until there is a safe supply of water and a satisfactory system for disposal of human waste and garbage. If in doubt, contact your local health unit office. If your home is in an area served by a public water supply, it is very possible the water will be safe.

Contact your local health unit regarding possible contamination of water or foodstuffs. Generally, however, to avoid a health hazard from eating food that has been contaminated with flood waters, health officials recommend that the following foods be destroyed:

Non-liquid foods, including dried fruits, cereals, flour, shortenings, spices, packaged goods, meats (fresh and cured), canned goods (if damaged or showing signs of seepage), bottled food products, including home preserves, bottled drinks because of contamination under the edge of the cap, leafy vegetables.

ELECTRICITY

Do not turn on electrical switch or flooded electrical equipment unless checked by a qualified electrician.

FLOOD RECOVERY

Your local media will carry information about assistance programs. Additional information may be received from your local government.

PROVINCIAL EMERGENCY PROGRAM

Most communities have established municipal emergency programs to coordinate flood fighting and other countermeasures. Look in the telephone directory white pages under the listing *Emergency Program* for the emergency program nearest you.

The Provincial Emergency Program head office in Victoria (387-5956) is supported by several field offices located throughout the province. Consult your local listings for the office serving your area.

Use phone for emergencies only.

Please do not phone the police, fire department, city hall, or the emergency program office unless you need help or wish to report an emergency. Your radio will keep you informed.

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PROVINCIAL EMERGENCY PROGRAM

FLOOD PRECAUTIONS FOR HOMEOWNERS

Ministry of Attorney General

175.

FLOOD THREAT PRECAUTIONS

In order that flood damage to your personal property and the disruption of your day-to-day life is minimized, there are certain precautions you may take. Of necessity, the information provided is general and we suggest you contact your local government for specifics related to your community.

The following suggestions apply when there is immediate danger of flooding.

ELECTRICAL SERVICE

Shut off power to premises. If the main switch is in an area that is already wet, stand on a dry board and use a dry stick to turn switch off. Do not attempt to turn off power if the room is already flooded.

ELECTRICAL APPLIANCES

Disconnect all electrical appliances and, if possible, move them to a higher level. Thermally-insulated appliances such as freezers, refrigerators, and ranges should be given priority. Any appliances that cannot be moved should have motors, fans, pumps, etc. removed to higher levels.

GAS OR OIL FURNACES AND APPLIANCES

Oil or water tanks will float if not full. Fill them if possible, then plug vent holes. If unable to fill, weigh down with sandbags or wedge against a solid object.

Propane gas tanks will float whether full or empty, so turn off valve, and disconnect and plug tubing. Tie a chain or cable around the tank and anchor it to prevent it from floating away.

PLUMBING FIXTURES AND WATER SUPPLIES

Turn off water supply.

Plug all basement sewage connections, i.e. toilet, sinks, showers, etc., with a wooden plug or other device. The plug should be held in place with a weight or wood brace to the joist above.

OTHER PRECAUTIONS

Pesticides, weed killers, fertilizers, and other articles that may cause pollution should be moved to higher levels.

In order to relieve overloading of the storm drain and sewer system, disconnect any downspouts draining to them. Move or remove all furniture and personal effects that could be damaged by flooding or which may float and cause damage.

EVACUATION OF YOUR RESIDENCE

Prepare a personal needs checklist now before there is an emergency; remember you may not be able to return for forgotten items. Here are some suggestions; take the following with you for all family members:

Warm clothing, waterproof footwear, sleeping bags or blankets, personal care items, prescription medication, personal identification, battery-operated radio, flashlight, and spare batteries.

Lock all doors and windows and double-check to ensure gas, electricity, and water are shut off. Give reasonable consideration to your pets.

Take extra care when driving; once-familiar roads may be dramatically different when flooded. Be alert for damaged bridges, slides, washouts, and downed power lines. Look for emergency personnel and information signs. Obey officials who may be directing traffic and other operations related to the flood — they are there to assist you.

WATER CONTAMINATION

If, through taste, color, or odor, you suspect that your drinking water has been contaminated, purify it before drinking by boiling, or adding purification tablets, or chlorinating with a bleaching compound. If the latter is used, add one or two drops per litre and allow to stand for 30 minutes before drinking.

APPENDIX G

A COPY OF A CITY ENGINEERING HAZARD ADVISORY LETTER DISTRIBUTED TO THE SOUTHLANDS RESIDENTS IN EARLY 1987

APPENDIX H

LETTER OF INTRODUCTION AND QUESTIONNAIRE DISTRIBUTED TO THE SOUTHLANDS FLOODPLAIN RESIDENTS

QUESTIONNAIRE ON FLOOD AWARENESS IN SOUTHLANDS

This questionnaire is being distributed to those residents in Southlands below South West Marine Drive, residing on the floodplain between Angus Drive and the Shaughnessy Golf Course.

You do have a right to refuse to participate in this questionnaire or withdraw at any time.

INSTRUCTIONS: Please feel free to make additional comments on any of the following questions.

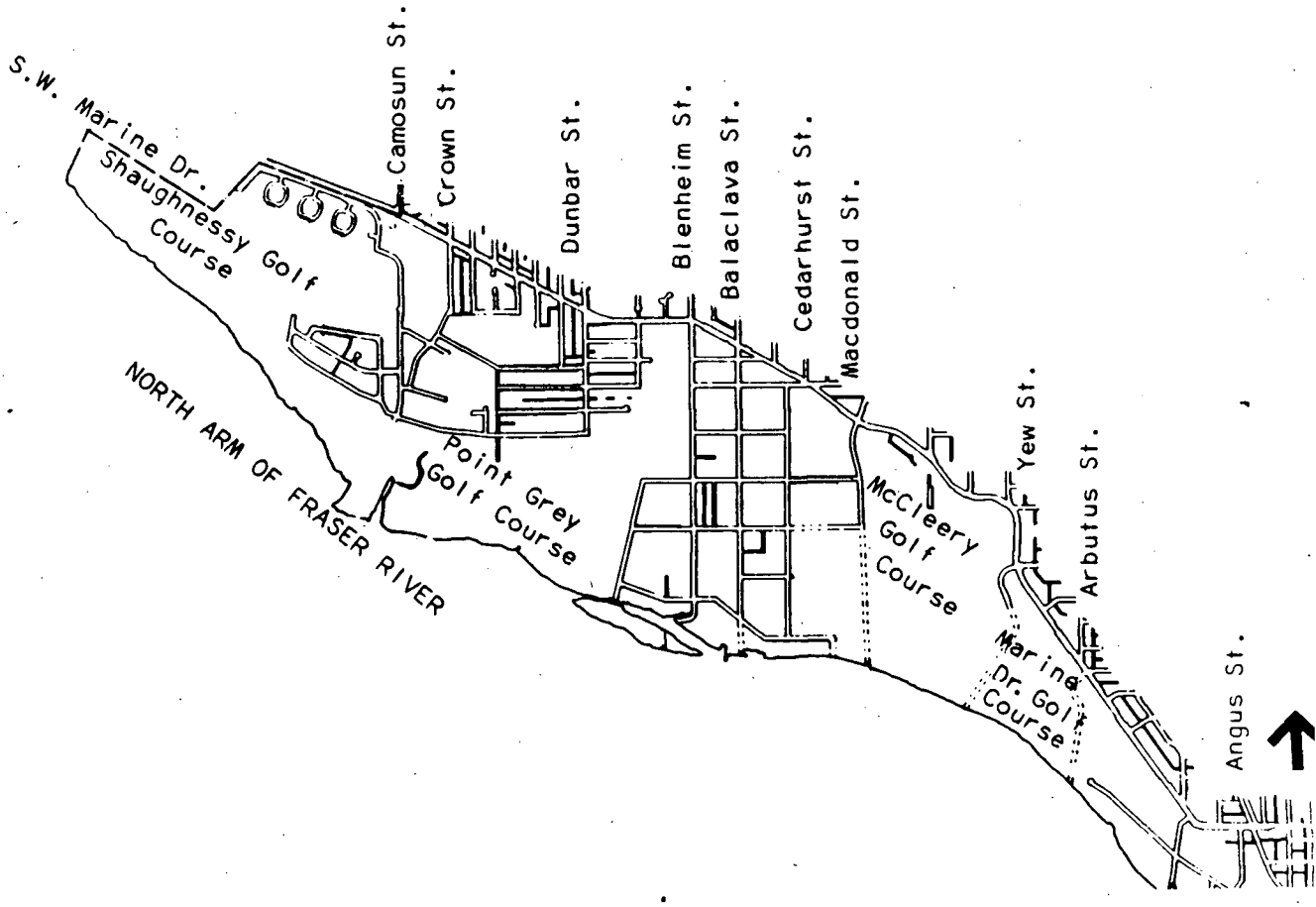
1. Have you ever (in your lifetime) experienced a flood?

   - o Yes _____
   - o No _____
   - o If YES, when, (year) _____

     where, (location) _____

     and what, (cause) _____

2. Please shade the area on the map below where you think the floodplain in Southlands is located.



3. How long have you lived at your present address in Southlands?

- Less than 2 years _____
- 2 - 10 years _____
- 11 - 20 years _____
- More than 20 years _____

4. To your knowledge has any part of Southlands ever been flooded?

- Within the past year _____
- Within the past 2 to 5 years _____
- Within the past 6 to 10 years _____
- More than 10 years ago _____
- Don't know _____

5. Do you know what are the potential causes of flooding in Southlands?

- Yes _____
- No _____
  - If YES, what? _____

_____

_____

6. Has your house or property in Southlands ever been damaged by flooding?

- Yes _____
- No _____
- Don't Know _____
  - If YES, what was the cause of the flood and what dollar cost in damage did you suffer?

_____

_____

7. When you moved to Southlands, did you consider that your home might be subject to flooding?

   o Yes _____

   o No _____

   o If YES, what checks did you make to evaluate the flood hazard?

   _____

   _____

8. If you were explicitly made aware that the area might be subject to flooding, would you still have gone ahead and bought the house?

   o Yes _____

   o No _____

9. Do you believe that it is important that prospective home buyers are made aware of the possible risk of flooding?

   o Yes _____

   o No _____

   o If YES, whose responsibility should that be?

   _____

10. Do you know whether the community or the government has looked into flood protection in Southlands?

   o Yes _____

   o No _____

   o If YES, who? _____

   _____

11. Did they write a report?

- o Yes _____
- o No _____
- o Don't Know _____
  - o If YES, did you read the report?
    - o Yes _____
    - o No _____

12. To your knowledge has there been much discussion of the flood hazard in this district?

- o Yes _____
- o No _____
  - o If YES, who? (Mark all appropriate)
    - o Neighbour _____
    - o Government Official _____
    - o Local Community Organization _____
    - o Other (please specify) _____

13. Compared to others you know in Southlands, do you think you talk about floods:

- o More often _____
- o Less Often _____
- o Just about the same as others _____

14. Do you think the flood hazard is serious in Southlands?

- o Very Serious _____
- o Serious _____
- o So-so _____
- o Not serious _____
- o Negligible _____

15. Using a scale of 0 to 100, what would you say is the likelihood of your house or property being flooded (under present circumstances)? (Please choose once in each column)

	A Within the next year	B Within the next 5 years	C Within the next 20 years	D Within the lifetime of your house	E Within your lifetime
0% (won't happen)	_____	_____	_____	_____	_____
25% (slight chance)	_____	_____	_____	_____	_____
50/50 (odds even)	_____	_____	_____	_____	_____
75% (sure it will flood)	_____	_____	_____	_____	_____
100% (certain flood)	_____	_____	_____	_____	_____

16. Do you know of anything that has been or is being done to lower the chances of flooding in Southlands?

- o Yes _____
- o No _____
  - o <u>If YES</u>, what? _____

_____

17. Do you know the different types of protective measures that can lessen the impacts of floods?

- o Yes _____
- o No _____
  - o If YES, what are the possible measures? _____

_____

_____

18. Have you done anything that would reduce the damage to your house or property if there were a flood?

- o Yes _____
- o No _____
  - o If YES, what? _____

_____

19. Is there a warning system set up in the community so that you would be notified if there was a chance that you would be flooded?

- o Yes _____
- o No _____
- o Don't know _____
  - o If YES, what is that system? _____
  - o If NO, do you think it would be good to have such a system?
    - o Yes _____
    - o No _____

20. Do you have insurance on your home and contents?

- o Yes _____
- o No _____
  - o If YES, does it cover flood damage?
    - o Yes _____
    - o No _____
    - o Don't know _____

21. Do you think more buildings should be allowed on the floodplain?

- o Yes _____
- o No _____
  - o If YES, should the new housing not be eligible for compensation for floods?
    - o Yes _____
    - o No _____

22. How high above the watertable (i.e. level of ground water) is the lowest floor of your house (that could be damaged if there was a flood)?

- o _____ feet
- o Don't know _____

23. Do you feel that new or improved dykes would provide you with sufficient protection from flooding?

- o Yes _____
- o No _____
- o Don't know _____

24. Do you feel that structural floodproofing (i.e. raising the house) would provide you with sufficient protection from flooding?

- o Yes _____
- o No _____
- o Don' know _____

25. Do you think enough is being done to prevent flood damage in Southlands?

- o Yes _____
- o No _____
- o Don' know _____
  - o If NO, what else could or should be done? _____

_____

26. Within the last two years, have you received any information on what you can do to protect your property from flooding?

- o Yes _____
- o No _____
  - o If YES, in what form was the information?
    - o Leaflet/brochure _____
    - o Radio _____
    - o Television _____
    - o Personal contact _____
    - o Public meetings _____
    - o Newspapers _____
    - o Other (specify) _____

27. Has the government provided you with any information on flooding and possible flood protection measures?

- o Yes _____
- o No _____
  - o If YES, which level of government:
    - o Prov. Ministry of Environment _____
    - o Environment Canada _____
    - o City Engineering Dept. _____
    - o City Planning Dept. _____
    - o City Permits & Licenses Dept. _____
    - o Other (specify) _____
  - o If YES, was the information:
    - o Not useful _____
    - o Somewhat useful _____
    - o Very useful _____

28. Do you feel that you are well informed about flood hazards in Southlands?

- o Yes _____
  - o If YES, source of information? _____
- o No _____
  - o If NO, why? _____

29. Do you feel that you are well informed about ways to deal with the flood hazard situation?

- o Yes _____
  - o If YES, source of information? _____

- o No _____
  - o If NO, why? _____

30. Do you feel that generally government has done a good job in communicating to you information about flood matters?

- o Yes _____
  - o If YES, why? _____

- o No _____
  - o If NO, why? _____

31. Have you had any exposure to the Southlands Local Area Planning Program?

- o Yes, I am a member _____
- o Yes, I have attended meetings _____
- o Yes, I have read the literature (committee minutes reports, etc.) _____
- o No, I have had no direct contact _____
  - o If YES, do you think the Southlands Local Area Planning Program has been of any value in raising awareness of flood hazard, and possible ways to deal with that hazard?
    - o Yes _____
    - o No _____

32. In which of the following age groups are you?

- o Under 17 years _____
- o 18 - 24 years _____
- o 25 - 44 years _____
- o 45 - 64 years _____
- o Over 65 _____

33. What is your occupation?

- o Managerial, administrative and related occupations _____
- o Professional and technological occupations _____
- o Clerical & related occupations _____
- o Sales occupations _____
- o Service occupations _____
- o Primary resource occupations (eg. fishing, farming, etc.) _____
- o Manufacturing occupations _____
- o Other, please specify _____

34. Education: (Please check highest level completed)

- o Less than 12th grade _____
- o High school graduate _____
- o Some college _____
- o College graduate _____
- o Professional training (nursing, etc.) _____
- o Some graduate work _____
- o Master's degree _____
- o Some graduate work beyond masters _____
- o Doctorate (M.D., Ph.D., etc.) _____

35. **In which one of the following areas in Southlands is your house located?**

- o **Musqueam Indian Reserve** _____
- o **West Southlands** _____
- o **Blenheim Flats** _____
- o **Angus** _____
- o **Other, please specify** _____

36. **Additional Comments:**

_____

_____

_____

_____

_____

_____

_____

THANK YOU FOR YOUR TIME AND PARTICIPATION IN COMPLETING THIS QUESTIONNAIRE.