

333 94TH



*This is my beautiful home*

**Risk perceptions towards flooding and  
environment in low income urban communities**

**A case study in Indore, India**



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**Cover:** Drawing by Javed Khan of Karbutakana, aged 10 years. This shows his house next to the nullah (in which a fish can be seen swimming); a pigeon (the translation of the Hindi word *kabuta*) and Moslem symbols of the moon and 6 pointed star.

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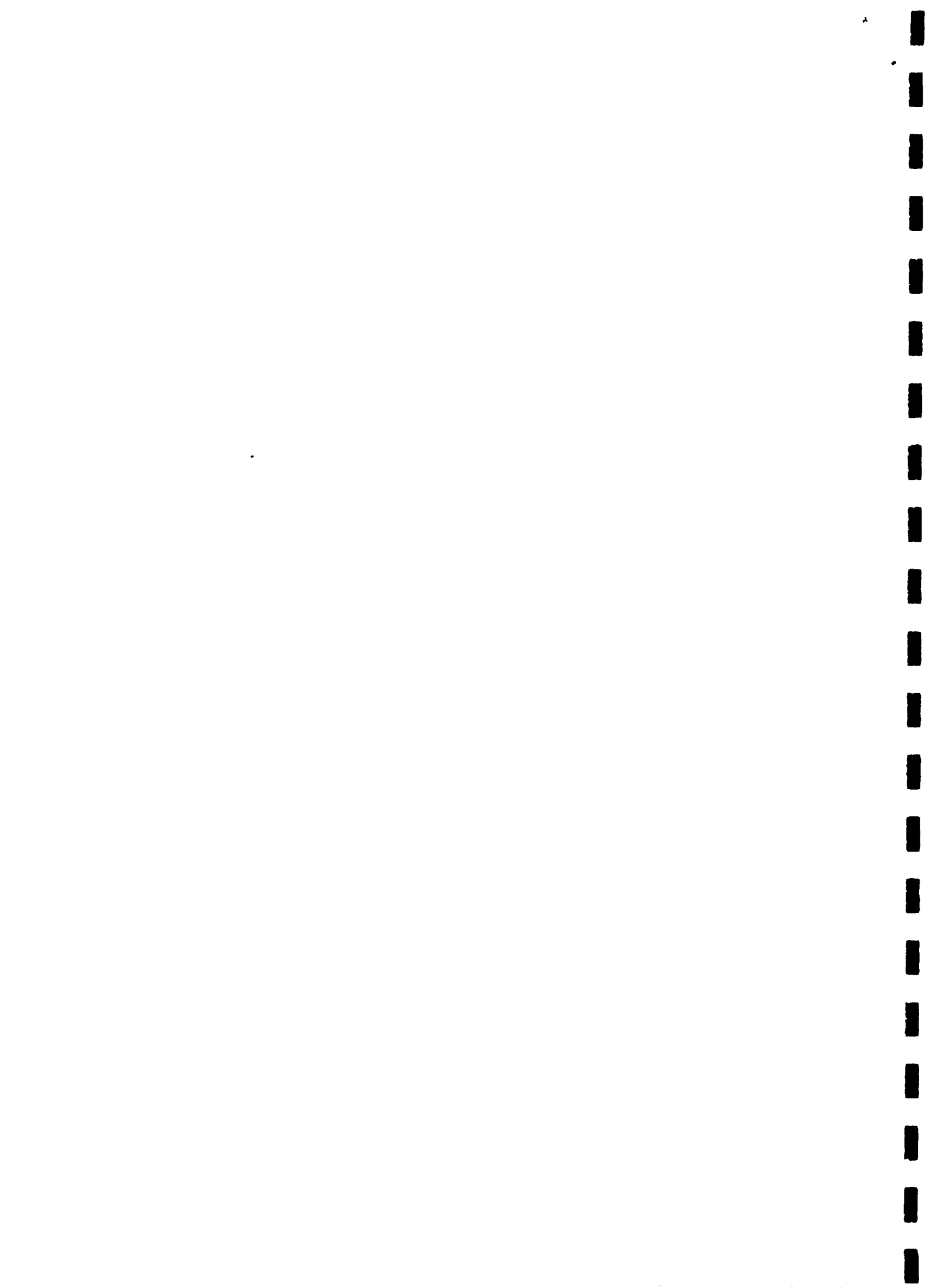
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The Flood

*We asked for rain. It didn't flash and roar.  
It didn't lose its temper at our demand  
And blow a gale. It didn't misunderstand  
And give us more than our spokesman bargained for;  
And just because we owned to a wish for rain,  
Sent us a flood and bid us be damned and drown.  
It gently threw us a glittering shower down.  
And when we had taken that into the roots of grain,  
It threw us another and then another still,  
Till the spongy soil again was natal wet.  
We may doubt the just proportion of good to ill.  
There is much in nature against us. But we forget  
Take nature altogether since time began,  
Including human nature in peace and war,  
And it must be a little more in favour of man,  
Say a fraction of one percent at the very least,  
Or our number living wouldn't be steadily more,  
Our hold on the planet wouldn't have so increased.*

The Gift Outright  
Robert Frost (1973 p.203)



## EXECUTIVE SUMMARY

This study aimed to investigate individual and group perceptions of, and adaptations to, flooding as an environmental risk. The study, conducted in August and September 1994, was based in 4 low-income communities in Indore, India and formed part of a larger research project evaluating stormwater drainage interventions.

### Methods:

Several complementary qualitative methods were used. Case studies of individuals and families living in the study areas were undertaken. These case-studies were built up using in-depth interviews with 19 residents and with key informants and also by observation of adaptations made in the private and public environments. 11 focus group discussions were also conducted. Analysis of local English language newspaper reporting on flooding was undertaken during the study period.

All interviews and focus groups were conducted in an informal environment and were guided by an interview checklist developed and piloted by the authors. This list included the advantages and disadvantages of living in the area, definitions of flooding, the effects of flooding on their lives and environment and the importance of flooding in relation to other problems. The research was conducted during the monsoon season, before and after several flood events, in 4 communities, of which 2 were at high risk for flooding and 2 at lower risk.

### Results:

#### 1. Community and Individual perceptions of flooding as a risk:

- 1.1 A range of descriptive terms has developed to interpret the hazard of flooding. *Bhadh* or flooding is used to describe inundation in large water systems such as rivers. Other terms, such as 'water fills up' and 'water collects' are used to describe the inundation experienced in flat areas. In this report the word 'flooding' is used to refer to the experiences of nullah dwellers while 'inundation' is used for the rise in water level in flat areas.





- 1.2 In the communities studied, flooding is primarily perceived as a natural event necessary for agriculture and is tolerated even though it may have problematic effects. A 'hazards culture' has therefore developed with coping mechanisms seen as part of usual activities. Man-made interventions, which are perceived to disturb natural flood patterns adversely, are not well tolerated.
- 1.3 Flooding was ranked low in comparison to other risks and problems, such as improvements in job opportunities, provision of housing, mosquitoes and smelly backlanes, in the areas studied.
- 1.4 The risks of flooding during the monsoon season are borne as part of a 'trade-off' of the risks and benefits, both social and economic, of living in a flood-prone area. These benefits include centrality in the city, access to sources of employment, low land costs, access to services, well developed social support networks and safety for children.
- 1.5 The social and economic risks of flooding and inundation are not evenly distributed across the city or across susceptible communities. Poorer households and those which are poorly adapted to flooding appear to be most affected. Businesses are also differentially affected, depending on the type of product sold and the nature of service provided.
- 1.6 The health risks of flooding and inundation, as understood by respondents, relate to their classification of water 'types' according to measures of quality such as composition and clarity. Floodwater is used in different ways depending on its perceived quality.
- 1.7 Residents feel that the after-effects of flooding and inundation, such as standing water, contaminated mud and noxious odours, are more important than the immediate effects, which may include water entering homes and, in riverbank areas, loss of possessions.



## **2. Individual and group responses to flooding:**

- 2.1 Householders in all 4 areas studied have made both permanent and temporary adaptations to flooding and inundation in their home environments. These include raising plinth levels and paving courtyards, using landfill, building houses out of materials which resist flooding and ensuring that shelving and wiring are above expected water levels. Newer residents appear to be less well adapted to flood conditions
- 2.2 The predictability of changes in water levels and the rate of rise of water levels are seen by residents as more important than the actual duration or depth of the flood. Residents have developed sophisticated flood prediction and protection systems and contingency plans for evacuating persons and possessions. These systems are dependent on local environmental conditions remaining stable. Short-term predictability is believed to have been reduced by recent engineering interventions and residents see themselves as adversely affected. Maintenance of drainage interventions is also seen to influence the predictability of flood events.
- 2.3 In the area where underground stormwater drains have been built, residents perceived these as being less efficient than pre-existing open drains. Some improvements were seen to have adversely affected the community as a whole.
- 2.4 In response to flooding, sophisticated routines of mobilising support and assistance in local communities have been developed. Communities differ in their dependence on municipal, state and religious network resources. The severity of flooding also influences the extent to which these support networks are mobilised.
- 2.5 Analysis of the municipal and state compensation systems show the relationship between political power and vulnerability to environmental risk. Some communities in Indore are able to use and manipulate the compensation system for gain, while political structures may receive



support in return. Compensation may also provide perverse incentives for settlement on very marginal land. The support systems available allow residents of flood-prone communities to mitigate the effects of flooding on their household and family.

2.6 The print media within Indore appears to be an important player in creating, filtering and distributing perceived risks. The relationship between media accounts of risk events and the social construction of risk is complex, and includes issues such as relations between the communities concerned and civic structures, the religious and/or caste structure of the communities and local perceptions of the relative importance of flooding.

2.7 Within flood-prone areas a differentiation is made between 'public' and 'private' spaces, and this in turn affects residents' perceptions of the distribution of responsibility for the maintenance of these spaces. This differentiation varies between the different areas studied and, to an extent, between individuals.

### **Conclusions and Policy Implications:**

In the context of policy-making on flood interventions, it is crucial that local perceptions of and adaptations to the environment are understood. Despite living in areas which experience severe flooding during the monsoon season, the study showed that residents of flat and nullah-based areas did not see flooding or inundation as a major problem in relation to the benefits of the area and in relation to other local issues. However, residents are not equally affected by flooding, which emphasizes the need to understand the differential impact of risk before developing policy. Issues such as the predictability of flood events, the after-effects of inundations and local understanding of the risks of contaminated water all reinforce the need to tailor interventions to local coping strategies and to support these where possible. The impact of flooding can also be seen to spread outward from the individual to local institutions. Strategies to minimise the impact of flooding therefore need to attempt to incorporate low-income settlements into broader city structures. As with any qualitative study, caution should be taken in generalising from the results.



## ACKNOWLEDGEMENTS

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## GLOSSARY OF TERMS AND ABBREVIATIONS

bahrsad ka pani - rainwater

bhad - flooding

bhangi - sweeper

bidis - hand-rolled cigarettes

chai - tea

chals - rooming houses

charpoy - wood and rope bed

dhobi - clothes washer and ironer

ganda gee - faecally contaminated mud

ganda pani - faecally contaminated water

halka aur lamba - light and steady

IDA - Indore Development Authority

IMC - Indore Municipal Corporation

kirana shop - small general store

kitanuh - small unseen insects

lamba aur bhari - steady and heavy

maila pani - dirty water without excreta

masala shop - snack shop

NGO - non-governmental organisation

nullah - small river

ODA - United Kingdom Overseas Development Administration

pan shop - betel nut and cigarette shop

pani bahr jata hai - water gets filled up

pani jam jana - water collects

pani ni ka bahve badana - a rise in water level

pata - leasehold

pi'neh ka pani - drinking water

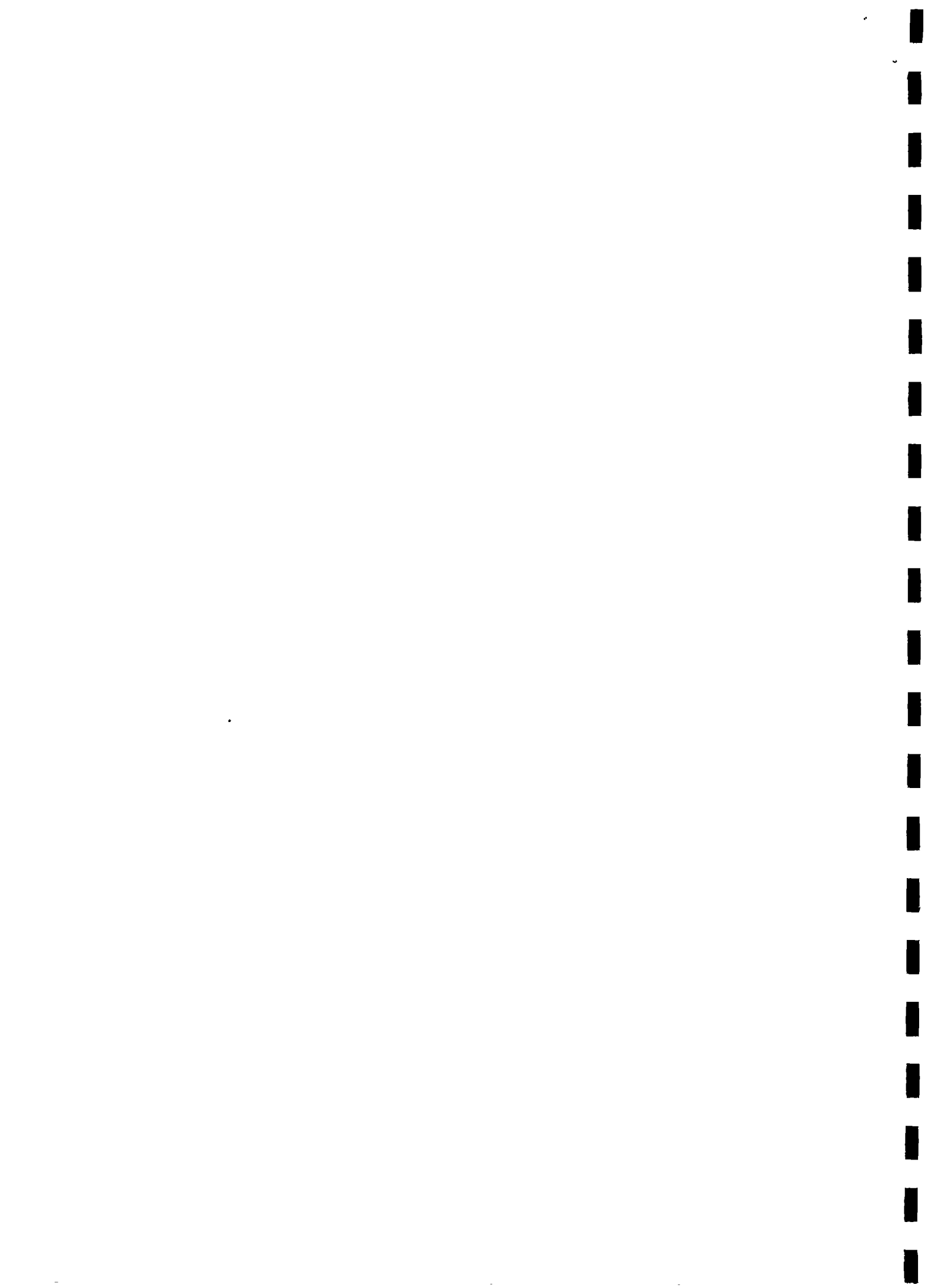
pukka house - house constructed of concrete and/or brick with galvinised corrugated sheet roof

Rs - Ruppees. At the time of study Rs35 = US\$1.

tej aur lamba - intense, longer

tej aur toda der - intense but short-lived

saf pani - clear water



# MAP OF INDORE, MADHYA PRADESH STATE, INDIA

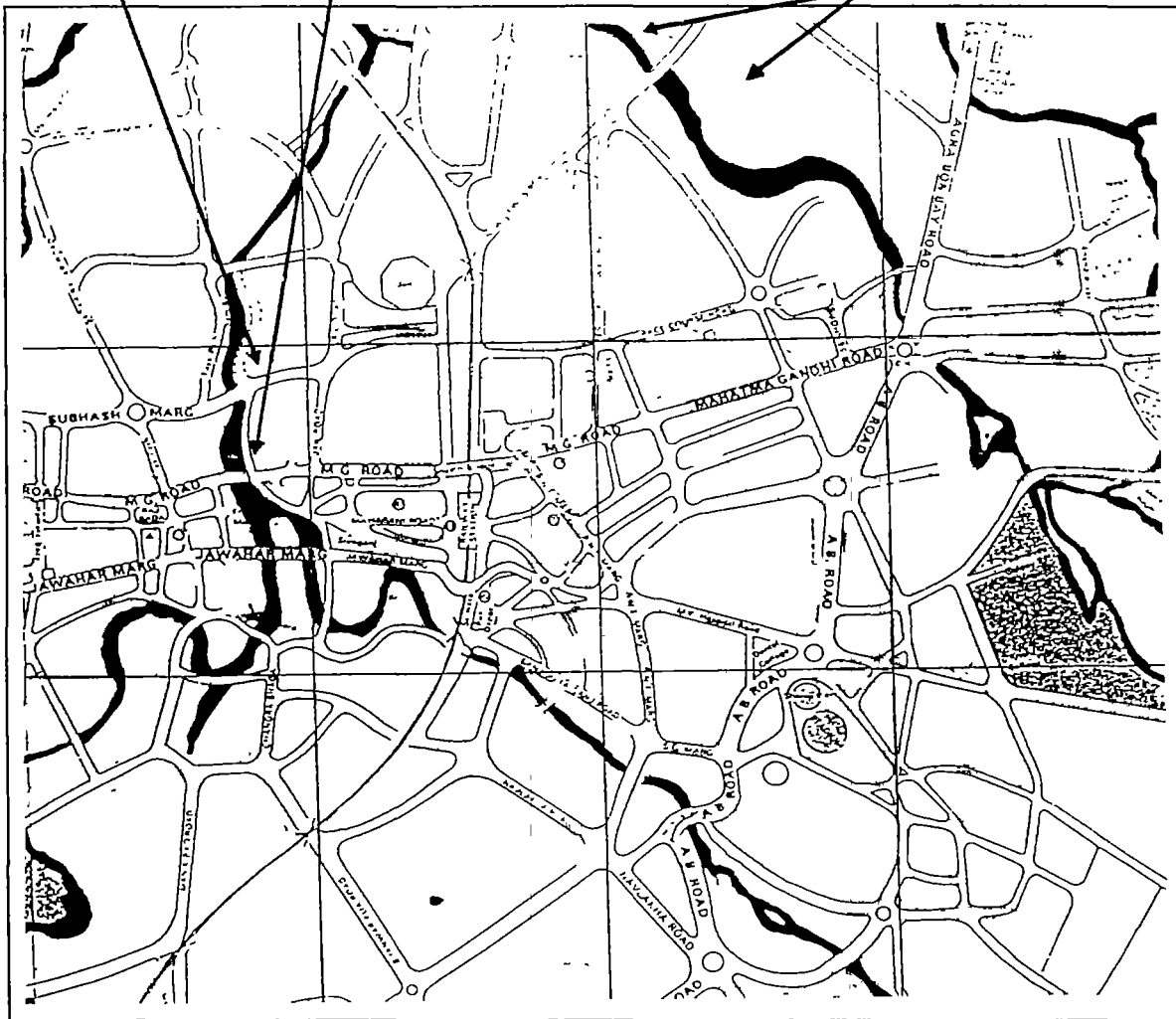
Rivers are shown as heavily shaded lines.

Chandra Shekha Nagar

Karbutakana

Motilal-ki-Chal

Pardesipura







## INTRODUCTION

This report has been prepared as part of a larger collaborative research project undertaken by staff of the Departments of Public Health & Policy and Epidemiology & Population Sciences of the London School of Hygiene & Tropical Medicine with the Department of Anthropology in the University of Andhra Pradesh and the Department of Civil Engineering in the Shri G.S. Institute of Technology and Science. The project overall has attempted to evaluate stormwater drainage interventions aimed at controlling or ameliorating the effects of flooding experienced by communities within the city of Indore, in Madhya Pradesh, India. The qualitative work reported here was undertaken as a complementary part of the project and was a study of community perceptions of and adaptations to the environmental risk of flooding. The qualitative study was undertaken during periods of flooding (Monsoon) in the months of August and September 1994. The qualitative work had the following aims:

### Qualitative Study: Aim and Objectives

Overall aim: To investigate individual and group perceptions of, and adaptations to, flooding as an environmental risk.

Specifically:

- a. To assess community perceptions of flooding as a risk to quality of life, particularly in relation to other environmental and/or socio-economic circumstances.
- b. To analyze community perceptions of risks and problems associated with flooding in relation to specific aspects of the risk (including depth; duration; intensity of rain; velocity of flow and quality of water) and specific aspects of impact (on health; work; convenience; livelihoods etc)
- c. To examine individual and group responses to flooding, including long and short-term modifications to individual and community environments.

### Background

Flooding is just one of the environmental and economic threats facing urban dwellers in low-income settlements (see for example Bradley et al 1992 for a review of epidemiological impacts of the urban environment on health). In other words, the risk of experiencing a flood or inundation in one's home



or residential area may form only one of a series of influences on peoples' quality of life and perceptions, or more specifically on people's choice of residence, choice of building design and on their behaviour towards their living environment generally. This may seem an obvious observation but it is an important point to state at the outset, particularly when one is trying to understand why people are making what appear to outsiders as a questionable set of decisions about where they live, and how they live.

The photograph on p.48 illustrates the logical paradox facing people living in low-income settlements in many cities and a paradox vexing many of those trained in public and environmental health: people living in the conditions illustrated by the photograph are at apparent environmental health risk - from flooding per se; from pollution by excreta-contaminated stormwater; from loss of home and livelihoods..... The list is lengthy and the technical threats posed by the environmental health hazard of inundations are quantified in depth by the public health engineering section of this project. Yet people living in the conditions of risk have selected the site; have stayed there for many years and, most paradoxically, will attempt to move back if well-meaning planners move them to more (theoretically) habitable conditions. Why? Apparently, because they have other priorities, and because for most people, one environmental risk is placed, consciously or unconsciously, within a broader set of attitudes towards the environment in which one lives, thrives, adapts or dies

Putting this theoretically, the perception of environmental risks can be defined as '.. the process whereby individuals and groups judge the degree of danger they face in relation to the benefits they enjoy by staying where they are, and hence search for and evaluate various means of reducing that danger should they be motivated to do so. Perception is regarded as the mechanism which links judgement to action.' (O'Riordan in Kates et al 1986 p.281). On a broad level, it can be proposed that events relating to hazards<sup>1</sup> '...interact with psychological, social, institutional and cultural processes in ways that can heighten or attenuate perceptions of risk and shape risk behaviour.' (Kasperson 1992 p.158-8). This theory of the 'social amplification' of risk implies that the experience of risk is both one of physical or potential physical harm *and* the result of the cultural and social processes through which *individuals or groups* interpret hazards. This interpretation can result in *attenuation or heightening* of risk perceptions and, thereby, the consequences of the risk or risk event. Such consequences could include, for example (in the case of amplification), demands for protective action or compensation following flooding or (in the case of attenuation), attempts to minimise negative reporting of a flood event. Clearly this interpretation of risk events is a complex one.

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<sup>1</sup>Hazards' have been defined as '...threats to people and the things they value ' (Kates, Hohenemser and Kasperson 1985 p 21)



In order to place flooding within the larger context of the "urban environment", we start by presenting briefly a classification of that environment which tries to incorporate different aspects of urban circumstance into one model. This aims to link the idea of the environment as an health risk as well as thinking about how people live in the urban setting, how they perceive the environment and how they adapt to it. Bradley et al in 1992, proposed a classification of the urban environment as it relates to man's health in which the urban milieu can be seen as a resource, as a hazard and as an ambience. Table 1 below shows this classification.

**Table 1: Proposed Environmental Classification for Health Analysis**

**Environment as:**

**Resource - availability, access, cost:**

- \* water
- \* health care
- \* food
- \* cooking facilities
- \* shelter

**Hazard - route of entry, prevention, containment, amelioration:**

- \* pollution
  - inevitable (personal wastes)
  - partly inevitable (domestic, some industrial)
  - preventable (occupational, locational)
- \* trauma
- \* vectors

**Ambience - protection, adaptation:**

- \* weather
  - temperature, humidity
  - surface water
- \* other people
- \* other animals

Source: Bradley et al 1992 p 4

If we relate this framework to flooding, we can see aspects of the physical phenomenon of inundation in each of the categories. In a broad sense, flooding can be seen as a **resource**, and as the report will show, for some groups the "hazard" is a literal source of environmental and socio-economic benefit. In contrast, this project has worked on the basic hypothesis that flooding is a **hazard** - and that engineering interventions should aim at containing and ameliorating the hazards of the environmental risk. As the report on people's attitudes to their environmental risks will show, people living in affected areas also have a perception of the hazards inherent in the flooding they experience. The risk, however, is fitted into a broad conception of the urban environment which incorporates the hazard sense of flooding within an understanding of their habitat more generally as



a place of resource and as an inevitable ambience. Finally, in a broad contextual sense, flooding is a part of the urban **ambience** within Indore: an inevitable consequence of living in the city, existing as it does on a flat floodplain in a Monsoon-prone climate. The inevitability of the ambience in itself affects people's ideas.

If we conceive of the urban environment in this three dimensional way, we can begin to understand the kind of choices people make and the kind of perceptions they hold. In this report, community and individual perceptions and interpretations of flooding as a risk are examined broadly, in order to try to answer the complex questions of why people continue to live in areas which experience heavy inundation, and whether and how they adapt their lives to cope with the risk. In answering these question we look at local understandings and definitions of flooding (the perceptions of the environment as ambience); we study the extent to which flooding is perceived as a risk (resource and/or hazard) in relation to other socio-economic or environmental circumstances faced by slum dwellers; we consider lifestyle adaptations and modifications adopted by slum dwellers and, finally, we examine the manner in which the risk of flooding is attenuated or amplified by social processes.





## RESEARCH METHODS

The overall approach to this study was qualitative, using rapid anthropological methods, which allowed an in-depth view of perceptions of flooding to be developed. Emphasis was on gaining community insights into aspects of flooding and flood control within the socio-cultural context of urban low and middle income communities. A selection of complementary qualitative techniques were chosen on the basis of the following criteria

- i. they should be non-intrusive to householders.
- ii. they should allow rapid analysis and feedback.
- iii. they should be capable of producing cross-validating data on community and individual perceptions of flooding.

To achieve the objectives of the study four principal methods were used.

- i. **Case studies** The case studies were used to understand an individual or family's background and experience of living in the areas, including recall of past events.
- ii. **Focus group discussions** These contributed to our understanding of the issues at a group level. A total of 11 focus groups were conducted. (For methodology see Stewart et al 1990; Khan et al 1992; Krueger 1994 )
- iii. **In-depth interviews.** For open-ended interviews an unstructured schedule was used covering key points. These informal interviews allowed the interviewee to express a wide range of views regarding flooding. The opinions of community members were elicited in 23 case studies and in-depth interviews. 19 discussions took place with people in or near their homes and 4 discussions were held with key informants such as the local project officer, the head of the Indore Development Authority community development division and the chief medical officer. A wide range of community members of different ages, incomes, castes and work were interviewed to develop a broad picture of community perceptions.
- iv. **Analysis of media responses** to flooding within the city; including types of geographic coverage; coverage of floods compared to other environmental problems and focus of coverage on different aspects of flooding.
- v. **Observation** during, before and after inundations in study sites and in Indore generally. This was used to verify statements made and to note relevant physical strategies of coping/not coping with floods, eg housing design, flooding levels and household goods. Particular care was taken to note adaptations, such as the raising of plinth levels and the construction of high



shelves, made to the private and public environments in response to flooding

The sites were visited frequently. Interviews were repeated at different times of the day. Interviews were conducted in Hindi and interviewees were asked the same set of core questions, including the advantages and disadvantages of living in the area, their definitions of flooding, the effects of flooding on their lives and environment and the importance of flooding in relation to other problems. The research design tried to achieve a balance between the three aspects of the study, i.e.

- i. appropriateness of the research techniques to the local conditions.
- ii. duration of the fieldwork.
- iii. reliability of data collected

The work was conducted in the months of August and September, which are part of the monsoon season. The rainfall pattern in central India, where Indore is situated, normally consists of monsoonal rains of varying intensity alternating with dry spells of days to weeks. This rainfall pattern makes it possible to collect data under varying conditions.

Initially, a pilot study was undertaken to, firstly, frame a checklist for interviews (see Appendix A) and, secondly, gain a rapid insight into the issues people consider to be relevant to flooding. During the pilot it became clear that individuals and groups have clear reasons for living in flood zones, one of them being the locational advantage these sites offer with respect to their livelihood. This understanding informed the development of the interview checklist and the study methods. Residents' perceptions of environmental problems and risks associated with flooding were approached from the perspective of the broader issue of why they find the area a good one to live in so as not to 'lead' responses on the problems of flooding and to site flooding within the context of other environmental problems.

The field study, using the above four techniques, generated a large body of data. At the analysis stage the data from these four techniques showed a marked degree of convergence which reinforced the reliability of the study. In addition, data on environmental phenomena from the view point of the community made it possible to examine cultural mechanisms such as prediction of flood levels and the health risks associated with flooding.

### **Site Selection:**

There are at least 183 slums in Indore, of which approximately 157 fall under the UKODA funded Slum Improvement Programme. The spatial distribution of these slums across the city is in three main areas: around the centre of the old city, in former mill workers' areas and newer slums on the periphery. The centre of Indore city is crossed by several nullahs or rivers and many slums are



situated on their banks or on the flood plain. Sites selected for this study, which was designed to complement an engineering study on flooding and drainage in flat areas of Indore, necessarily included the two sites selected by the engineers. Of these, one (Motilal-ki-Chal) has received improvements under the UKODA scheme while the second (Pardesipura) is unimproved. Both these sites can be described as flat with poor natural drainage. In order to explore differences in risk perceptions between residents of flat areas and those living in other high risk flooding areas, two improved sites in the city centre adjacent to a nullah, and prone to severe flooding, were also selected for investigation. These sites differ in the religious and ethnic background of the residents: Karbutakana is a predominantly Moslem community and Chandra Shekha Nagar (or Shekha Nagar) a Hindu community. This allowed comparison of the perceptions of these different groups.

A brief physical description of each areas follows.

i. Motilal-ki-Chal

This flat area has two main parts: the older section adjacent to the main road is the former location of the *chals* (rooming houses) which have been partially replaced by shops and family homes. There is also a large cluster of low-income houses in this area. The second section (also known as Nehru Nagar) is a planned suburb with a mixture of former mill workers' housing, largely occupied by lower income residents, and upgraded middle-income housing. Most houses are *pukka*, i.e. constructed of concrete and/or brick with galvanised corrugated sheet or concrete roofs, and have more than one story. Drainage consists of an underground stormwater system, a sanitary sewer system, and the use of streets as surface water channels.

ii. Pardesipura.

Originally farmland, this planned suburb is about 40 years old and consists of a mixture of former mill workers houses and newer middle-income housing. There are small pockets of low-income housing scattered through the area, but most buildings are *pukka*. Drainage is through a system of open channels and there are large areas of standing water in open spaces during the monsoon.

iii. Karbutakana.

Karbutakana was settled about 12 years ago on an area of sloping land next to a nullah. Housing is a mixture of *pukka* and shack structures, built with bricks and mud or wood, along narrow concreted paths. Most houses have electricity and water taps have been placed at vantage points along the paths. Drainage is through a mixture of covered and open drains down to the nullah. The population is approximately 200 families.



#### iv. Chandra Shekha Nagar

This area, upstream of Karbutakana, is also adjacent to a nullah and has a population of 500 families. Housing is almost entirely shacks, built of mud and brick or wood with galvanised corrugated sheet roofing, along narrow concreted paths. Most houses have electricity and taps are, again, located along the paths. Drainage is through underground stormwater pipes to the nullah.

#### **Selection of Respondents:**

Respondents were selected in order to achieve as broad a picture of the perceptions of flooding in the community as possible. The following factors were taken into account: spatial distribution of respondents; income; occupation, gender, vulnerable groups (such as tenants, those with no *pata* [leasehold]); the elderly and children; and key respondents, such as community leaders

#### **Data Analysis:**

Interviews were guided by the interview checklist, although notes were made after the meetings rather than at the time so as to reduce inhibition in the respondents. After the interviews the interviewing team discussed the responses, categorised them according to the checklist and produced a written record on a pre-structured form. These discussions allowed the interviewers to compare their memories of the interviews and acted as a cross-check on the results, thereby reducing inter-interviewer bias. Some modification of the checklist was undertaken during the fieldwork as the investigators' knowledge of the issues deepened. Later the data was categorised into broad areas relating to the objectives of the study to facilitate analysis. At this stage responses were compared across different areas, different individuals and groups, before and after flooding and during dry spells. The perceptions of flooding and local classification of natural and man-made phenomena were drawn out.

#### **Limitations of the Study:**

##### i. Reliability of results:

The reliability or consistency of results is sometimes seen as a problem in qualitative studies. In this study reliability was enhanced by a number of methods. Firstly, a checklist to standardise and systematize the issues covered in interviews and reduce inter-observer bias was produced. This was pretested in the study area and adapted accordingly. Secondly, interview reports were compiled by at least 2 researchers which allowed for cross-checking of data. Finally, data analysis was undertaken by the research team to further reduce inter-observer bias (Silverman 1993)

##### ii Validity of data:

Validity of data or the extent to which an account accurately represents the phenomena to





which it refers' (Hammersley 1990 p.57 cited in Silverman 1993) was enhanced in the study firstly by the use of several different qualitative methods and the comparison of results obtained to ascertain whether they corroborated one another. Secondly, results were fed back to the respondents during the study in order to validate the results with them. Thirdly, respondents were chosen in order to achieve a wide representation of views of different income, gender and occupation groups. Potential biases include the association of the researchers with the engineers and development workers responsible for the development programme. Residents may feel unable to be forthright about their opinions of drainage and other development interventions in the presence of potentially powerful municipal employees and, as is evidenced in Box 11, may produce different versions of events depending on the listener. This bias was minimised by the use of open-ended methods which encouraged a wide range of views to be expressed, by the approach of siting perceptions within a framework of the benefits of living in the area and by reassuring respondents of the researchers' independence from local structures

While the results of this study should only be generalised to other cities or communities with caution and full cognisance of different socio-economic contexts, the methods used may have a broader applicability for similar studies. The approach of contextualising perceptions of the environmental risks of flooding within a broader picture, which includes the advantages and disadvantages of living in an area, is particularly useful in ascertaining community environmental priorities and beliefs. If similar techniques are to be used in other studies or areas, they may need to be modified for the local context/culture and caution exercised in interpreting information gathered from respondents with different backgrounds.



## RESULTS AND DISCUSSION

Why do people continue to live in areas which experience heavy inundation, and where both person and property are at considerable risk, during the monsoon season? In answering this question it is necessary to look at local understandings and definitions of flooding, to study the extent to which flooding is perceived as a risk in relation to other socio-economic or environmental circumstances faced by slum dwellers.

### 1. Community and individual perceptions of flooding as a risk

#### 1.1 How is flooding perceived?

Flooding is primarily perceived as a natural, seasonal event. Residents believe that rain is an important natural and life-sustaining phenomenon (*'It has to come'*), and particularly important for agriculture, and therefore food supply. Respondents living next to the nullah also commented that, while the water may rise and flood, *"...it will later flow off"* and they would be able to continue with their daily lives. A sweet shop owner in Pardesipura noted that *'Without rain there is no food'* and *'Rain is a bother, but rain is a must'*. Thus flooding is tolerated as a natural event with positive attributes, even though it may have some problematic effects for the individual or household. This state, in which the risks of a hazard are downplayed and coping mechanisms viewed as a normal, regular part of daily activities, has been termed a 'hazards culture' and occurs where natural hazards, such as flooding, are pervasive (Cutter 1993 p.24). Changes in the nature of the hazard can, however, alter perceptions. 'Man-made' interventions, such as attempts to change or regulate the flow of the nullahs or improve local drainage, which are seen to disturb natural patterns of flooding and drainage and thereby reduce local predictive abilities and increase the chances of damage and loss of property, appear to be perceived negatively in the communities studied. Respondents were accepting of flooding or inundation caused by 'nature', but had a lower tolerance for what they perceived as man-made changes which could change a 'familiar' hazard into an 'unfamiliar' one and operated through mechanisms which were not necessarily fully understood. Whyte (cited in Kates et al 1986 p 255) has commented that 'people with different individual characteristics, roles in society, and cultural backgrounds will assign different mixes of natural versus man-made origin to the same hazard event.'

Residents of the areas studied use different terms to describe inundation, according to severity and danger. These are explored below.



1.2 Definitions of inundation:

In **flat areas** (Pardesipura and Motilal-ka-chal), respondents do not define as 'flooding' the water inundation which

"bhadh" - flooding  
"pani bahr jata hai" - water gets filled up  
"pani jam jana" - water collects  
"pani ni ka bahve badana" - a rise in water level

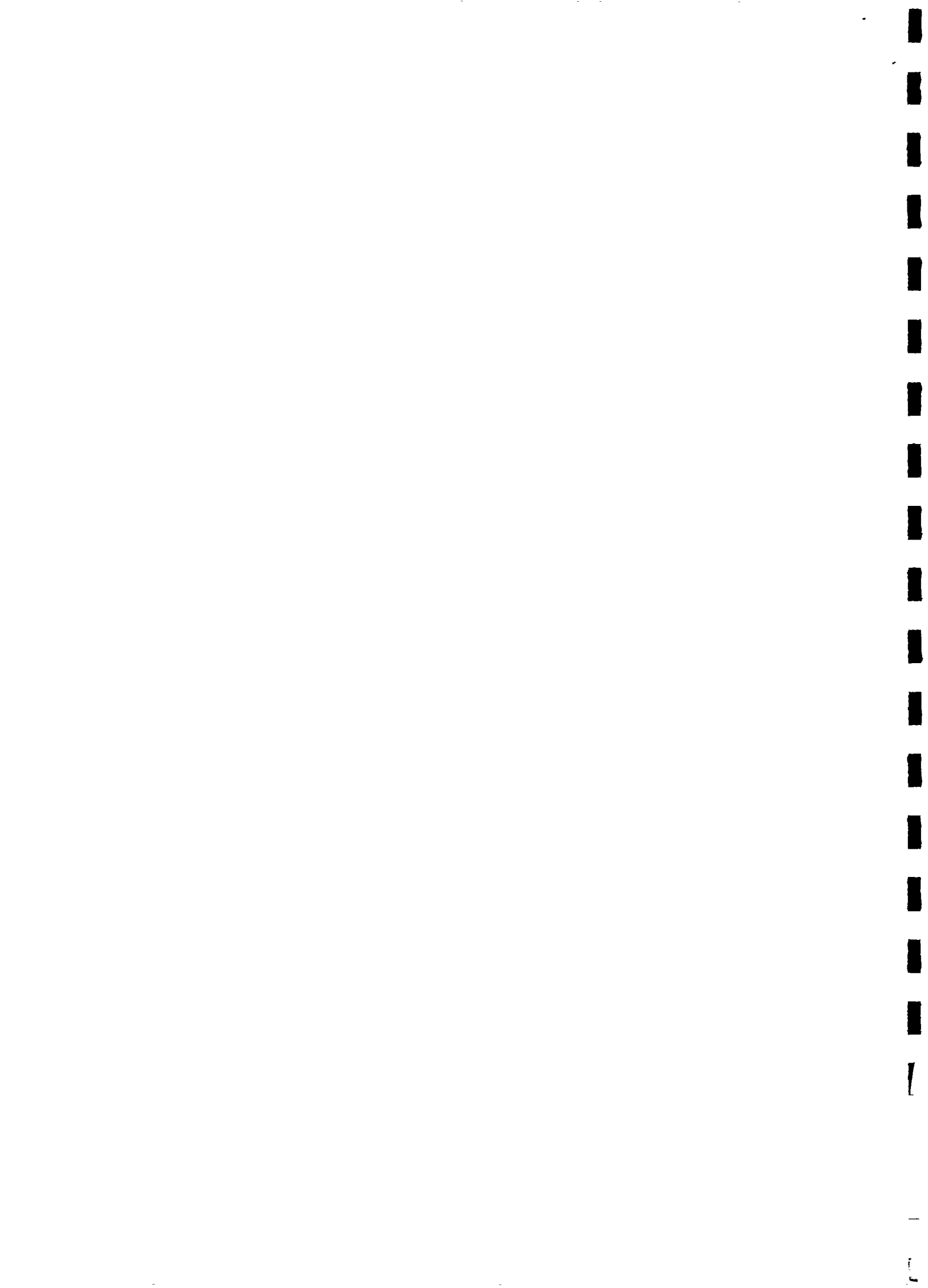
BOX 1 WHAT IS FLOODING?

they experience - their water problems are termed *pani bhar jata hai* or 'water gets filled up'; *pani jam jana* i.e. 'water collects' and *pani ni ka bhav badana* - 'a rise in water level'. 'Flooding' per se is termed *bhadh* and is a term used to describe the inundation in the **nullahs or in other large water systems**. Box 1 illustrates these different definitions of flooding. Therefore it can be seen that 'flooding' as understood by outsiders is not necessarily the same as 'flooding' as understood by residents in the areas studied, who have a detailed local understanding of different grades of inundation, each of which carries different risks. A range of descriptive terms has therefore developed to describe and interpret the hazard. In this report the word 'flooding' is used to refer to the experiences of nullah dwellers while 'inundation' is used for the rise in water level in flat areas.

Figure 1: 'Inundation' in the market place, Indore, August 23 1994.



How, then, is flooding perceived in terms of risk? It has already been mentioned that flooding is seen as a natural annual event and that the perceived risks of flooding are minimised by local coping responses. Relative to other risks or problems in the areas studied, flooding did not rank high, and was sometimes not ranked at all, as is shown in the box below:



| RESPONDENT                    | PROBLEM  |
|-------------------------------|--|
| - teacher in MK:              | provision of bins for garbage<br>flooding  |
| - local community leader, MK: | improvements in job opportunities<br>provision of housing<br>provision of adequate drainage<br>provision of toilets  |
| - an old man in PP:           | mosquitoes<br>smelly backlanes<br>inadequate pressure in the water reticulation system<br>free-ranging pigs<br>contaminated mud ( <i>ganda gee</i> )<br>difficulties of being a tenant |

**BOX 2: Rankings of local environmental problems (from highest to lowest priority)**

The risks of flooding are not only ranked low compared with other problems in the areas studied, but are also borne as part of a 'trade-off' of the risks and benefits of living in the area. These benefits or advantages can be divided conveniently into economic and social aspects, as outlined below

1.3 The benefits of living in the locations:

For people living by the **nullahs** the economic advantages of residence include the following:

- i. **centrality in the city.** Living centrally offers many advantages:
  - ~ access to markets, both for selling of goods produced or collected within the slums, such as collected waste plastics or chopped betel nuts, and for casual employment as labourers in the informal sector. Proximity to markets also has the advantage of easy access to packing materials and housing materials, such as wood and sheet metal.
  - ~ low transport costs One respondent in Shekha Nagar commented that if he were to move to a proposed relocation site he would have to pay Rs4 per day in transport costs to his workplace.
  - ~ other job opportunities nearby.
  
- ii. **source of employment.** Many residents of Shekha Nagar are ragpickers and their easy access to the nullah, which runs through the centre of the city, allows them to collect plastics and scrap metal for sorting and resale. The nullah itself is therefore a source of employment in the community. For ragpickers flooding can sometimes be an advantage in that more waste materials are washed up which can then be collected and sold.





- iii. **land costs.** As the nullah edges are flood-prone, they are not seen as desirable by more wealthy groups resulting in low land costs which are affordable to the poor. The river banks are usually the property of the municipal authority, so the likelihood of eviction may be less than if dwellings were built on private land.
- iv. **visibility in the city.** As the nullah communities are located near the city centre, they are particularly visible to the public. The communities are perhaps more likely to receive funds for improvements than 'invisible' slums on the peri-urban fringe which do not impact on the 'image' of the city.

As can be seen, all these economic factors interact, with access to raw materials and markets giving cumulative advantage to the location. Residents are able to enter formal employment when this is available and can fall back on the resources of the area when necessary. This is illustrated in Box 3.

Social advantages include:

- i. **access to services,** including health services (both public and private), schools, electricity and water. The centre of the city is well supplied with electricity pylons and residents of Shekha Nagar, for example, are able to derive their power supply (albeit illegally) from these pylons. Interruptions to the electricity supply were reported as being less frequent than in other areas because most of the city centre is inhabited by relatively wealthy and influential people who complain if supplies are terminated. Similar factors apply to the supply of water.
- ii. **well-developed social support networks,** within immediate and extended families, the local community and the broader religious and/or caste communities. These networks, established over time, confer both social and economic advantage. For example, many of the residents of Shekha Nagar descend from four Maharashtran families of the same village who moved to Indore 50 years ago and subsequently to the area some 25 years ago. They have retained strong kinship ties and to a large extent the community can be perceived as several extended families, who support each other in times of need. The communities of Shekha Nagar and Karbutakana appear to be more cohesive than those of Pardesipura or Motilal-ki-Chal. If these networks are broken by leaving the area the resident's livelihood would probably suffer.
- iii. **safety for children.** Residents commented that, because the areas have only two or three entry points and narrow streets which are inaccessible to vehicles, it is relatively



safe for children. Furthermore, residents 'keep an eye' on local children during their daily activities.

- iv. **access to entertainment** such as cinemas and cable television.

The social and economic advantages of residing in flood-prone areas are therefore considerable and appear to outweigh in importance the risks of flooding during the 2 month monsoon season. It has been noted that studies of '...what the government has classified as a 'slum' often reveal that the location and low cost suit [residents'] needs far better than any alternative that the government can offer...' (Editorial - 'Environment and Urbanisation'. 1989. 1(2). p.4).

In contrast, for people in **flat areas** the economic locational advantages include

- i. **good business opportunities** The owner of a small bangle shop in Pardesipura commented that the community had become sufficiently affluent to justify him establishing the shop in addition to his original premises in the centre of the city. Furthermore, many mill workers in Motilal-ki-Chal have started small *pan* (betel nut and cigarette) or *kirana* shops (small general store) after being made redundant as a result of mill closures. These are very dependant on passing trade.

From a social perspective the areas' benefits include:

- i. access to schools.
- ii. access to transport.
- iii. Motilal-ki-Chal and Pardesipura are perceived as 'respectable' areas, mainly on the basis of being originally planned.

These advantages are experienced on an individual level in Motilal-ki-Chal and Pardesipura, rather than on a community level as in the nullah areas. The networks which exist are less crucial to the residents' livelihoods.

Overall, neither flooding nor inundation appears to be seen as a major problem for residents of flat or nullah-based areas in relation to the perceived locational advantages of each residential area. Residents of all four sites rather perceive these events as an inconvenience, ranging in significance compared to both other problems perceived and to the perceived advantages of the location as a whole. This is shown in Box 3 below. Even for those living along the nullahs in housing which experiences a waist-high flooding of polluted water two to three times in each monsoon season, and sometimes complete submersion, there is a dramatic, rational trade-off of perceived benefits of the location overall, as outlined above, with



the perceived temporary disadvantages associated with flooding.

BOX 3: THE BUSINESS ADVANTAGES OF LOCATION: FOCUS GROUP DISCUSSION WITH THE RAGPICKERS OF SHEKHA NAGAR

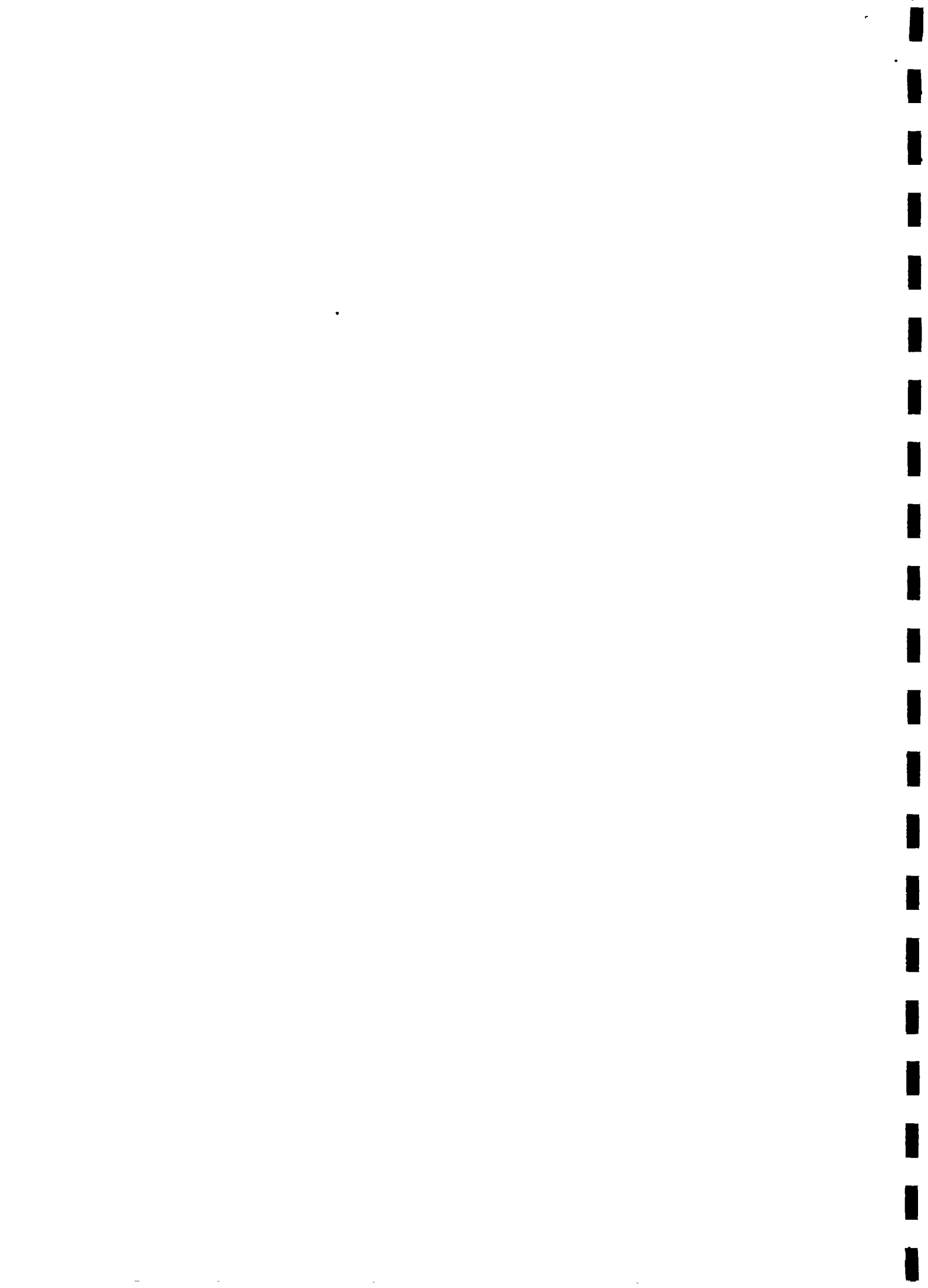
Shekha Nagar is largely a community of ragpickers, but some of the men are engaged in other occupations such as vending. Ragpicking involves the collection of waste materials, including plastic bags, shredded plastic and broken glass which is brought back, sorted and sold to middlemen within the slum. Groups of ragpickers go out in the morning and, according to a routine, visit specific areas in the city, returning in the mid-afternoon. Some sorting of materials takes place in the home and the waste is then sold to middlemen, who sort it further and pack it. Another group of men act as intermediaries to sell the fully sorted materials to large businesses and bring in bulk waste from these businesses to be sorted in the community. The 6 women interviewed were aged between 25 and 35 years, all married and ragpickers. They pointed out that, by staying in Shekha Nagar, they have the advantage of being near to densely populated areas where waste materials are available. They also have easy access to the middlemen for sale of materials. The children assist in collection, particularly of small pieces of scrap metal from the nullah, which they pick up either using magnets or attached to floating pieces of wood. In addition, the women are able to combine their housework with sorting of plastics and other materials. The livelihoods of the women are therefore dependent on the ragpicking network in this area and they commented that relocation to another area, even if it had better housing and facilities, would be to their disadvantage. They said that seasonal flooding is more bearable than losing their livelihood.

1.4 Flooding: who is most at risk?

The social and economic effects of flooding are not distributed evenly across the city or across susceptible communities. In this section the differential effects of flooding on households and businesses will be examined

i. Households:

Householders' assessment of the risk of flooding appears to be determined by a number of factors: familiarity with seasonal flood patterns, the degree of physical adaptation in the household, the extent of community and municipal support (see section 2) and the economic resilience of the household to flood losses. **Poorer households** are affected most by flooding for a number of reasons. Firstly, as the nullah communities are situated on marginal and sometimes illegally occupied land, due to the low cost of this land and its poor marketability, they are more likely to be composed of low-income and low caste families. These households are less able to withstand the economic losses of flooding than the generally more wealthy households of flat areas. Secondly, poorer households may be less able to mobilise support within the city or municipal and state structures for flood relief and for physical changes to the local environment, such as flood barriers, that might reduce the effects of flooding. Respondents in the poorer section of Motilal-ki-Chal, for example, thought that they had only received improvements as a spin-off of wealthy residents' demands for improved infrastructure



in the area. Thirdly, poorer households may be unable to afford even small adaptations to the local environment, such as building raised shelving, to minimise the effects of flooding.

**Physical adaptation** of households to flooding is related both to income and to length of residence in the area (see section 2.1). Households with minimal adaptation appear to suffer most from the immediate effects of flooding or inundation. These effects include the submerging of houses with consequent weakening or collapse of structures, the loss of possessions, an influx of often polluted water requiring extensive post-flood cleaning and fear of possible physical danger (see Box 7). Effects are most severe when water rises unexpectedly fast or at a time of day when people are asleep or not enough people are in the area. In flat areas, however, the effects of inundations on private property are generally minimal as residents have made modifications to their private environment. Inundations are seen as temporary disruptions, differing in severity according to the extent to which individual homes are affected. For example, women may have to spend a considerable amount of time washing *ganda* out of the house following inundation, and this disrupts their daily work pattern. A family interviewed in Motilal-ki-Chal, who earn a living by rolling *bidis*, commented that they find it difficult to return the rolled *bidis* to the factory in the evening and to collect money and raw materials for the next day if it is raining or flooded.

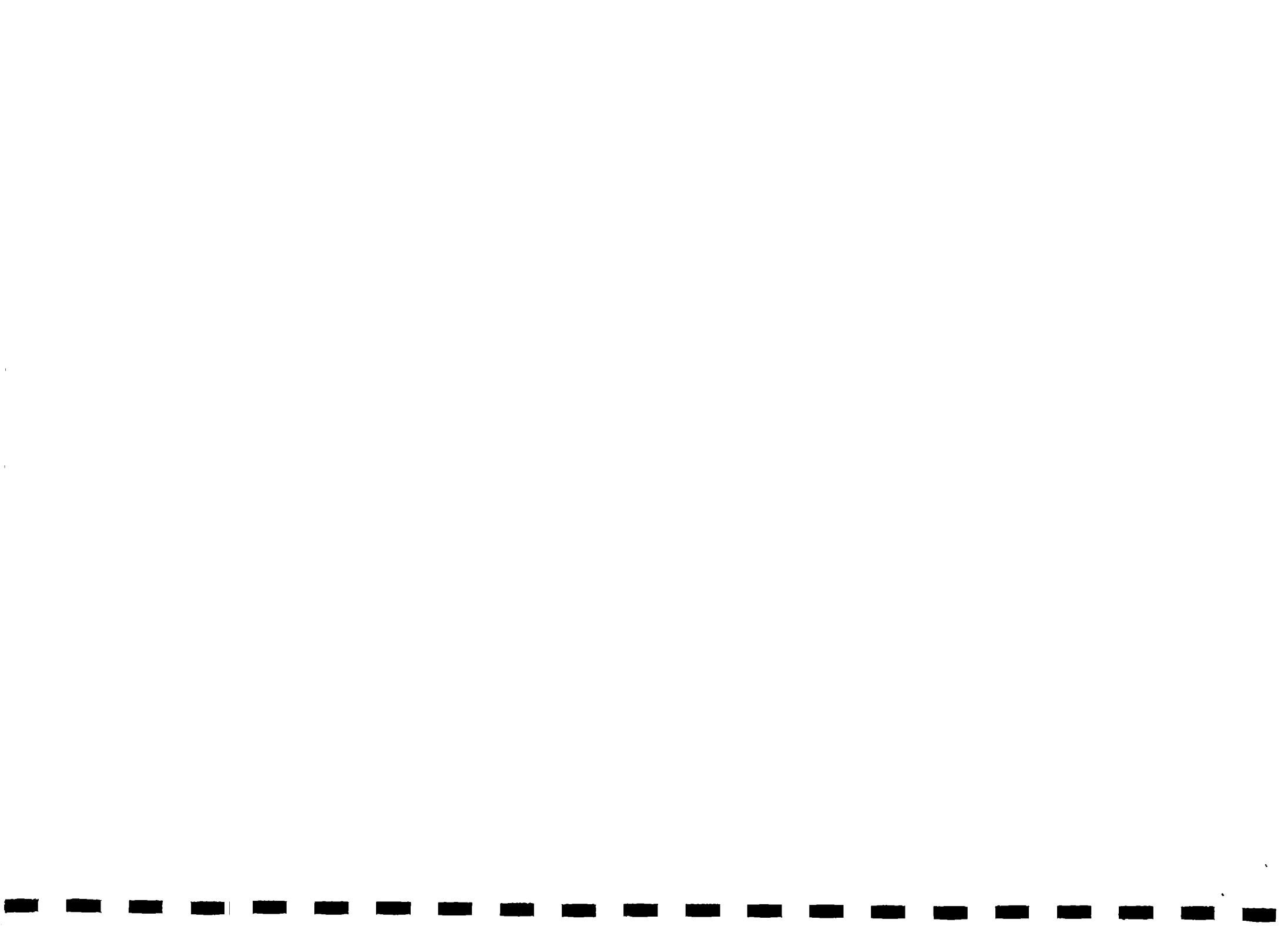




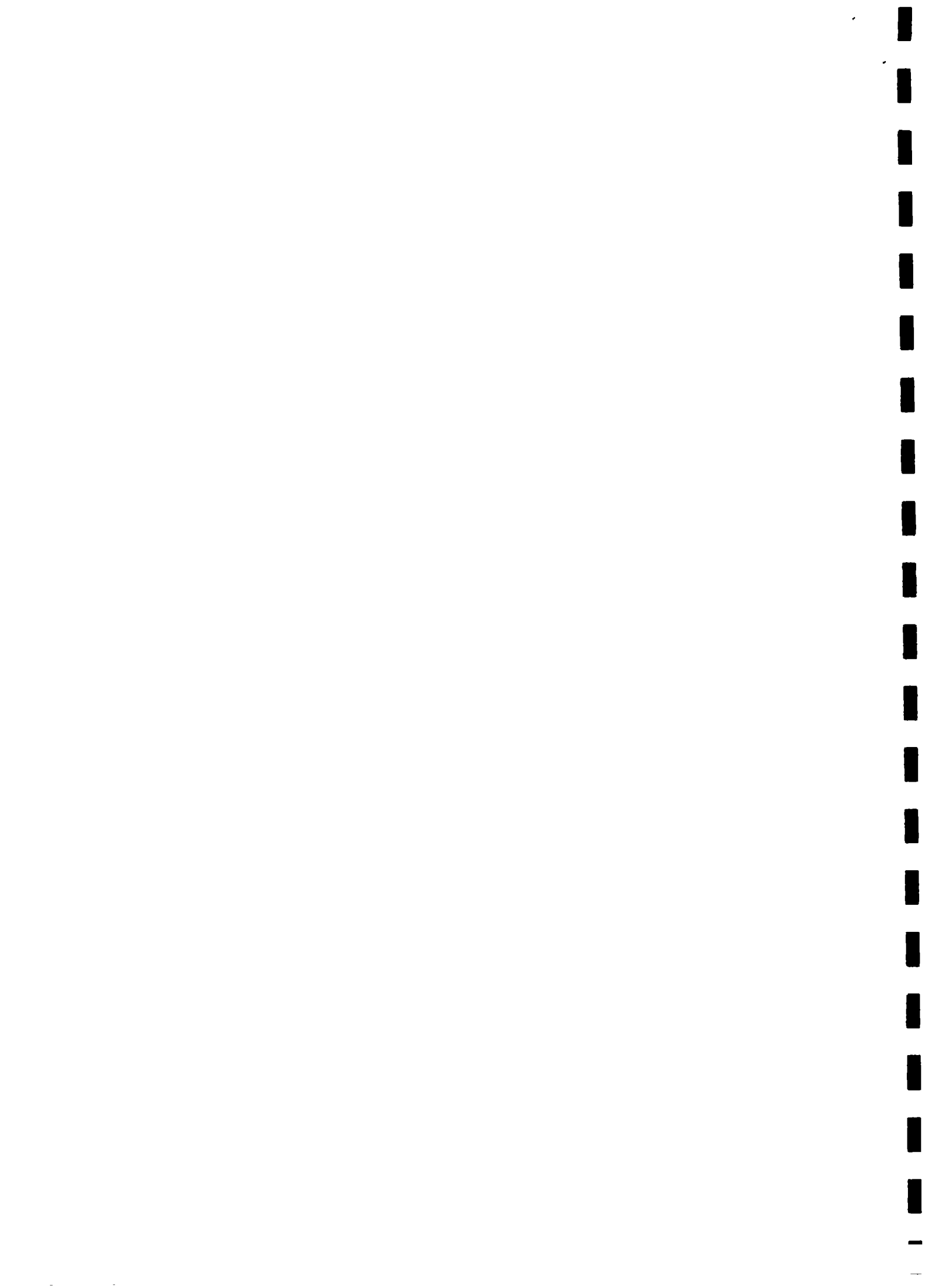
Figure 2: Family rolling *bidis* in Motilal-ki-chal, Indore



Another family in Motilal-ki-Chal, who live in an old flat house, said that, after heavy rains, water enters the house from the backlane and the front yard. This then has to be bailed out and the floors washed as the water from the backlane is *ganda pani*. Sunken tap pits may also become inundated, requiring bailing out and cleaning and increasing the risk of cross-contamination of water supplies.

ii. Businesses:

Different types of businesses are affected differently by flooding. Two main themes emerge: firstly, the effects depend on the type of product sold and, secondly, on the nature of the service provided. Businesses selling goods which are unaffected by immersion in water are



able to successfully occupy premises in flood-prone areas of the market and see themselves as having only to cope with the relatively minor inconvenience of baling out the store two to three times during the monsoon season. The case study below illustrates this point.

#### BOX 4: THE EFFECTS OF FLOODING ON BUSINESSES: A STOVE REPAIR SHOP IN KARBUTAKANA

This kerosene stove repair shop is located on a busy street prone to flooding near the market close to Karbutakana. The shop is in the basement of a building and has 2 sections. The back section, which is used to store cheap spares, such as pins and burner rings, and tools, has a floor 1m below road level while the front section, which is used as a workshop, has a higher floor and an 80cm high opening onto the road, through which one has to bend down to enter. The total floor area of the shop is equivalent to a large cupboard and the height of the shop is slightly more than a meter. The customers usually conduct their business while standing on the road. This poorly lit shop is run by a 12 year old boy, supervised by his father. It was started by his grandfather and has been passed down through the family. When it rains, water enters the front section of the shop and during heavy rains also enters the back section. During the storm of 6 September 1994 water entered both sections of the store and, when visited later in the day, the boy was bailing water out of the shop. He commented that the water was not a problem as the spares and tools were not damaged by it. He also said that this was a good area for this type of shop as many local people use kerosene stoves which periodically need repairs. In addition, he gets a large number of repairs from vendors who sell hot foods in the market.

The type of product sold also determines the status of the customers who frequent the business and this, in turn, will influence the impact of flooding on the enterprise. For example, shopkeepers in flat areas commented that street inundations cause most difficulty to customers who wear respectable clothing when shopping. The owner of a sweetshop in Pardesipura, who had paid to improve the pavement around his shop, said the following with regard to the relationship between his clients and rain on important business days:

*'On festival days what is one is ten. I spent Rs25 [on stepping stones through standing water], but if I don't I lose Rs100-200' [in lost business].*

*Dhobis* (washing and ironing people) also report a decrease in business during rain as customers do not want to carry clothes out of the house.

The nature of the services provided also impacts on susceptibility to flooding with vendors and casual sellers being unable to ply their trade during heavy rains. However, they also see some benefits of rainwater and stormwater in that the water cleans the roads. Shopkeepers with permanent premises generally see heavy rains as a temporary inconvenience and their income loss is minimal. Shopkeepers or vendors with a lower income are also more likely to experience difficulties if their businesses are closed than those with higher incomes, for example, a vendor in Shekha Nagar complained that the combination of rain, which decreases his number of working days, and the effects of the flood, have left him short of money for food.



1.5 Health risks of flooding:

The health risks of flooding, as understood by respondents, are related to their classification of water 'types'. These are classified according to composition and clarity and residents are fairly knowledgeable regarding their potential health risk and, thereby, their household usability.

i Types of water:

Residents have a well-developed classification of stormwater and this is illustrated in Box 5 opposite

- "ganda pani" - faeces contaminated water
- "maila pani" - dirty water without excreta
- "bahrsad ka pani" - rainwater
- "saf pani" - clear water
- "pinch ka pani" - drinking water

BOX 5: CLASSIFICATION OF WATER QUALITY

Types of water are distinguished carefully according to perceived quality. *Ganda pani* (dirty water - faeces-contaminated) is worst - walking through such water is unhealthy and requires that you wash afterwards in order to avoid stomach problems. *Ganda pani* is thought to contain *kitanuh* or 'small unseen insects' responsible for these stomach problems and other illnesses. *Maila pani* (dirty water without excreta) is less bad, but inconvenient to wade through. *Bahrsad ka pani* (rainwater), when collected directly from the roofs, is tolerable and you can use it for washing. Walking through rainwater is not problematic and the water can be useful in that the roads are washed by it. *Saf pani* is used to describe clear water (i.e. not containing any *ganda*) which can be used for washing and cleaning, as opposed to drinking water which is termed *Pi'neh ka pani*. Floodwater is therefore of varying usefulness depending on its perceived quality. Water can also be polluted by animals<sup>2</sup>. For example, in Pardesipura, one family complained that local free-ranging pigs contaminated water and rendered it unfit for drinking if it was left in containers outside the house, as is shown in Box 6 below. Another respondent in Pardesipura commented that '*Pigs eat dirt, but also carry dirt*'.

<sup>2</sup>In local culture, pollution can also be caused by the touch of other people.



## BOX 6: INUNDATION IN FLAT AREAS: A FAMILY IN PARDESIPURA

The family consisted of 3 brothers, between 20 and 30 years of age, and their wives, children and mother of 55 years. Their father, who had bought the house 35 years ago, was a mill worker and two of the brothers worked in the mills before being made redundant 3 years ago. They now work in a power loom factory for less pay, while the youngest brother operates a 3 wheeler delivery van which they own. The family are vegetarians and belong to a higher Hindu caste. They are a traditional 'joint' family<sup>3</sup> with more than 2 married couples living together. The interview took place on the veranda of their old wood and cow-dung plastered house with 4 rooms. A small bathroom cubicle could be seen in the frontyard next to the tap pit. A dry latrine was situated at the back of the house, and cleared by a *bhangi* who charges Rs5 per adult. When asked what kind of sewer system they considered to be best, they ranked flush to sewer line first and flush to septic tank second. However, the family are intending to build a septic tank rather than a sewer link to replace the dry latrine as this system is less likely to get blocked. The brothers complained that the frontyard becomes muddy during rain as it is not paved. Near the open drain, in front of the house, the mud becomes *ganda gee*. If water stands in the frontyard for long periods of time it also becomes *ganda gee* which allows mosquitoes to breed and the family then have to sleep under nets to prevent bites. Insecticide then has to be bought to sprinkle on the area. The family also complained that stray pigs bring dirt into their yard and contaminate their water. Flooding did not seem to be a problem and they saw stormwater as positive as it removes dirt from the area. They noted that they had not had any illnesses in the house for the last 8 months, except for mild seasonal fevers.

### After-effects of flooding:

Residents in flat areas give equal, if not more, weight to the after-effects of rains (standing water and contaminated mud) as compared to immediate effects. Water may stand for long periods in very flat areas. Respondents feel that this makes walking difficult and allows the breeding of mosquitoes. Faeces-contaminated mud (*ganda-gee*) caused by storm-water is seen as most problematic as it is also a perceived source of mosquitoes and noxious smells

This is illustrated in Box 7 below

<sup>3</sup>A 'joint' family is a form of extended family in which all family members eat from the same hearth and the property is held by the oldest male member.





BOX 7: THE AFTER-EFFECTS OF INUNDATION: DISCUSSIONS WITH A DHOBI IN PARDESIPURA

The family, who have lived in Pardesipura for 10 years, consisted of husband, wife and 3 thin young children dressed in clean clothes (*Dhobis* have a reputation for dressing in their clients' clothes!). The husband works as an clothes ironer at a 'ready-made' clothing manufacturer in the city centre. The family rent the bottom floor of a fairly old *pukka* 2 story house for Rs300 per month, which is cheap by present standards for the area. Their portion consists of one room, a veranda, where the wife irons clothes for local residents, a doorless outside bathroom and a bucket toilet at the back. Between the front veranda and the street is a unpaved small courtyard. The dhobi commented that, as the house has a slightly raised plinth level, water does not enter it during rains, but stagnant water remains in the front courtyard and is *ganda pani*. During rain customers do not come to the house, but once the rain clears business continues as usual. Due to the *ganda pani* in front of the house, however, she has to create stepping stones using stones and broken bricks through the water to allow customers to cross without becoming dirty. She also complained that the stagnant water is source of mosquitoes which are a risk for malaria and, once the water dries into *ganda-gee*, it is a source of nocuous smells. Drinking water has to be fetched from outside, so during rain she has to cross the *ganda-pani*. An open drain runs in front of the house, and is cleared every fifteen days by the municipal corporation. Despite these problems, both husband and wife liked the area, particularly as "...it is a nice area", the ironing business was good and the children could attend schools nearby. Apart from occasional flooding in the front yard, then, the area is considered to be very pleasant.

In this section the following major points have emerged:

- \* flooding is perceived as a natural, seasonal event with positive attributes.
- \* residents have a detailed classification of grades of inundation, each of which carries different risks.
- \* there is a trade-off for residents of flood-prone areas between the risks of flooding and the social and economic benefits of living in the area.
- \* the poor and households which are poorly adapted to flooding are most at risk for the negative effects of flooding.
- \* water is classified according to perceived quality. This classification informs water usage.



## Individual and group responses to flooding:

In this section the responses or adaptations of individuals and communities to flooding as an environmental health risk will be examined. Whyte has commented that 'For natural hazards, adaptation has come to mean a reduction in loss of life and overall damage while minimizing human effort (costs) in coping with the hazard...A response that may appear maladaptive to hazards...may be adaptive in the total context of the risks and opportunities available.' (cited in White et al 1986 p.262). Adaptations therefore have to be understood within the context of the communities and their resources and within the framework of the overall trade-offs made by those communities in choosing to live in flood-prone areas.

Responses may include either those that deal directly with the hazard, such as modifications to the local environment and prediction and protection systems or responses that are directed outward into the broader community, including municipal authorities and the media. These will now be reviewed in turn.

### 2.1 Modifications to the local environment:

The modifications necessary to prevent inundation or damage due to flooding differ in the different areas studied, with householders in all four areas having made adaptations in their home environments. These can be divided into structural or permanent adaptations and temporary or household adaptations. In **flat** areas, structural changes have been made to houses and the 'private' environment by wealthier residents who can afford the cost of building and by those constructing new homes. Houses tend to have high plinth-levels to keep water out and paved courtyards which reduce the accumulation of *ganda pani* and *ganda gee*. Extensive land fill is also used to raise the level of the property to prevent the influx of floods or stormwater. Poorer residents, tenants and inhabitants of older houses have low plinth-levels, but have adapted by building raised doorsteps and housefronts. Small amounts of landfill are also used to create paths through standing water around houses. Adaptations have also been made to improve access to business premises. A *masala* shop owner in Pardesipura had placed 2 slabs of concrete in front of his shop at a cost of Rs48 and had also asked the IDA to supply 'metal' (gravel) for filling up puddles. He commented that the expenditure on the slabs was small in comparison to the cost of the stall (Rs4000) and in terms of lost business from customers not wanting to cross puddles to the store.

Residents of **areas beside nullahs** also make permanent structural adaptations to their environment, including building houses out of wood and mud plaster rather than mud brick as these are perceived by some as less likely to be severely damaged by flooding. These



wooden structures also appear to have suffered greater damage once the mud has been washed off than comparable brick structures, which may enhance compensation to the owner. Roofing, which is made of corrugated metal sheeting, is often not attached to the house with bolts or nails, but rather weighted down with rocks so that it can be easily and quickly removed if the structure is in danger of being swept away. Other structural adaptations include high internal shelving, raised storage platforms for valuables and electricity connections at head-height. Temporary household adaptations include using metal, rather than the cheaper wooden, floor level storage and furniture. This is more durable and resistant to immersion. Grains are stored in metal containers on high shelves to protect them from damp and many households own trunks which are useful for carrying away valuables during flood evacuation.

**Newer residents**, who may have less of a 'stake' in the community and in their homes because they are renting, are only planning to live in the area for a short time or do not have the financial means to pay for adaptations may be less well adapted to the local environment. One such case, a *dhobi-wallah* in Karbutakana (see Box 8 below), who had been living by the nullah for only ten months and was experiencing her first monsoon season, had not stored grains on high shelves and lost these during a flood. She appeared to be more frightened than the longterm residents by the flooding she had experienced and subsequently moved out of the area following the major flood of 5-6 September 1994. Residents are therefore more likely to invest in adaptations if they think they have a long term future in the area.



## BOX 8: LIVING WITH AN UNFAMILIAR HAZARD: A PRESS WALLAH IN KARBUTAKANA

This 50 year old Hindu women lived with her son and daughter-in-law and their children in a 2 roomed house backing on to the nullah. The front room, which had a floor area of 1.75 square metres, was built of brick and mud plaster with a mud floor. The walls had been recently whitewashed and were still damp from the previous flood. The back room, which was slightly bigger than the front room, was constructed of wood from packing crates. Water could be seen flowing a few centimetres away from the structure. The roof was of galvanised corrugated sheet. The family rented the house for Rs300 per month (plus Rs50 for electricity) from another resident of Karbutakana who lives further up the bank. The woman works as a clothes ironer and her son is a mechanic, but she feels that he is irresponsible, as he drinks too much, so much of the family burden is on her. The family moved to Karbutakana approximately 10 months ago from an area which had been affected by communal violence. The press wallah, who suffers from hypertension, experienced 'palpitations' at this time. This, then, was their first monsoon season by the nullah. During the large flood of 19 August, when water rose to 1m in the press wallah's house, she lost food grains, her mattresses were soaked and she experienced palpitations again. Water rose to floor level during the smaller flood of 27 August and kept the family up all night. The press wallah expressed great fear regarding future floods and the safety of the family and their possessions.

*On 6/9/94, when the nullah rose above roof level, the family had to take refuge on higher ground. The house was destroyed and most of their possessions lost. The family moved back to the centre of the city to stay with relatives. Other residents reported to us that she would receive Rs3000 in compensation and the owner of the house, who would not receive any compensation, had started rebuilding the structure.*

### 2.2 Flood prediction and protection systems:

A major concern mentioned by residents of all four areas relates to the predictability of the changes in water levels and rate of rise in water levels. To an extent these factors outweigh in perceived importance the actual duration or depth of the water inundation itself. In other words, even extensive inundation is bearable if expected (in relation to observed intensity and duration of rainfall), and if the rate of rise is not high. Both the rate of rise and the velocity of flow are seen by residents as determinants of the damage caused by water to housing and other possessions. As mentioned earlier (see section 1.1), flooding is seen to be part of a natural and necessary process and is tolerated within its season. The ability to predict flooding diminishes the fear that might exist in the context of severe floods. People believe that they have 'control' over flooding because they have developed mechanisms to cope with it. If inundation is unexpected, however, due to engineering factors or due to unusually high intensity rainfall, possessions may be lost. If the rate of rise of water is high, children and the elderly are considered particularly at risk. In Karbutakana, respondents commented that a recent flood (27 August 1994), although small in comparison with the floods of the 6 September 1994, had caught them unawares as it occurred at night and with high intensity. As a result some residents lost food grains which could not be shifted on time. During the



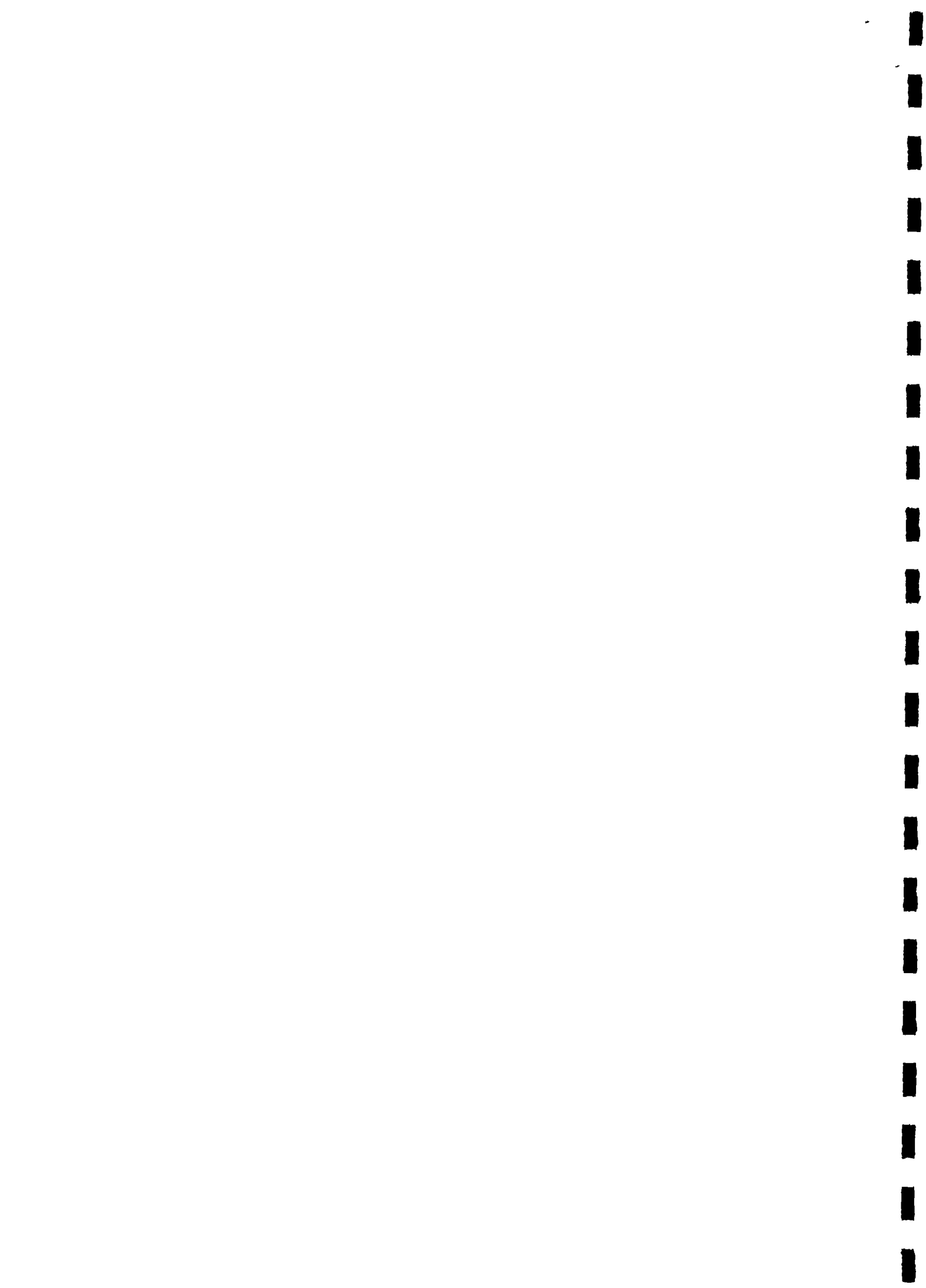


flood of 6 September 1994 a small dam upstream of the slums was opened without warning residents and this resulted in an unexpectedly fast and high rise in water levels.

**Figure 3: View from Karbutakana across the nullah to South Toda. During the flood of 6 September 1994, water rose to the top of the bank shown on the far-side of the nullah**



Residents have therefore developed sophisticated routines of flood prediction and protection and have clear priorities of action in response to rainfall duration and intensity. Depending on these two factors, various contingency plans are put into action. This includes moving foodstuffs, electrical valuables and bed mattresses to ceiling level platforms. In severe floods, all valuable possessions are moved to higher ground. Items are moved in order of perceived value, perceived vulnerability and time available before submersion. In Shekha Nagar residents tend to take the following action: first the elderly, children and animals are moved to higher ground using vendor's barrows where necessary, then electrical goods such as televisions and radios are moved. Other lighter valuables and cooking utensils are removed next, with clothes being transferred last as these are reasonably easy to replace and are not



damaged by immersion. Bulky items, such as mattresses, may also be left for last. Two residents of Shekha Nagar were also noted to have removed galvanised tin roofs during the flood of 6 September 1994, which they then tied to a nearby tree to stop the sheets being washed away.

During intense rain, particularly at night, a watch is usually kept by residents on the level of water in the nullah so that evacuation programmes can be initiated in good time as the water starts to rise.

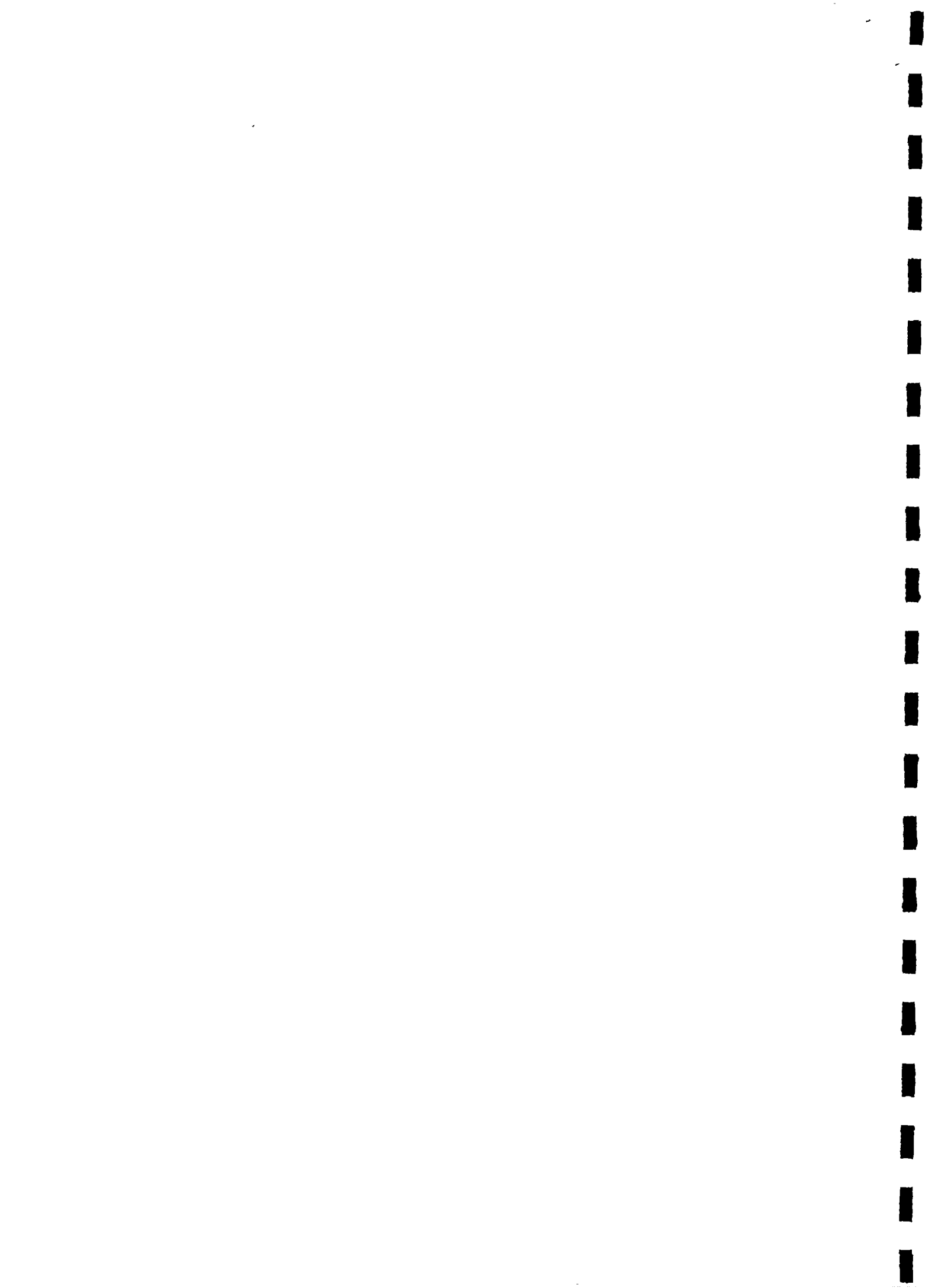
#### BOX 9: PATTERNS OF RAINFALL AND PREDICTION MECHANISMS

Longterm residents are very familiar with the flooding patterns of the nullah and described some of the ways in which the people can predict changes in the level of the nullah. Four patterns of rainfall were distinguished:

- *halka aur lamba* or 'light and steady' rain will lead to a gradual rise in water level in the nullah and the velocity of the water will be low.
- *Tej aur thoda der* or 'intense but short-lived' rain leads to a rapid rise in water level with high velocity.
- *Tej aur lamba* or 'intense longer' rain causes a quick rise in water levels but, in this case, the level continues to increase and the velocity is high. The flooding which occurred on 6 September 1994 was *tej aur lamba*.
- *Lamba aur bhari* or 'steady and heavy' rainfall leads to a steady rise in water level which remains at a given level and lasts for a longer time. The velocity is not as high as in the two previous instances.

*These definitions were reported by a 30 year old man who is an influential person in the local community because his father was a local leader and one of the original residents of the Karbutakana. He lives with his extended family in a pukka two-story house with a rooftop veranda about 10m from the nullah. He commented that 'If it rains steadily for one hour and the water level rises one foot on a structure on the opposite side of the nullah, then it is a problem.'*

Maintenance of drainage works also affects predictability of flooding events. Factors such as blocked drains, irregular maintenance of drains, changes in the flow of the nullah due to construction and increased runoff from drainage changes in other areas of the city can change water levels and flood patterns unexpectedly. These unexpected or unpredictable changes appear to adversely effect community perceptions of drainage improvements, as has been shown elsewhere (Hoque et al 1994).



### 2.3 Floodwater drainage:

Respondents saw drainage interventions, such as the building of stormwater drains, as having long-term benefits for the personal and community environments. However negative perceptions of interventions to improve flooding were more frequent than positive perceptions. These negative perceptions have arisen for a number of reasons.

~ residents had high expectations of drainage improvement when the projects were initiated and appear to have expected that flooding and inundations would cease or be reduced substantially. It is likely that the feeling that their expectations have not been met is in part an immediate sense of disappointment that flooding has not ceased altogether.

~ some residents seem to distrust the concept of closed rather than open drainage for water run-off and see closed drains as being less efficient than pre-existing open drains for several reasons. Firstly, the open drains were larger and less easily blocked by rubbish such as plastic bags. Secondly, as they can now no longer see the water draining, they feel that it is not draining adequately. Finally, the open drains had the added benefit of washing away rubbish and excreta which now remains on the streets as *ganda-gee*, particularly in the backlanes behind rows of houses where children defaecate (see Box 10 below). In other words several residents appear to have a limited appreciation of the technical capacity and operation of closed drains, road-as-drain and other improvements. This not only makes them suspicious of the changes but means that they do not necessarily perceive the beneficial effects of the drainage improvements.

~ some respondents have reported that their living conditions have, in reality, been made worse by the drainage improvements in that they now experience inundation in their houses for the first time, sewage lines back-up and flood the area during heavy rains. In Motilal-ki-Chal, several respondents felt that the community as a whole was worse off after the improvements, and that this '...was no longer a nice place to live'.

~ for some residents, negative perceptions of drainage interventions also appear to be linked to a feeling about the poor technical quality of drainage improvements (in terms of poor materials and execution of the works). This perception seems to fall within a broader distrust of municipal interventions and their quality.

~ Finally, perhaps the most substantial disbenefit perceived by residents in relation to the initiatives to improve drainage has been the negative effects of interventions on peoples' ability to predict flood events. Many residents, particularly in the nullah-based sites report that



community coping strategies towards flood events have been affected considerably by drainage interventions. In other words people report that drainage interventions aimed at containing the environmental risk have reduced their capacity to understand and cope with the impact of different rainfall episodes and consequent inundations (Shekha Nagar and Karbutakana).

BOX 10: PROBLEMS ASSOCIATED WITH STORM WATER: A FOCUS GROUP DISCUSSION WITH 4 MEN AND 2 WOMEN IN MOTILAL-KI-CHAL (NEHRU NAGAR)

This discussion was conducted at a busy street corner several days after the heavy rains of 6 September 1994. All the participants were vehement in their criticism of the new drainage system installed about 8 months ago and replacing open drains with underground pipes. They outlined a number of problems created by this new drainage system. Firstly, during rains, stormwater runoff accumulates on the roads and enters the frontyards of their houses which did not happen before. Water also entered older residences, including those of two of the participants, and mattresses and other possessions were soaked. Secondly, the stormwater entered the sewer line which led to 'sewage coming up through the manholes in a fountain' and to water backing up in the toilets. As a result residents could not use the toilets because it was unbearable to put up with the splashes. Thirdly, the stagnant water, particularly in the backlanes and on uneven parts of the road, creates *ganda-gee* and one old man commented that he could no longer sit outside on his *charpoy* (wood and rope bed). Finally, they noted that as children of less than 5 years of age defaecate outside the house, mainly on the pavements and in the backlanes, rather than in the open sewers as was previously the case, the excreta are spread across the area following rains. This contributes to the *ganda pani* and *ganda gee*. They related all these problems to the fact that the new drains were less efficient than the old system, which consisted of large open drains on the sides of the roads and smaller open drains in the backlanes. A lot of garbage was washed away in these open drains. Now, however, the underground system is easily choked and, furthermore, they said 'How can such a small pipe carry all this water?'

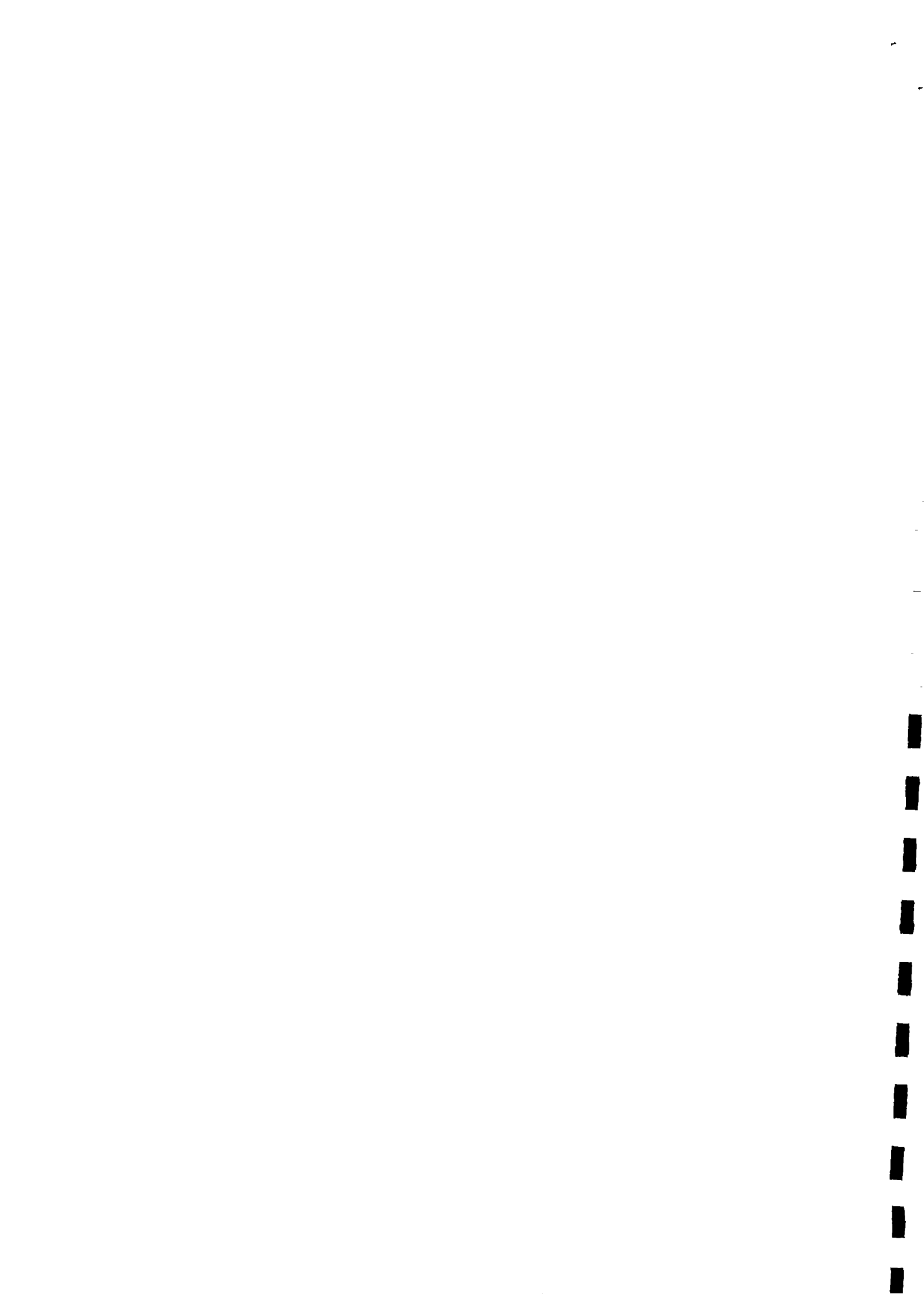
The effects of changes in the built environment, such as the increased number of houses, on floodwater drainage were also noted by respondents of Pardesipura, who made the following comments:

- shopkeeper: 'Water now stands around for 8 to 9 days after rain.'
- old man: 'There used to be more open fields and agricultural space in the area which allowed the water to seep away'
- vendor: 'The area was more open with fields so there was more rain but less impact. There was less stagnant water.'

2.4 Responses in the broader community:

i. Community support networks:

There are sophisticated routines of mobilising support and assistance in the local community and more broadly within the city following flooding. These differ between the different communities studied in terms of dependence on municipal and state resources and the extent





to which religion-based networks are used. The severity of the flood will also influence the extent of mobilisation of support and, even if support is needed following small floods, it may not be forthcoming if the networks are not activated. In this situation, unaffected families may assist those who have been displaced or lost possessions.

It is interesting to compare the support networks activated in the communities of Karbutakana and Shekha Nagar during the floods of 19 August 1994 and 6 September 1994. In Karbutakana following the 19 August flood, a local wealthy Moslem resident provided food to those families affected. During the larger flood of 6 September, Moslem and Jain welfare organisations provided cooked food for 3 days to families who had been temporarily relocated to the local mosque. Medical supplies were also organised. In Shekha Nagar, after the flood of 6 September, relief supplies such as food, blankets, clothes and medicines were provided by local businesses and co-ordinated by the municipal authorities. It can therefore be seen that quite different networks of support come into play for the two communities, relating to both their religious composition and their influence within local administrative structures. The Karbutakana community looks first to fellow Moslems for assistance, while Shekha Nagar depends on civic structures.

ii. The Municipal authorities and compensation.

For residents holding *pata* along the nullahs, compensation is made available by the state following damage caused by flooding. There are a number of issues associated with this. Firstly, residents have learned to use and manipulate this system by mobilising the press and local community leaders to highlight the flood damage and facilitate rapid provision of compensation. The press is mobilised through the local leadership who may also petition the Collectors's office for flood compensation payments. In some instances large groups from the community may 'camp' outside the collectors office in order to reinforce the urgency of the demands. Secondly, the compensation (which can range from Rs400 to Rs3000) provides a perverse incentive to residents to build houses in the most vulnerable and dangerous areas. Thirdly, while compensation is supposed to accrue only to residents holding *pata*, in practice tenants have also received compensation which, again, may provide an incentive to live in vulnerable areas. Finally, it would seem that areas with a high political profile use and are used by the compensation process for political advantage. The two major national political parties are well represented in Shekha Nagar, and their leadership appears to have links with middle-level politicians who are quite powerful at the district level where compensation claims are processed. In turn, the community is an important source of votes, and it is therefore to the advantage of both groups to maintain close contacts and co-operate where possible. It is interesting to note that the Chief Minister of Madhya Pradesh visited Shekha Nagar



sometime ago. As O'Riordan has aptly noted 'The manner in which individuals and various social institutions cope with both predisaster preparations and postdisaster relief should...suggest something about the relationship between political power and vulnerability to environmental risk.' (cited in White et al 1986 p.273). By being able to mobilise religious and/or municipal support, flood-prone communities in Indore are able to mitigate the effects of flooding on their households and even gain from the process in terms of compensation and political influence.

BOX 11: FLOODING AND COMPENSATION: A FAMILY AFFECTED IN SHEKHA NAGAR

This family consists of a husband and wife and 5 children. The husband is 45 years old and works as a sweeper in the main jewellery market making Rs1100 per month. The younger 2 children attend school. The family is a unit of a larger kin group whose older members migrated from Maharashtra. They are members of a scheduled caste<sup>4</sup>. The house is situated about 20m from the nullah and has one meter of cement plastered brick walls on top of which is mud and brick wall. The roof is made of galvanised corrugated sheet. During the flood of 6 September 1994 the upper section of the house was washed away. At the time of interview the husband and children were sitting on a steel cot outside. The wife was trying to cook inside the partially destroyed house. There was much activity in the slum as many people were trying to rebuild houses and assess their losses. The husband's official version of the events is that they lost roofing materials, a television, clothes and cooking vessels but his actual losses consisted of one small trunk of clothes which had floated away, a few aluminium vessels and Rs119 in cash. He had safely removed all other possessions as the flood waters rose, including the roofing materials, which he tied to a nearby tree. He was hoping to get the Rs3000 compensation which had been announced by the state government for the victims. He had not, in fact, attended work since the flood as he expected officials to visit and decide on the amount of compensation for each individual. Although absence from work would lose him pay and the assessor had already visited, he did not mind because he expected other high officials to visit.

iii. The media:

The media are important players in creating, filtering and distributing risks and, thereby, in the social construction of risk (Stallings 1990). The relationship between media accounts of risk events and the social construction of risk is complex. Some of the interactions between the press, and other forms of media, communities of Indore and the municipal and state authorities will be explored here to highlight a number of points about the perceptions of flooding as an environmental health risk, including the relative importance of flooding and its effects as a problem in Indore.

It should firstly be noted that there are 19 newspapers, including daily and weekly papers, operating the Indore area. This number seems unusually high for a population of 1.25 million. Secondly, many of these newspapers sell for as little as Rs1 which makes them 'very

<sup>4</sup>Scheduled castes are those castes who have been socially deprived in Indian society and receive special benefits by law. This classification includes the group previously known as untouchables.



accessible to even less affluent residents. Newspapers are often read aloud in *chai* shops (tea shops) and other gatherings and, as a result, are widely discussed

The role of the press in reporting and interpreting flood events and related health issues was explored in the focus group and in-depth discussions. A number of residents of Shekha Nagar commented that if there was an outbreak of diarrhoeal disease or suspected cholera in the community, they contact the press rather than the Indore Municipal Corporation (IMC) directly. The IMC then responds to the press releases, as is shown by the quote below

*'A spate of cases of acute gastroenteritis, chiefly caused by consumption of contaminated water, have been reported from different parts of the City in the past 24 hours.. Chief medical officer of Indore.. refused to comment on the issue, maintaining that he and the authorities concerned of the corporation were making efforts on a war-footing. He added that he would look into the cases..' (Indore Free Press, 10 July 1994)*

A discussion with the Indore chief medical officer (CMO) confirmed this and highlighted the manner in which the IMC see communities such as Shekha Nagar as 'using' or 'manipulating' the media. The CMO commented that residents 'over-report' the number of deaths from infectious diseases such as cholera to the press and that the media go on to link these deaths to local living conditions. Furthermore, overreporting of gastro-enteritis cases is seen by the CMO as a political means of shifting IMC budgets during the rainy season and attracting political attention to the slums. The press therefore acts as a communication channel between slum communities and the municipal authorities with both sides attempting to influence the nature and content of reporting.

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## JAVY RAINS BATTER INDORE



By Our Staff Reporter

Three persons lost their lives and hundreds of homes collapsed following incessant rains in the city and surrounding areas, since last night. The city was paralysed here today, even as tens of thousands of residents of low-lying areas were evacuated. The rains started lashing the city and surrounding areas, since last night. The city was paralysed here today, even as tens of thousands of residents of low-lying areas were evacuated. The rains started lashing the city and surrounding areas, since last night. The city was paralysed here today, even as tens of thousands of residents of low-lying areas were evacuated.

and hundreds of homes collapsed following heavy rain in the last 24 hours. Details about the three victims, official sources said, a 17-year-old boy was washed away in a nullah in Karbala Maidan area, while 15-year-old Ajay Kumar, in the nullah of Yadav Nagar area in Mhow, near here. The two were trying to cross the nullah. The bodies of the youths could not be traced. The third victim was a three-year-old girl, a resident of Gyanika Ka nagicha. Her body was recovered from the nullah near Poojap Oil Mill. Municipal Corporation officials claimed that over 1500 persons, had been shifted in Government Girls Degree College, Sadhvi Dharmshala (Yashwantrao Road), Kains Colony, Urdu Middle School (Haradibhi), Shastri Nagar, B.C. Community Hall, Phul Mangal, Cloth Market and Mangal Maidan (Dharamshala). Normal life in city was also affected by the heavy rains. School children and offices were affected. The worst-hit areas include Chhatrapati, Poojap Nagar, Arjuna, and hundreds of homes collapsed following heavy rain in the last 24 hours.

Karbala Maidan bridge where water of the nullah threatening to overflow. Police constables controlling traffic. Free Press photos by Dilip Lokra.

SEASON'S HIGHEST RAINFALL

The temples behind Chhatrabagh submerged

Other areas where hundreds of homes and trees submerged due to heavy rain include Karbala, Tapu Nagar, Tapa Palla, Dube Ka Bagicha, Gurunagar Colony, Bhanu Road, Jagan Colony, Shastri Nagar, Bajrang Nagar, Ganga Bazaar, Khatwani, Mangal Maidan, Chhatrabagh, Lohar Colony and Poojap Nagar. The worst-hit areas include Chhatrapati, Poojap Nagar, Arjuna, and hundreds of homes collapsed following heavy rain in the last 24 hours.

Sector, Khatwani, Chhatrabagh, Shastri Nagar, Sikandara Colony, Bhandari Nagar, Ganga Road area. It is the second downpour of the current season which has caused havoc in city, the first was on August 19, when 82 mm rainfall was recorded in which at least one person was washed away and dozens of homes were damaged. About 138 mm rainfall was recorded in city in the last 24 hours till 5:30 pm, which is the highest in the current season. Heavily Rescued: At 8 pm, Fire Officials informed that they had had calls from public for rescue. More than 2,000 inmates in several parts of the city collapsed and the said three deaths since early in the morning. They however, maintained that they rescued five persons from Road No 5, Tapu Nagar, 34 from Ganga Nasaal Nagar, 10 from Bhanu road area, about 100 from Poojap and Ganga colony, 10 from Khatwani Nagar, 2,000 from Khadwani, Mada, Jh Nagar and many from Jagan Sector, Khatwani, Chhatrabagh, Shastri Nagar, Sikandara Colony, Bhandari Nagar, Ganga Road area.

Figure 4: Headlines, Indore Free Press, September 7 1994.

An examination of the main Indore English language newspaper (the 'Indore Free Press')<sup>5</sup> undertaken between 1 August 1994 and 21 September 1994 revealed interesting emphases in coverage. A standard quantitative measure, the column centimetre (cm), was used to assess the amount of attention paid by printed media to an issue<sup>6</sup>. On the issues of rain and flooding, 408 column-cm focused on the effects of flooding on persons and their possessions while 486 column-cm focused on weather reports and rain measurements. Other effects of rain and flooding, such as airport closures and crop damage, received 71 column-cm. In comparison, articles on slum improvements and services received 109 column-cm and on water-borne diseases 40 column-cm. Reports on the conditions of local and national roads,

<sup>5</sup>This newspaper is also published in Hindi

<sup>6</sup>see Herman et al 1988





however, received 1024 column-cm during the survey period. Therefore, while rain and flooding receives substantial press attention during the monsoon season, most of this attention is focused on measurement and weather prediction. The effects of flooding on local communities and health risks seem to be given a less important position. Reporting on the effects of flooding, however, is far exceeded by that on road conditions - an issue potentially more important to businesses and therefore potentially of more political importance. It is surprising that, despite the occurrence of what was perceived by residents as the worst flooding in 20 years, more attention was not paid to the risks and effects of flooding in the print media reviewed. Clearly, further studies would have to be undertaken to establish the reasons for this but it does, perhaps, reflect the relatively low importance of flooding on local agendas. This would be compatible with community perceptions.

#### 2.5 Responses to flooding: public and private spaces:

As has already been outlined, residents in areas susceptible to inundation have made modifications to their home environment ('private' space) to minimise possible flood damage. Interestingly, in most areas there is a clear differentiation made by residents between public and private spaces, but this differs between the areas. In Karbutakana residents take responsibility for keeping the concrete paths between houses clean either by cleaning them themselves or by employing a sweeper. They were concerned to be seen as a 'clean' community with resulting good health. Also, as the lanes in Karbutakana are very narrow and any debris would impede access to barrows and people, there are further reasons for 'public' space to be seen as 'private' in the area. In addition, residents felt that the appearance and hygiene of the area reflected on their status and social standing, particularly as a minority Moslem group in a majority Hindu community. In Pardesipura and Motilal-ki-Chal, however, residents generally took responsibility only for their yards ('private' space) and felt that the cleaning and maintenance of 'public' spaces, that is the streets and verges, was the responsibility of the municipal authorities. One family in Pardesipura felt that, although the authorities attempted to keep the areas clean and maintain drains, they were short-staffed and could not perform the task. Other residents were less complimentary about the authorities' work in the area. Another problem noted in Pardesipura and Motilal-ki-Chal is that, while the authorities clean out drains and remove any garbage, this is then left on the streets which is unsightly, causes a health hazard and washes back into the drains during the next rains.

It is also important to note that the differentiation between public and private space differs between individuals in different areas



In this section, individual and group responses to flooding have been outlined. A number of points emerge:

Individuals are prepared to invest substantial amounts of resources in protecting their 'private' environment and their businesses from the effects of flooding.

adaptations that may appear illogical to the outsider, such as building wooden rather than brick structures next to the nullahs, are shown to be rational and protective responses within the context and constraints of the communities studied.

In living with a natural hazard individuals have developed sophisticated prediction and protection systems and contingency plans for flood evacuation. These systems, developed over time, can be adversely affected by man-made or unexpected changes to normal seasonal patterns of flooding and drainage.

community responses to man-made environmental changes, such as improved drainage systems, are affected by social and cultural beliefs. These therefore need to be assessed before changes are instituted.

flooding and its effects do not only impact on the communities directly affected. Networks exist in the city for flood relief and compensation. In turn, the responses of the wider city, including municipal and religious institutions will affect the lives of individuals and groups in flood-prone areas.



## CONCLUSIONS and POLICY IMPLICATIONS

"Articulation is the tongue-tied's fighting;  
In the silence around all poetry we quote  
Tidd, who wrote

*Sir, I ham a very Bad Hand at Righting."*

G Hill (1964)

This study has attempted, firstly, to assess community perceptions of flooding as a risk in Indore and, secondly, to examine individual and group responses to flooding, including modifications and adaptations to the local environment.

Our major, and perhaps most startling, conclusion emphasises **the importance of discussing with people how they feel about and cope with their environment before making strategic decisions or policy choices**

Generally, in terms of concerns about flooding, while residents of both flat or nullah-based areas perceive the disbenefits of inundations, **flooding was not perceived as a major life problem in relation to the perceived overall advantages of respondents' residential location.** Residents commented that they actively liked living in their residential areas and felt strongly, even in the nullah-based sites, that they would not want to be elsewhere. Children, when asked to depict the environment in which they live illustrated the positive aspects of their homes rather than the negative (see cover illustration). This finding is not atypical of reactions found by studies of residents living in hazard-prone situations in the North: O'Riordan analyzing a North American context writes '...people live in hazard-prone areas because they consider the benefits from doing so to outweigh the risks.' (cited in White et al 1986 p.277-78). These benefits include both economic and social factors. This finding suggests that slum improvement initiatives which seek to improve environmental health conditions and quality of life for slum-dwellers must consider deeply the perspective of the residents before initiating policy. This view is not fresh and is corroborated by many studies (eg Salmen 1989; Stephens & Harpham 1991; Skinner 1987).

<sup>1</sup> As might be expected, the flood-prone areas were made up of complex networks of kinship, caste, religious and economic relationships which allowed residents not only to cope with seasonal flooding but to transform outwardly inhospitable environments into homes and communities. To deal with the



inundations, a 'hazards culture' appeared to have evolved in the study sites generally, and particularly in the nullah-based sites where risks were minimised by the adaptations made to the local environment and by flood prediction mechanisms which protect property and persons.

Within these overall conclusions, several points with policy implications emerged:

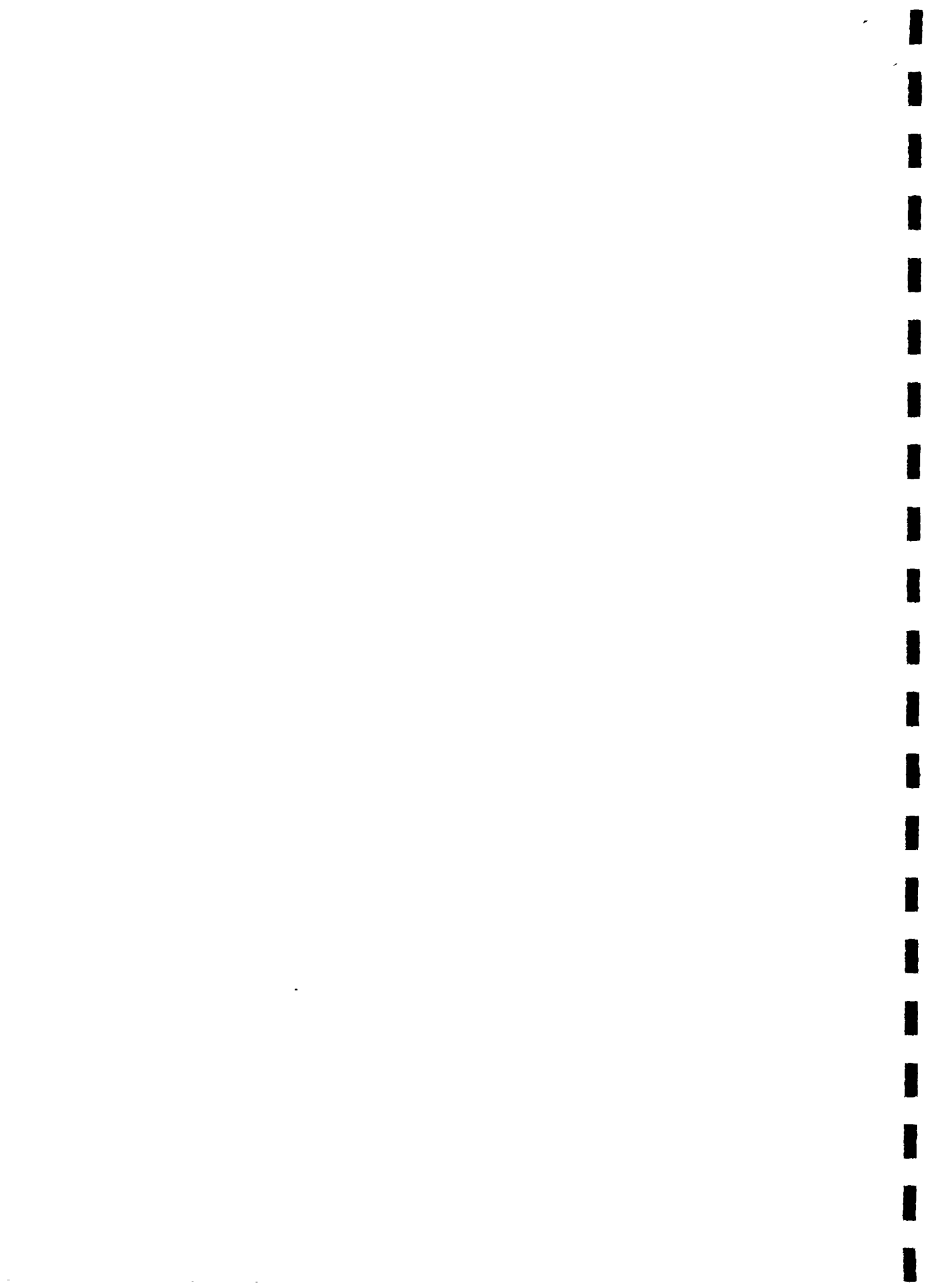
1. Within the city, 'flooding' as defined by residents, only occurs in the nullah-based sites. **Respondents differentiated between 'inundations' experienced in flat areas and the 'flooding' experienced near the nullah.** In other words, technical understanding of flooding (loosely, when water flows over a surface and/or an inundation occurs), is distinguished in the minds of residents interviewed into various degrees of inundation. Only the extreme form of inundation in the nullahs is defined as a 'flood'. The local terms used to describe different forms of inundation reflect the perceived intensity of the problem and thus influence the perceived environmental risk. This to an extent may influence community concern over the risk of flooding and community prioritizing of the problem
2. As might be expected, within the communities studied, **residents do not experience equally the effects of flooding or inundation.** Poorer households and those which, for various reasons, are less well adapted to flood conditions are more severely affected by flooding and appear less able to withstand the concomitant economic losses. This finding emphasises the need to understand the differential impact of the risk, even within a community and to incorporate this understanding into intervention policy.
3. A major concern mentioned by residents of all four areas relates to the **predictability of the flooding event and the velocity with which the inundation occurs.** To an extent these factors outweigh in perceived importance the actual duration or depth of the water inundation itself. In other words, even extensive inundation is bearable if expected (in relation to observed intensity and duration of rainfall), and if velocity of water flow is not high. If inundation is unexpected, possessions may be lost; if water flow is high, children and the elderly are considered particularly at risk. Interventions aimed at ameliorating the effects of flooding should try to take account of the needs of residents to understand and adapt their coping strategies if necessary.
4. In each of the areas studied **the after-effects of inundations were perceived to be as or more problematic than the immediate effects.** This related to clean-up difficulties, particularly as contaminated mud and water are seen as a source of mosquitoes and odours and as a health risk. Women were perceived as responsible for clean-up, while men were





responsible for building repairs and for moving furniture. Drainage interventions for flooding might be perceived more favourably if they had a complementary effect on longer-term standing water

5. **Residents of all four areas studied had a sophisticated understanding of health risks associated with flooding**, and related contaminated water and mud to common diseases such as malaria and stomach complaints. Their classification of water quality includes precautions necessary to prevent illness after coming into contact with contaminated water and the various uses to which different types of water can be put. There is some congruence between local and technical understanding of stormwater environmental health risks. Linked to point 4, interventions would gain favour if residents could perceive (or be informed) of impacts on water quality and contamination.
6. **Tolerance of inconvenience and well-developed personal coping responses were perceived by residents to be a normal part of seasonal activities**. Coping strategies were extensive and ranged from modified building design to emergency routines set up to evacuate goods and families and publicity mechanisms to garner compensation.
7. **Man-made drainage interventions were judged by residents with reference to their performance in affecting floods per se and by their effect on the well-established community coping strategies** set up to deal with the understood natural phenomenon of flooding. To an extent, negative perceptions of drainage interventions intended to ameliorate flooding outweighed reported benefits of the interventions. Interventions would gain favour if residents understood and were clearly informed about the effects (good and bad) on the environmental risk which they perceive as inherently a natural event. This, of course, necessitates technical personnel being able to predict the consequences of technical interventions. Such a strategy might reduce the scale of expectation.
8. **Positive perceptions of the interventions were substantially oriented towards the long-term benefits of drainage for personal and community environments and the benefits of drainage in ameliorating the after-effects of floodwater**. For example, people reported that there are now less mosquitoes, noxious smells and mud in areas where improvements have taken place. Substantial numbers of people mentioned the improved neighbourhood conditions, but without specific reference to flooding.



9. The complex and extensive networks activated in response to flooding within the local and broader community indicate that **support can be and is currently mobilised to assist those affected severely by inundations**. Support mechanisms differ according to the religious, caste and political composition of the community, but in all cases act to contain the worst effects of flooding and spread the burden of compensation. This is an important factor in enabling residents of flood-prone areas to continue living there. If possible, it would be productive if a systematic understanding of the effect of interventions on the likelihood of floods could be routinely fed to community leaders.

10. Related to wider responses to the risk of flooding, it appears that **information, ideas and perceptions regarding flooding are interpreted at various different levels** in the study area. On the individual and household level, respondents generally see flooding as a natural event and adapt their environments to minimise its effects. Vulnerable households, however, can experience fear, losses of both possessions and income, illness, disability and occasionally death as a result of flooding. Attempts are made, firstly, to prevent losses through evacuation and other adaptations and, secondly, to activate networks of support within the community and more broadly within the city using word of mouth, religious and caste networks, the media, municipal officials and NGOs. Information could be utilised productively for preventive strategies; information on the effects of interventions, and the effects of maintenance of interventions.

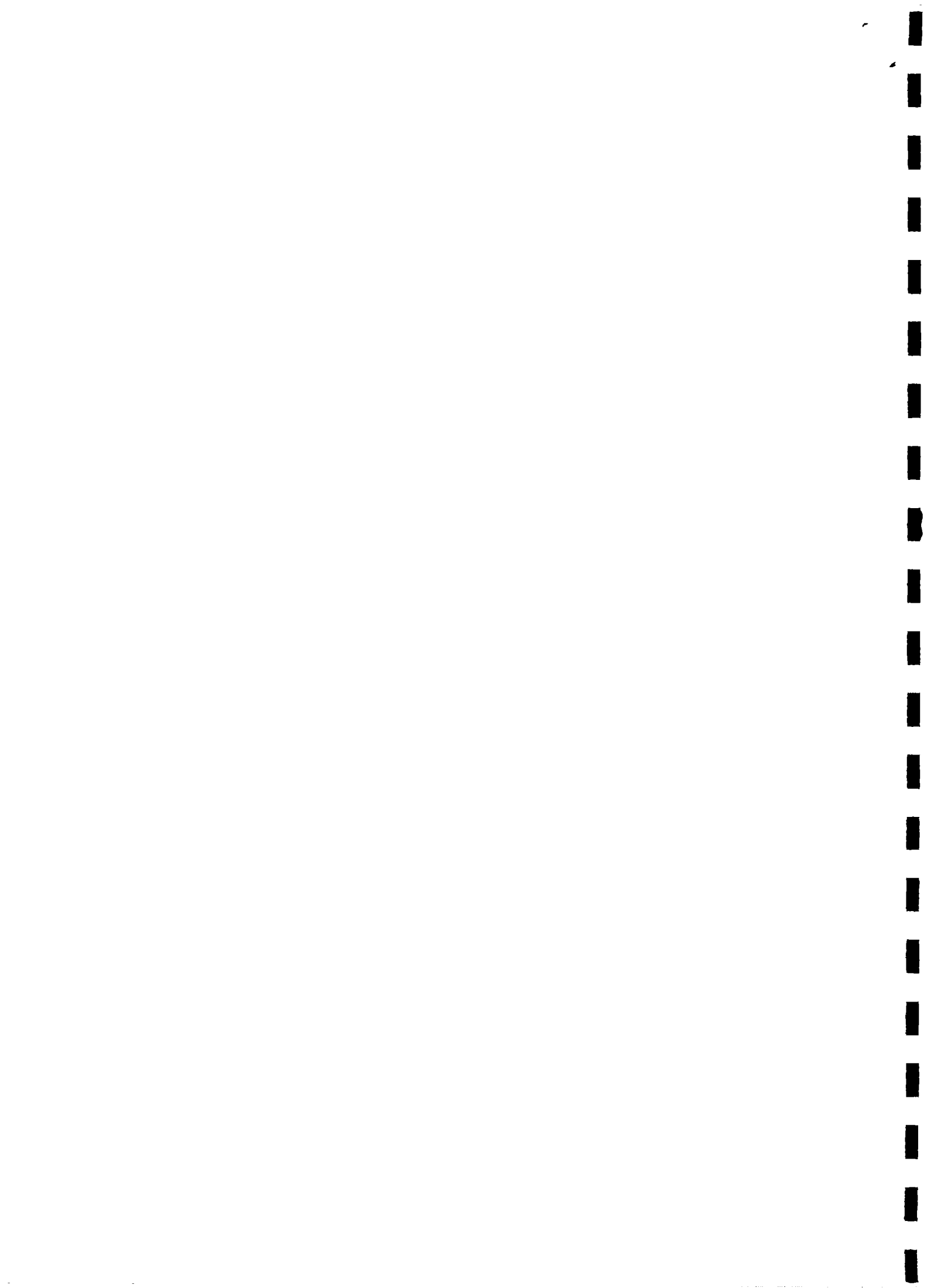
11. While this study has focused on specific communities, as has the slum improvement approach generally, the impact of flooding, even when it affects only specific areas, is felt city-wide, both in terms of perceived impact, support and policy. In other words, **the impact of flooding on perception and policy spreads outward from the individual and household to include religious, municipal and state institutions**. The support for those in nullah-based sites which experience the greatest level of inundations, evinces a city-wide concern over the situation of those in low-income settlements generally. This might suggest more broadly that strategies to incorporate low-income settlements into the broader city structures would meet support.



Finally, to reiterate the starting point of these conclusions: understanding peoples' own perspectives on their environment and health concerns is a vital step to strategising about improvements. In other words, the physical improvement of the environment through engineering interventions is a necessary, but not sufficient approach. In the words of a senior urban development specialist. "...my colleagues say - it is as though you suggest that if you water and house the urban poor they will not be poor anymore. This obviously does not make any sense. We need to have a much more integrated view of the needs of the urban poor" (Cohen in Harris 1991). The call for integration between professionals working on urban poverty is still largely rhetorical - this is true at city level, in international agencies and in academia. Yet, if we do actually take time to listen, with as little prejudice as we can, to the needs of those living in low-income communities, we find they articulate concerns and understandings which are complex and not distant from our own. If we have asked them seriously what they are concerned about, then our policy-making should follow responsively. Otherwise, perhaps we should not ask.

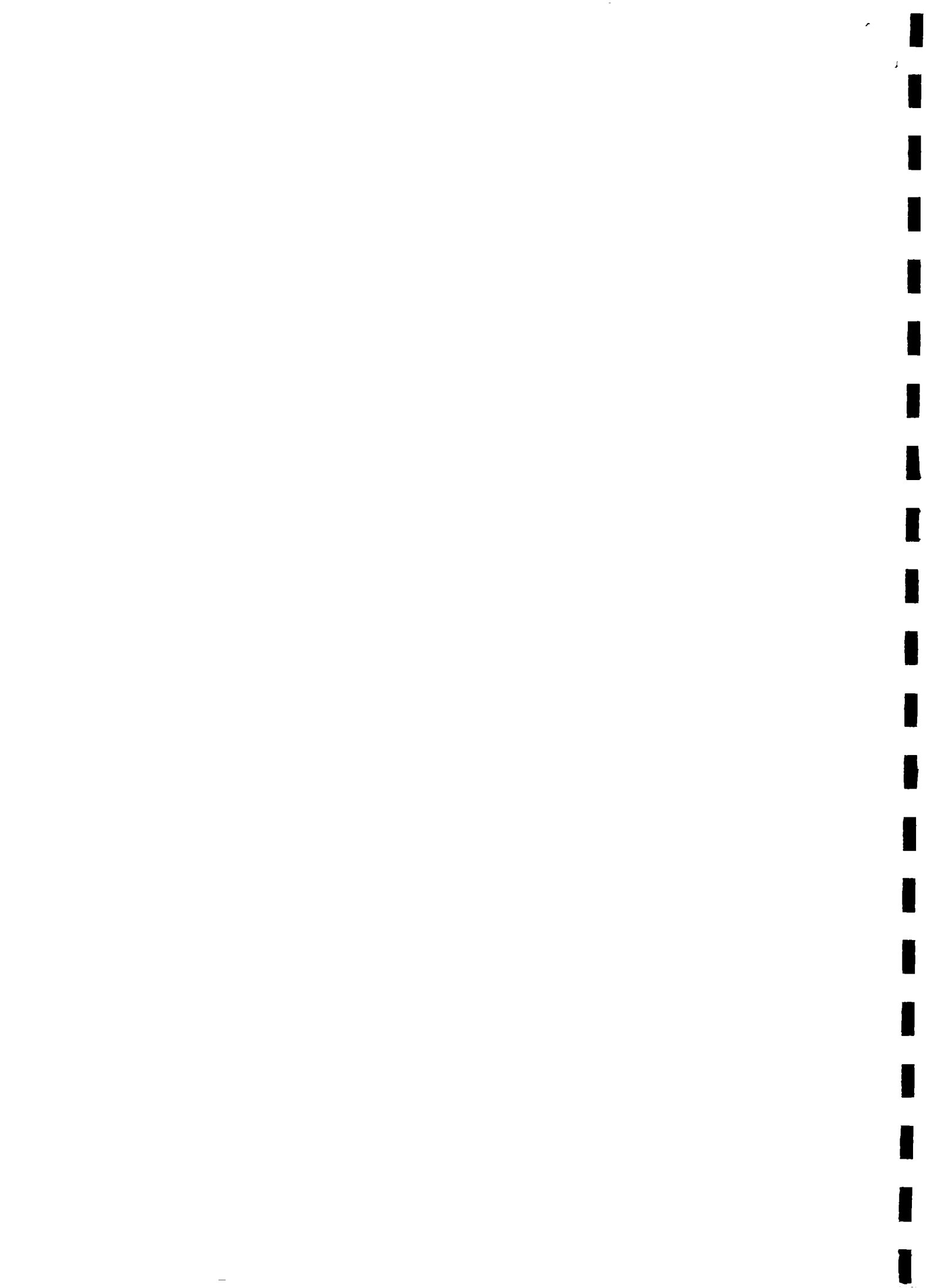


Figure 5: View of the nullah near Karbutakana



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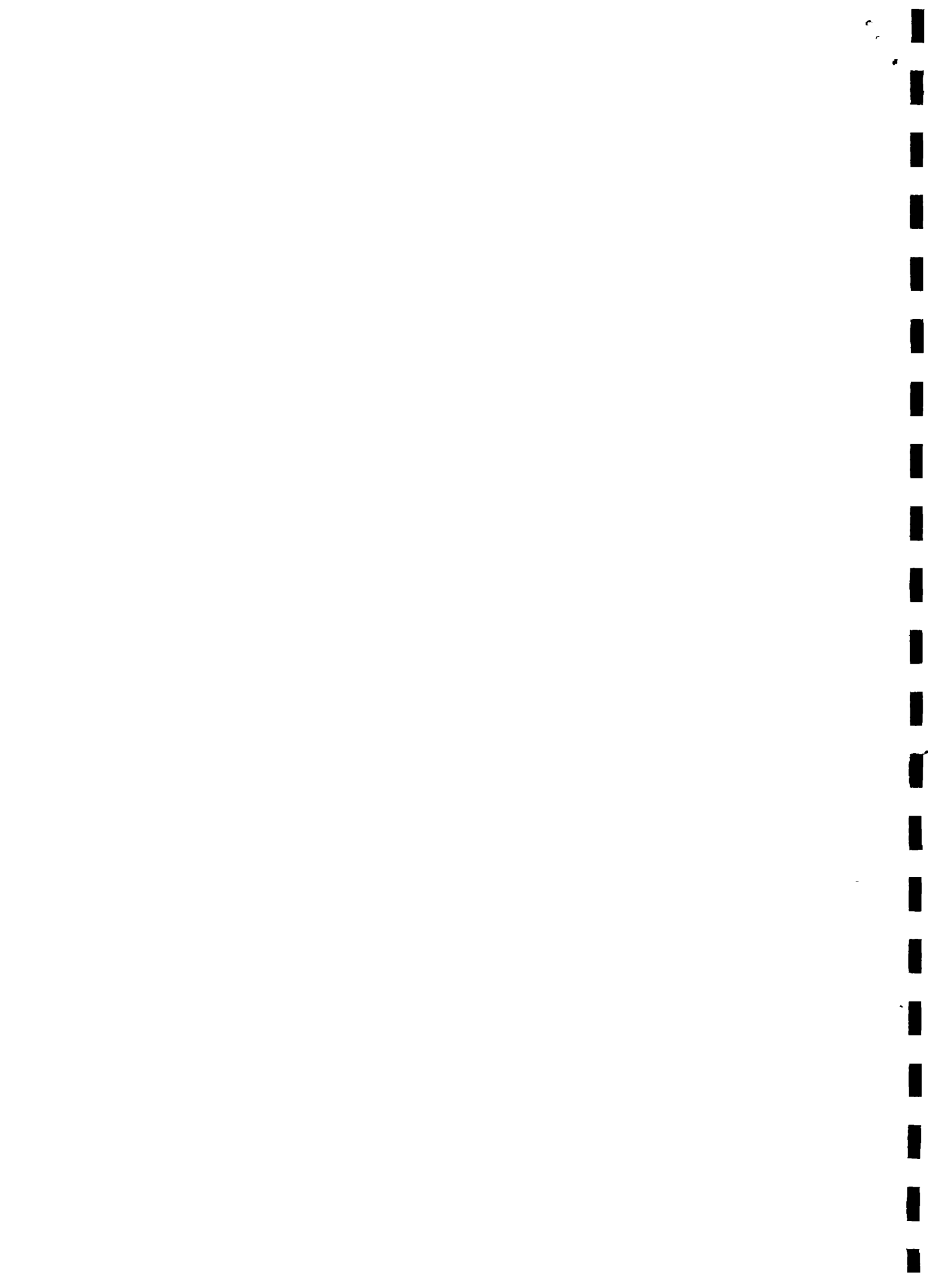
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## APPENDIX A

### Checklist for interviews:

Interview No:

Site:

Date:

Respondents: (age; sex; occupation group)

Background: (time of day; location characteristics; weather; other)

Location: (advantages/disadvantages; why live/work there; how long there)

Flooding: (What is it?; definitions; predications)

Effects: (immediate/long-term; intensity of rain; depth/duration; who - gender, age, economic, social)

Modifications: (individual; contextual)

Other: (flooding in comparison to other problems)

