RISK SOCIETY AND PLANNING: THE CASE OF FLOOD DISASTER MANAGEMENT IN TURKISH CITIES

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submitted by **MELTEM ŞENOL BALABAN** in partial fulfillment of the requirements for the degree of **Doctor of Philosophy in City and Regional Planning Department, Middle East Technical University** by**,**

Prof. Dr. Canan Özgen _____________
Dean, Graduate School of **Natural and Applied Sciences**

Prof. Dr. Melih Ersoy _____________
Head of Department, **City and Regional Planning**

Prof. Dr. Murat Balamir _____________
Supervisor, **City and Regional Planning Dept., METU**

Examining Committee Members:

Prof. Dr. Melih Ersoy _____________
City and Regional Planning Dept., METU

Prof. Dr. Murat Balamir _____________
City and Regional Planning Dept., METU

Assist. Prof. Dr. Tayfun Çınar _____________
Faculty of Political Sciences, Ankara University

Assoc. Prof. Dr. H. Çağatay Keskinok _____________
City and Regional Planning Dept., METU

Assoc. Prof. Dr. H. Tarık Şengül _____________
Political Science and Public Administration Dept., METU

Date: 12.03.2009

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last Name : Meltem Şenol Balaban

Signature :

ABSTRACT

RISK SOCIETY AND PLANNING: THE CASE OF FLOOD DISASTER MANAGEMENT IN TURKISH CITIES

Şenol Balaban, Meltem

Ph.D., Department of City and Regional Planning

Supervisor: Prof. Dr. Murat Balamir

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Global warming and climate change is believed to increase the hydro-meteorological natural disasters. Floods, the most widespread of natural hazards, are expected to occur more frequently and severely in the near future. This means that urban areas of Turkey are likely to be under intensive threat of floods, the adverse impacts of which are already considered only next to that of earthquakes. The recent disaster policy of United Nations together with contemporary interpretations of risk society shifted to capacity building and risk management prior to hazards, rather than preparations for relief after disasters. This historical turn in policy demands a more comprehensive and integrated form of planning for the mitigation of risks in the riverain cities of Turkey than existing approaches.

Turkey's current flood protection structure seems to be based on the surveys and assessments of a central authority and on its limited powers of intervention. The local municipal administrations are under different interests and pressures for development and land-use. It seems essential to integrate flood risk mitigation efforts with the local planning system and to involve municipalities in their estimations of risks and its declaration on official duty, as contemporary international approaches indicate. This conviction is based on a sample survey of four cases of riverine cities in Turkey, and on a review of current approaches in a sample of international cases.

Findings on four riverain case cities indicate that river floods turn into destructive disasters mainly due to tolerant land-use decisions. Inaccurate and discrete implementations and developments in and through the river basins are a second source of flood losses. Currently, neither urban development plans nor available flood plans are equipped with necessary measures to mitigate risks.

Findings indicate that current vulnerabilities are greater in value than investments made to curb flood risks. Independent and discrete efforts of mitigation seem to generate illusory feelings of safety, which aggravates vulnerabilities.

The compulsory declaration of flood vulnerabilities by municipalities themselves in their entitlement for special subsidies could raise the general level of awareness, could curb further vulnerabilities, and contribute to the articulation of planning methods in the more effective mitigation control.

Key Words: Integrated Basin Management, Urban Flood Risk Management, Urban Land-Use Planning, Flood Legislation, Climate Change and Floods

ÖZ

RİSK TOPLUMU VE PLANLAMA: TÜRK KENTLERİNDE SEL FELAKETİ YÖNETİMİ

Şenol Balaban, Meltem

Doktora, Şehir ve Bölge Planlama Bölümü

Tez Yöneticisi: Prof. Dr. Murat Balamir

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Küresel ısınma ve iklim değişikliğinin hidro-meteorolojik doğal afetleri arttırmakta olduğuna inanılmaktadır. En yaygın doğal afetlerden birisi olan taşkınların, yakın gelecekte saha sık ve şiddetli yaşanması beklenmektedir. Bu da, Türkiye'de kentsel alanların, olumsuz etkileri açısından depremlerden hemen sonra gelen taşkınların yoğun tehdidi ve tehlikesi altında kalacağı anlamına gelmektedir. Birleşmiş Milletlerin afetlere ilişkin politikası ile risk toplumuna ilişkin güncel yaklaşımlar; felaket sonrası yara sarmaya yönelik hazırlıktan, afetler öncesinde kapasite artırımına ve risk yönetimine kaymıştır. Politikadaki bu tarihsel değişim, Türkiye'nin akarsu kentlerindeki risklerin azaltılması için mevcut yaklaşımlar yerine daha kapsamlı ve bütünleşik planlama yöntemlerinin yürürlüğe konulmasını gerekli kılmaktadır.

Türkiye'deki mevcut taşkın yönetimi sistemi; merkezi bir kurumun araştırma ve değerlendirmeleri ile bu kurumun sınırlı müdahale yetki ve araçlarına dayanmaktadır. Yerel yönetimler ise, kentsel gelişme ve arazi kullanım kararlarına ilişkin olarak farklı çıkar ve baskılarla karşı karşıya bulunmaktadır. Bu bağlamda Türkiye'de; taşkın risklerinin azaltılmasına yönelik çabalar ile yerel düzeydeki planlama sisteminin bütünleştirilmesi ve yerel yönetimlerin risklerin tahmin edilmesi ve kamuoyunun bilgisine sunulması süreçlerine dahil edilmeleri önemli ve gerekli görünmektedir. Bunlar, güncel uluslararası yaklaşımlar kapsamında da vurgulanan hususlar arasında yer almaktadır. Bu kanaat; Türkiye'deki dört akarsu kenti özelinde yapılan araştırma ile güncel yaklaşımlara ilişkin olarak bir dizi uluslararası örnek üzerinde yapılan incelemelere dayanmaktadır.

Dört akarsu kenti özelinde elde edilen bulgular, akarsu taşkınlarının yıkıcı felaketlere dönüşmesinin arkasındaki temel nedenin, arazi kullanımına ilişkin gevşek ve toleranslı kararlar olduğunu göstermektedir. Akarsu havzaları içerisinde gerçekleşen hatalı ve münferit uygulama ve gelişmeler ise taşkın kayıplarının diğer bir nedeni olarak tespit edilmektedir. Hali hazırda, ne imar planları ne de az sayıdaki taşkın planları, risklerin azaltılmasını sağlayacak uygun araç ve tedbirleri içermektedir.

Bulgular, mevcut durumda tehlikeye maruz varlıkların toplam değerinin taşkın risklerini sınırlamak için yapılan yatırımların çok üzerinde olduğunu göstermektedir. Risk azaltmaya yönelik bağımsız ve münferit çabaların, yanıltıcı bir güvenlik hissi yarattığı, bunun da tehlikeye maruz varlıkların sayısını daha da arttırdığı anlaşılmaktadır.

Yerel yönetimler tarafından tehlikeye maruz alan ve varlıklarının kamuoyuna duyurulmasının zorunlu kılınması, konuya ilişkin duyarlılığın artmasını, tehlikeye maruz varlıkların düzeyinin sınırlandırılmasını sağlayacak ve etkin risk azaltma çabaları ile planlama yöntemlerinin birbirine eklemlenmesine katkı yapacaktır.

Anahtar Kelimeler: Bütünleşik Havza Yönetimi, Kentsel Taşkın Risk Yönetimi, Kentsel Arazi Kullanım Planlaması, Taşkın Mevzuatı, İklim Değişikliği ve Taşkınlar

To my parents;

Filiz and Altay Şenol

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TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF CHARTS

CHARTS

LIST OF FIGURES

FIGURES

LIST OF ABBREVIATIONS

AİGM: Afet İşleri Genel Müdürlüğü (*General Directorate of Disaster Affairs*)

CRED: Center for Research on the Epidemiology of Disasters

DDR: Disaster Risk Reduction

DEM: Digital Elevation Model

DMİ: Devlet Meteoroloji İşleri Genel Müdürlüğü (*Turkish State Meteorological Service*)

DSİ: Devlet Su İşleri Genel Müdürlüğü (*State Hydraulic Works*)

DTM: Digital Terrain Model

EEA: European Environmental Agency

EİE: Elektrik İşleri Etüd İdaresi (*General Directorate of Electrical Power Resources Survey and Development Administration*)

EM-DAT: The International Emergency Events Database

EQs: Earthquakes

FEMA: Federal Emergency Management Agency

FRMF: Flood Risk Management Framework

HDA: Housing Development Administration (*Toplu Konut İdaresi Başkanlığı*)

IEMS: International Emergency Management Symposium

IPPC: Intergovernmental Panel on Climate Change

ITC: International Institute for Geo-Information Science and Earth Observation

MEDD: Minister of Ecology and Sustainable Development

MEF: Ministry of Environment and Forestry (*Çevre ve Orman Bakanlığı*)

MENR: Ministry of Energy and Natural Resources (*Enerji ve Tabii Kaynaklar Bakanlığı*)

MPWS: Ministry of Public Works and Settlement (*Bayındırlık ve İskan Bakanlığı*)

NASA: National Aeronautics and Space Administration

NOAA: National Oceanic and Atmospheric Administration

SAR: Search and Rescue

SPRC: Source-Pathway-Receptor-Consequence

TEFER: Turkey Emergency Flood and Earthquake Recovery Project

TPAO: Türk Petrolleri Anonim Ortaklığı (*Turkish Petroleum Corporation*)

TPs: Territorial Plans (*Çevre Düzeni Planları*)

TÜİK: Türkiye İstatistik Kurumu (*Turkish Statistical Institute*)

UN: United Nations

UNISDR: United Nations' International Strategy for Disaster Reduction

ZBK: Zonguldak Bartın Karabük

CHAPTER 1

Planning for Flood Risk Mitigation: Aim, Scope and Method of Study

This chapter aims to present reasons for studying river flood disasters in Turkey. It begins with the general description of flooding. Turkey's flood disasters are depicted with official flood loss statistics, illustrating river floods as the most widespread and persistent of disasters since 1950's.

Further, current conditions that necessitate research on floods in Turkey are distinguished as:

- The effects of 'climate change' that is likely to increase the number of flood events on Earth and in Turkey
- The broad policy shift related to natural disasters, and its implications at the national level
- Relation of the issue of flood management to approaches in contemporary society described as the 'Global Risk Society'

Identifying the aim and objectives of the dissertation, the chapter then explains the scope and method of the research study, which the dissertation based on, leading to the exposition of the structure of the dissertation with a review of all chapters and the steps of the research process.

1.1. BACKGROUND

1.1.1 The Description of Floods and Flood Hazards in Turkey

Flood or flooding is generally defined as 'temporary inundation of normally dry areas from several sources; such as the overflow of inland or tidal waters, the unusual and rapid accumulation, and runoff of surface waters of any sources'

(FEMA 1986). Flooding occurs due to excessive rainfall, rapid snowmelt, natural stream blockages, tidal waves, wind storms over lakes or any combination of such conditions. Coastal floods, tsunami (earthquake wave) floods, flash floods, storm floods, floods due to dam breaks, and river floods are several types of floods.

Floods have great damage potential among all natural disasters worldwide, and affect significant numbers of people. On a global basis, there is evidence that the number of people affected by flooding and economic damages resulting from it are on the rise at an alarming rate as UN (2003) declares.

As the main concern of thesis, river floods are the most widespread hydro-meteorological hazards in Turkey. Except one province, 80 provinces of Turkey have been affected from flood events (Gökçe and others 2008, 37). According to DSİ records, **1232 persons** lost their lives in **1930** separate **events** and approximately **23 million hectares of land surface** was inundated by flood-waters during the past five decades (1955-2008). Within that period, **36 flood events** occurred, **23 persons** were killed and **430’000 hectares** were inundated annually at an average. Investigation and Planning Division of DSİ states that the financial losses of flood events between 1989 and 2007 are approximately 2 Billion US Dollars.

Figure 1.1: Major Rivers, Basins and Flooded Areas of Turkey (1970-1997)
(Source: DSİ 1998)

The 'UN Development Program' has observed that after the earthquakes, floods have been most effective in generating damages in settlements when compared with the yearly disaster averages like droughts, earthquakes, floods and tropical cyclones between 1980 and 2000 as shown in Chart 1.1. Flood hazards, may not have as much impacts as earthquakes on people's life and property in Turkey but they nevertheless cause considerable losses.

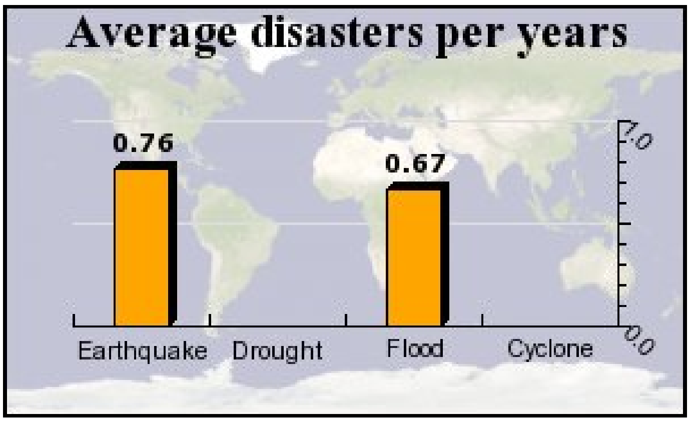

Chart 1.1: Average Disasters per years in Turkey (1980-2000)
(Source: http://gridca.grid.unep.ch/undp)

As shown in Table 1.1, exposure average yearly population physically exposed to a flood hazard (number/year) is also higher in descriptive figures.

Table 1.1: Descriptive Figures per Disaster Types (1980-2000)

	Disasters per year [nb/year]	Casualties [killed/year]	Physical exposure [nb/year]	Relative vulnerability [killed/mio. exp.]
Droughts	-	-	-	-
Earthquakes	0.76	949.9	2'745'757	345.9
Floods	0.67	20.9	1'883'782	11.1
Tropical Cyclones	-	-	-	-

(Source: http://gridca.grid.unep.ch/undp)

Another international data base regarding natural disasters is the International Emergency Events Database (EM-DAT 2009). In order for a disaster to be recorded in this database, at least one of the criteria[1] defined has to be fulfilled. This database indicates that floods are the second frequent type (24%) among all disaster types in Turkey (Table 1.2).

[1] Basic criteria for recording data-base: 10 or more people reported killed; 100 people reported affected; a call for international assistance; declaration of a state of emergency.

Table 1.2: Distribution of Disasters Recorded in Turkey (1900-2008)

Disaster Type	Number of Events	% By Disaster Type	Number of Killed	Totally Affected Population	Injured Population	Est. Damage (US$ Million)
Earthquake (seismic activity)	71	49,31	88.538	6.874.596	92.866	22.941.400
Epidemic	8	5,56	613	204.855	0	0
Extreme temperature	7	4,86	100	8.450	450	1.000
Flood	**35**	**24,31**	**1.274**	**1.743.386**	**180**	**1.645.500**
Mass movement dry	1	0,69	261	1.069	69	0
Mass movement wet	8	5,56	404	13.275	185	26.000
Storm	9	6,25	100	13.639	139	2.200
Wildfire	5	3,47	15	1.150	0	0
TOTAL	144	100,00	91.305	8.860.420	93.889	24.616.100

(Source: EM-DAT 2009)

14% of all disaster events occurred between 1955 and 2008 are composed of floods according to the records of General Directorate of Disaster Affairs (Gökçe and others 2008, 11). As indicated in Chart 1.2, among all disaster types, floods are the third frequent type after landslides in Turkey.

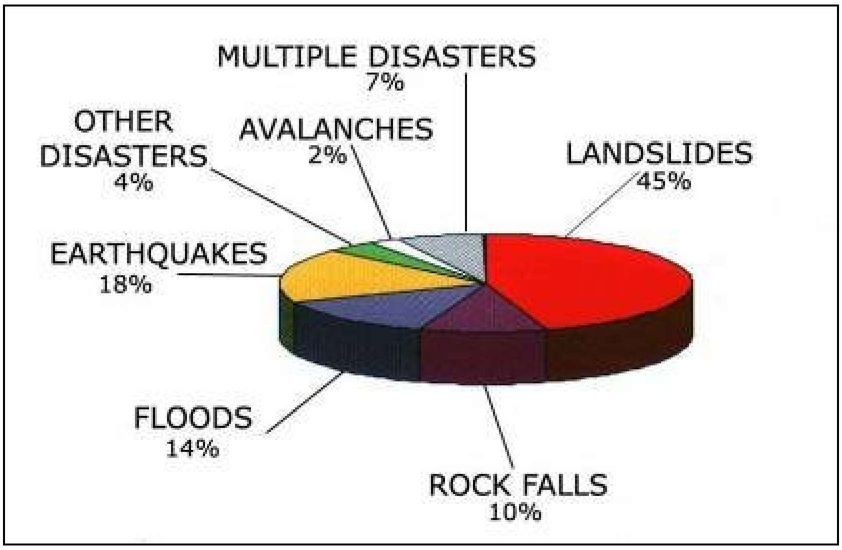

Chart 1.2: Distribution of Disaster Events in Turkey by Types (1952-2007)
(Source: Gökçe and others 2008, 11)

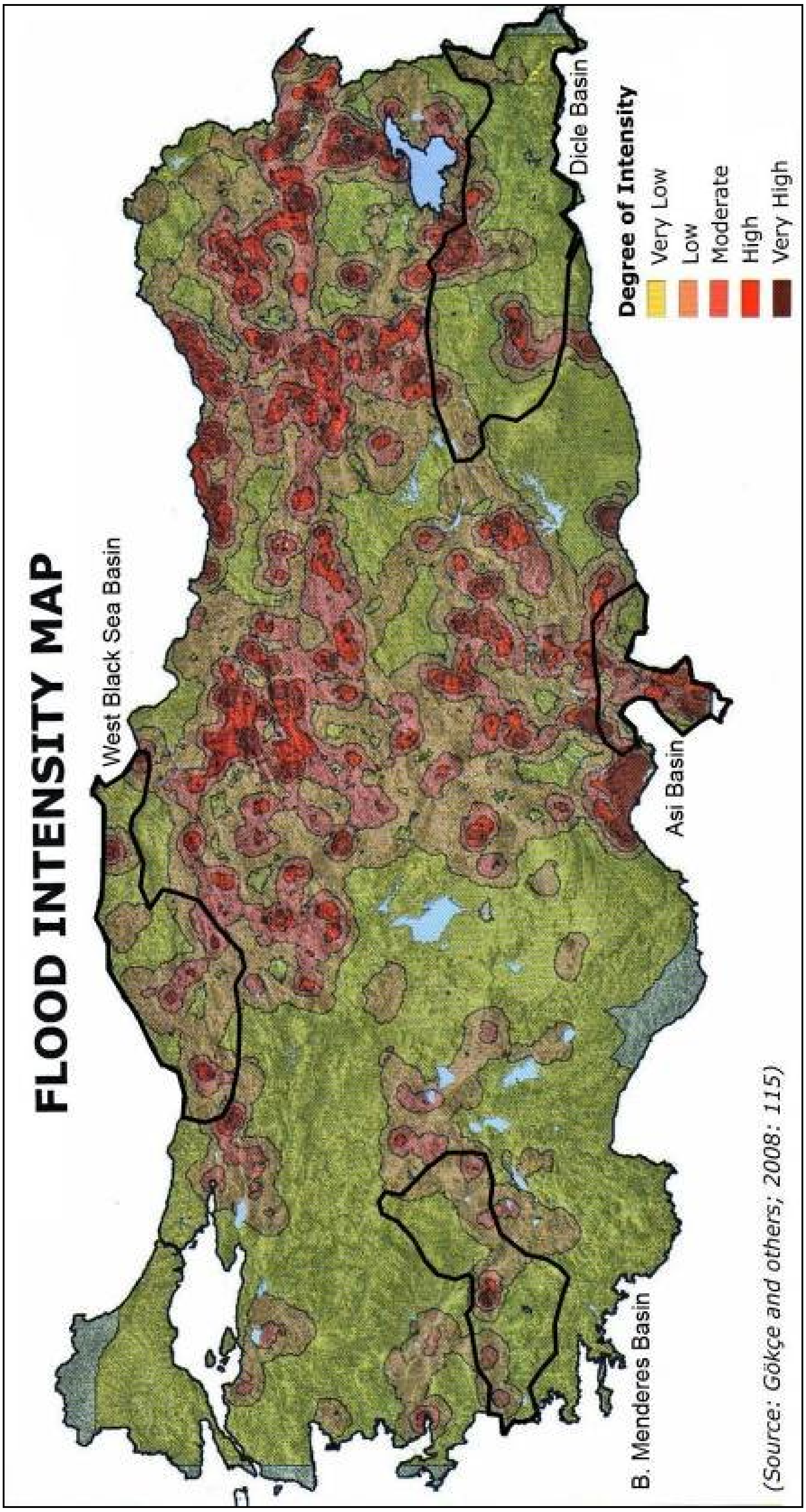

Figure 1.2: Flood Intensity Map *(Source: Gökçe and others 2008, 115)*

River floods as the main concern of this thesis seem to be the most widespread hydro-meteorological hazards in Turkey. Except a single province, **80 provinces** and **22'157** disaster victims and survivors have been affected from separate flood events in Turkey. According to General Directorate of Disaster Affairs (GDDA) records[2] since 1955 the total number of flood events have been **4067** (Gökçe and others 2008, 37). AİGM prepares than 'a flood intensity map' considering statistical and spatial distribution of previous flood disasters (Figure 1.2). As shown in this map, brown-red areas are high exposure of floods; such as some parts of East Black Sea, Eastern and Western Anatolia Regions. This is likely to increase in the near future due to global warming and climate change.

1.1.2 Global Warming, Climate Change and Increase in Hydro-Meteorological Disasters

In the 20th century drastic changes on the globe have been observed due to excessive consumption of fossil fuels by human activity. Severe environmental problems like degradation, pollution and ozone layer depletion, which in turn have led to global warming and climate change, are now main concerns of many countries of the world (IPCC 2007). Increasing global temperature, rising sea levels, species in the process of extinction are the aspects of this process. And in turn, the impact of any minute change in the food chain can easily spread its affects out to whole species, as well as human beings. Intercontinental transfer of dust from African deserts to South America's islands, for instance, may cause drastic increase in Asthma cases due to changes in atmospheric systems and cause rises in the Indian Ocean temperatures (National Geographic's Documentary 2005, EP II).

Another consequence of global warming and climate change is to be observed in the hydro-meteorological[3] system, leading to natural disasters such as droughts, storms, tornados, typhoons, cyclones, dense fogs, frost/freezing temperatures, heavy snowfalls/rainfalls and floods, which have progressively

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[2] Numbers of victims and survivors are calculated from the houses that are decided to move to another location by AİGM. Number of events is calculated from the number of survey reports of AİGM.

[3] Climatological disasters: Droughts, Extreme Temperatures, Wildfires; Hydrological disasters: Floods, Wet Mass Movements; Meteorological disasters: Storms (Classification of CRED)

increased since 1980's (Chart 1.4). Ethiopia and Sudan droughts in 1984, Bangladesh floods in 1987 and 1998, Mid-Europe river floods in 1998 and 2002, Western Europe Heat Wave in 2003, Hurricane Katrina in U.S., in 2005, Myanmar cyclone in 2008 are some of the disastrous events affecting great populations throughout the world.

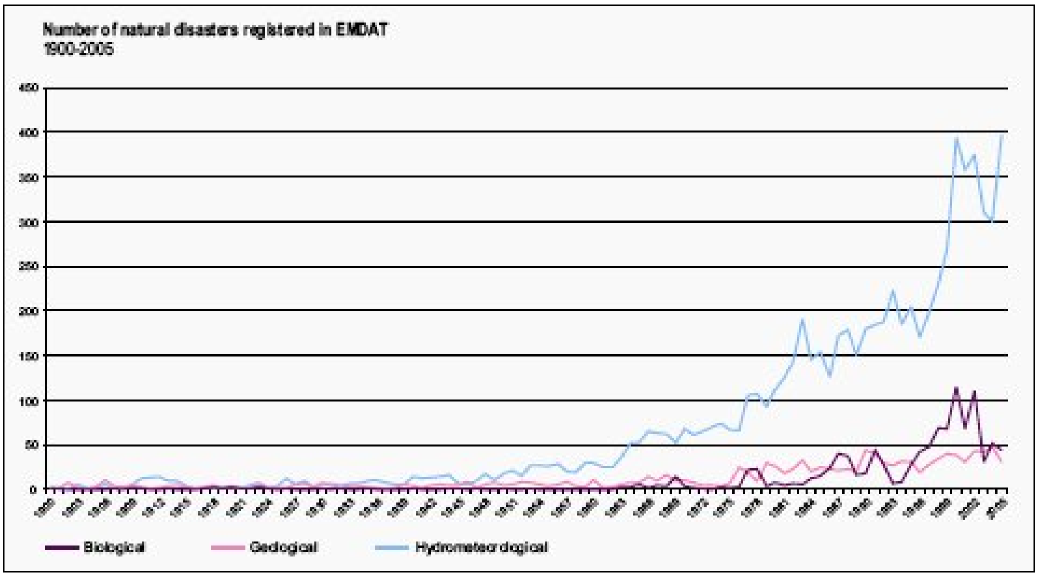

Chart 1.3: Number of Natural Disasters by Origin (1900-2005)
(Source: EM-DAT)

The number and magnitude of flood events tend to be aggravated due to global warming and climate change as shown in Chart 1.4 given below. More frequent floods causing greater losses in the next decades are expected.

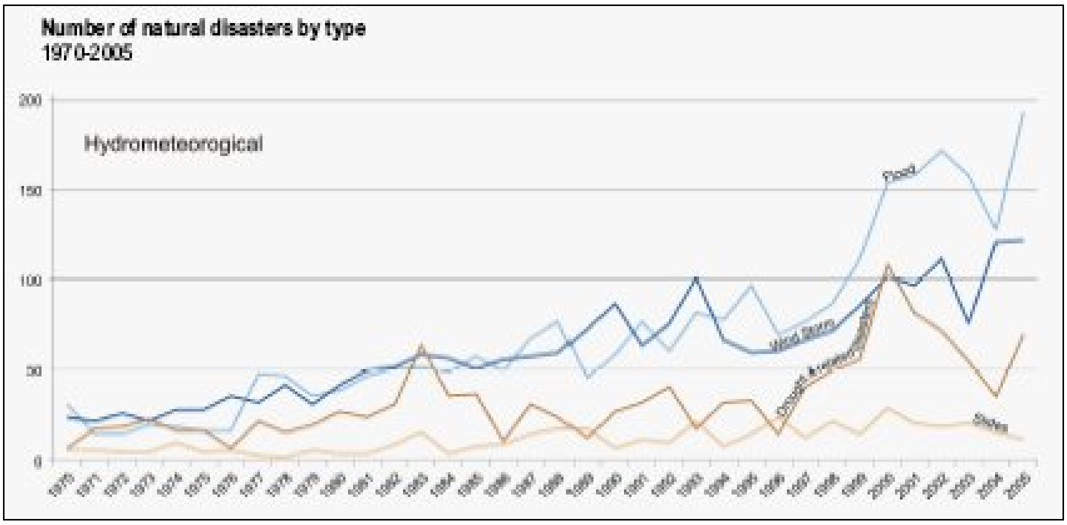

Chart 1.4: Number of Hydro-Meteorological Disasters (1970-2005)
(Source: EM-DAT)

1.1.3 Natural Disasters Policy Shift of United Nations

Human and economic losses from natural disasters have recently been so high that no nation could possibly afford the costs by itself. Besides, the extent and magnitude of risks have surpassed national boundaries. It is also admitted that disasters were not relegated to the least developed nations, but they could also devastate the most economically advanced and industrialized nations. United Nations' disaster policy that prevailed for decades shifted from *disaster response* to *disaster risk reduction* by 1990s. According to this new policy, proactive works that consist of several measures foreseeing possible effects of disasters should require greater attention than that of disaster response activities. Therefore, it could be claimed that response activities are likely to be relatively reduced in time, when societies and the built environment in which they live become more resilient to possible hazards by mitigation of risks and preparedness prior to hazards.

For the adoption of this new policy throughout the world, United Nations launched programs and declared the 'International Decade for Natural Disaster Reduction' (1990-99), Foundation of 'International Strategy for Disaster Reduction' (2000), and the 'Hyogo Framework for Action' (2005-2015) to promote resilient communities in all nations (Albrito 2008, 2).

As many countries began to explore new ways of mitigating the effects of natural hazards, 'Climate Change Adaptation' is commonly embraced as an opportunity for Disaster Risk Reduction (hereafter DRR) by UN-ISDR (Albrito 2008, 10). A broad consensus has been reached on the need to engage local and regional authorities in the DRR processes. The reason is that there is growing evidence on DRR as a local issue which needs efforts at local and sub-national levels.

To disseminate this policy (2000) United Nations' ISDR defined priority areas for action aiming to reduce disaster risk. One of them is to set up or strengthen 'regional and local governance' within institutional and policy frameworks. A second priority area is risk assessment and risk monitoring, and requires determination of 'acceptable risk' levels based on data, information and shared resources. Still a third priority area is the reduction of underlying risk factors and requires urban risk management and plans, planning and land-use commitment especially compliance to regulations and codes building on risk assessment, locally applicable insurance or related financial instruments with variations of micro-finance and micro-credit tied to DRR. A fourth priority area is public participation and participatory process and requires the enforcement of regulations for wider infrastructure protection, investments in human capital for the improvement of recovery capacities and safety nets, and applications of available technologies focusing on local issues (such as GIS applications, telecommunication systems, remote sensing) (Albrito 2008, 5-7).

In short, the new disaster policy of 'disaster risk reduction' (DRR) requires new organizational approaches in contemporary societies to set up or strengthen regional and local governance, as well as transnational collaboration.

1.1.4 Risks and Threats in Contemporary Society: 'Global Risk Society'

Accidents and Hazards, some of which are entirely new, can no longer be limited in time and space. They embrace the potential to have trans-boundary impacts on both today's and future generations' lives. Global warming, environmental degradation, global terrorism, nuclear power plants, renewable internet viruses, natural hazards, etc. have devastating potential power in contemporary society.

With the observation of severe impacts of such hazards and threats, some authors criticize the contemporary life-styles and the treatment of the environment in the post-industrial society. Ulrich Beck (1992), has called the new 'global society' of 1990's as 'risk society', a creation of the scientific and industrial development of modern society. According to him, progress in information and communication technologies has accelerated the transformation of the 19th century industrial societies into a new global society. The reflections of this transformation could be observed in changes of the world order, state structures as well as labor, class and family structures. In this new phase, as the previous consequences of some individual events have shown, risks and hazards seem not to be pervasive, and could not be overcome by means of improvements in traditional procedures, division of labor, or subsystems that were effective in the early industrial societies. Since the scale, range of impacts and side-effects cannot be easily foreseen, unlike the consequences of former events in a closed and homogeneous system, it is less probable to cope with hazards of today's society by previous tools of the 'industrial society'. In other words, the institutions and instruments of modernization based on 'accountability principle' supported by rational thinking have failed to handle the globally effective threats and hazards, impacts and accountability of which could hardly be anticipated (Beck 1999, 40).

Therefore foresighted and innovative forms of approaches are now required to deal with intricate features, chain effects and irreversibilities of contemporary crises (Beck 1992 and Balamir 2000). Today it seems necessary to embrace a systematic method of dealing with these hazards and insecurities generated; that is <u>the concept of risk</u>. Hence, as Beck (1992) states it, a new kind of modernization, identified as 'reflexive modernization', and new institutions are needed in our globalized world. With the reflexive modernization; democratically monitored public sector should not only take the control from current scientific institutions that fail to calculate possible consequences of global hazards, but also restructure the scientific community into a new democratic environment. In other words, public sector should take the control of a new scientific approach and promote knowledge, based on the concept of risk and generate a renewable capacity with respect to learning from the experiences of newly emerging risks.

Some of the recent actions of United Nations against the climate change and natural disasters, for example, may have the potential for the creation of a 'world reflexive society' as described by Beck in most of his theoretical works. Particularly hydro-meteorological disaster risks have already created a broad consensus on worldwide since the rise of adverse effects and risks of global warming and climate change across national boundaries. While new ways of mitigating the effects of flood hazard risks are explored, the understanding of risk concept and the ways how to manage it are the key evolving subjects today and near future as well. For this reason dealing with flood risks is receiving higher attention worldwide from all scientific disciplines. The intentions behind this attention are to make best estimations, simulations and decisions as well as to improve social aspects to have higher capacity of resiliency.

1.2. PROBLEM DEFINITION

Flooding as a natural event creates necessary and valuable ecologic effects that are vital for the sustainability of flora and fauna of surrounding lands. Yet it could turn into a disaster when its basin and territorial effects are disturbed. Being a part of hydro-meteorological cycle, the occurrence of floods is inevitable. Yet, areas that may be affected, and the excessive water volume that may inundate such areas can be calculated within probabilities. With the help of historical data about weather conditions and major floods that occurred previously, hydraulic and hydrologic models that simulate flood water expansion in time can be generated for a particular basin terrain.

Yet the growing impacts of climate change on precipitation patterns and trends reduce the reliability of historical data. The increase in the uncertainty of data on weather conditions and precipitation patterns endangers the validity of the findings of hydraulic and hydrologic models. This constitutes one of the reasons behind the shift in the disaster policies and strategies.

The most-widely used flood protection method through ages has been to construct embankments parallel to both banks of a stream or sea in order for resisting the highest flood water level observed thus far. Nevertheless, it was experienced that structural (engineering) measures, which were used to keep flood away from settlements, such as construction of levees, embankments, channel alterations, riverbed reclamations, dams, retention and detention ponds had provided temporary solutions. Moreover it was observed that these measures have created more destructive flood disasters following extreme events. Many examples proved that factors which were not taken into account before, brought unforeseen destructive consequences; such as inundations due to collapse of protection facilities while lower discharges occurred. Therefore, a '**risk management**' approach, which calculates the probability of occurrence and identifies impacts in areas of various return periods in the catchment area, has been a basic requirement. Besides, it is definite that this approach could propose mitigation strategies to reduce risks with non-structural measures; such as preparing flood hazard, vulnerability and risk maps, generating flood scenarios in land-use planning process, proposing necessary regulations including building supervision codes, establishing early-warning systems and improving the insurance sector, structuring responsibilities of institutions and all other stakeholders.

Today in the related literature, the mainstream arguments on flood risk management is in consensus about the necessity of a balance between *structural and non-structural measures* basin-wide, to be comprehensively considered. Although, it is difficult to achieve this balance in the current contexts, some ongoing processes have already been launched like a number of collective projects (FloodSITE, FloodATLAS, IRMA etc.) initiated by European Countries in order to set guidelines for flood risk management including mitigation measures (EU Communication 2004 and Directive 2007). Since climate extremes have trans-boundary impacts, as in the 1998 and 2002 Mid-Europe floods, many countries in Europe have been obliged to cooperate internationally and internally between administrative levels for re-estimating the extreme conditions altered by the global warming, and revising mitigation measures.

Nevertheless, the situation in Turkey is different from international experiences. Although the infrastructure, open river channels and their flood protection and discharge structures are designed for 500-year return period, even relatively less effective rainfalls can easily cause significant damages on public services and residential areas in many urban areas of Turkey. Such floods have continually damaged life and property due to the <u>unauthorized occupation and use of flood-prone areas,</u> and <u>adherence to inefficient *structural measures*</u> rather than appropriate responses to the extreme conditions due to global warming.

Flood hazards are easier to estimate and control in comparison to EQs. Yet regulations concerning floods have had little improvement within the disaster management system of Turkey. It could be stated that no 'flood disaster management system' which includes the effective coordination of all related institutions and stakeholders exist in Turkey. What is observed in the current organizational structure is that 'dealing with floods' is considered as a *technical issue* that ought to be solved by the central administration of hydraulic works (State Hydraulic Works; hereafter DSİ). With its extensive experience and knowledge, this body is the responsible authority to provide:

- Preparation of technical reports on flood disaster incidence, and technical projects and major construction works for flood protection facilities; such as dams, embankments, river reclamations.
- Determination of flood prone areas with respect to 500-year flood discharges of a particular river for the use in 'development and implementation plans' of urban areas as a base map[4].
- Implementation of management, maintenance, and protective activities, hydrometric observation and hydrology works, erosion and debris controls

Currently, this authority is responsible for recording related flood data, delineating flood-prone areas that may probably be affected by a frequency of 500-year floods and preparing projects for flood protection facilities. However such structural projects to keep water away from the inhabitants have been deficient to mitigate the flood risk (Cigler 1996). Moreover, it is observed that

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[4] This does not necessitate the determination of flood-prone areas of all the rivers. This task is being performed on the basis of a request coming from local governments or other related institutions. Moreover, flood-prone areas with respect to 500-year flood discharges are not determined for rivers that were subjected to reclamation works.

these structural improvement investments encourage people to settle nearby reduced hazard areas where they feel safer.

This body, however, is independent of the municipalities who have ultimate discretion in land-use decisions while satisfying the needs of population today and for additional population in the near future. Thus, municipalities usually neither could avoid development and preserve natural conditions nor neglect encroachment of areas identified as floodplains (and even the riverbeds) as designated by DSİ. Further, there is a lack of supervision, and penalty mechanisms to control implementation, in such vulnerable areas.

Hence, the unforeseen and uncontrolled changes in land-use patterns and development processes ignore the predetermined extremes. Such development are often realized by individuals and approved by the authorities either ignorant of or in disregard of flood mitigation requirements. Since rapid urbanization from 1950's flood-prone areas have been preferred in Turkey especially by unauthorized housing developments deprived of adequate infrastructure. With the 'amnesty laws', providing legal status to illegal developments in flood-prone areas, many settlements of this category have become much more vulnerable today.

It has become too complicated to overcome flood risks in many riverine settlements with aggregated vulnerabilities. Although partial attempts for improvements in these conditions were made, the flood risks in riverine cities needs special attendance therefore for an analysis of alternative and contemporary means of mitigating risks.

1.3. AIM, OBJECTIVES AND METHODOLOGY OF THE THESIS

1.3.1 Aim and Objectives

Most of the urban areas in Turkey are under the threat of flash floods and river inundations that could cause severe losses. Although a number of protective efforts; such as dams and other protection structures are accomplished since the establishment of the DSİ as a central administration of hydraulic works in 1954, losses are continual and in the increase today.

The flood risk is inquired here from the urban planner's point of view, in relation to urban development planning process for particular riverine settlements of Turkey. Whether alternative methods in planning in the mitigation of river flood risks could prove feasible to reduce the chronicle human and property losses.

The thesis defines the study in the following manner;

- Investigation of the factors causing flood losses
- Analysis of these factors to derive appropriate tools and concepts to incorporate in the planning discipline
- Review of the relevant practices of flood loss mitigation
- Extending the possible means of measures beyond engineering solutions
- Investigating ways of enforcement of such measures in existing built up areas
- Based upon evidence acquired from a set of cases, to build up flood management strategies that could improve the current flood protection approach the Turkish planning system

1.3.2 Scope and Method of Research

Uncontrolled urban growth and provisions of development plans, which neglect flood hazards, are main causes of life and property losses in Turkish cities. This statement constitutes the starting hypothesis of this research. In order to test this hypothesis a set of descriptive and empirical research have been made. On the one hand, flood disaster histories of certain urban areas selected from different geographic and climatic regions are investigated in relation to their planning and growth histories. Also two of them, which have current flood hazard maps, are examined with reference to the existing vulnerabilities over flood-prone areas. Yet the other two cases, namely Aydın and Hatay, have no flood hazard map available due to the previous river reclamation facilities constructed. For this reason, vulnerability analysis cannot be made for these two cases.

In addition to such research, the legal and administrative framework concerning flood protection works are reviewed to establish ineffective and instrumental relations in preventing flood disasters in Turkey.

Parallel to these surveys, general strategies and approaches on flood risks and risk management frameworks are examined to introduce fundamentals of flood risk management system in theory and practice. In this regard legal and administrative structures of several countries concerning flood protection and mitigation system are examined with an objective to adopt tools and methods of effective use in the Turkish context.

The first part of the research covers factors causing flood losses in selected cities. These cities, as case studies, are selected according to the following criteria:

1. Cases are selected from different geographical regions, with different precipitation patterns and climatic features. Rather than investigate common factors that cause flood losses in riverine cities with similar climatic and geomorphologic conditions, this part of the research focuses on the analysis of human interventions that cause similar flood related losses in different climatic and geomorphologic conditions. In other words, independent from climatic and geomorphologic conditions, possible set of factors behind flood losses are the intended subject of investigation in the selected case cities.

2. Cities which are located in heavily affected river basins are selected as cases. These cities are settlements that suffered from frequent flood events, where greater casualties took place and large areas were inundated.

3. Each case has repeated flood events and losses through years, in spite of implementations of various protection activities mainly after each flood event.

Two heavily effected regions are excluded in this selection. East Black Sea Region, which has the highest casualties between 1970 and 2005, is excluded since this basin has extreme precipitation patterns directly affecting flood occurrence. The second basin excluded is the ‘Sakarya Basin’, which had frequent flood events between 1970 and 2005. The reason of this exclusion is that lower flood losses are experienced recently in this basin due to major improvements like dam investments along the streams. However, this is not to exclude the probability that in the long-term Sakarya basin may experience high flood loss due to dam break caused by earthquake hazards. It is preferred that cases selected should have continual flood loss histories.

To justify the selection, the cities and basins should have had satisfactory representative attributes. This has been maintained in terms of regional and size distributions of cities, as well as geographical and size distributions of the basins in the country. A discussion of these criteria takes place in Chapter 3.

Hence, as shown in Figure 1.3, four cities from different climatic regions and river basins; namely Bartın, Batman, Aydın and Hatay, are selected as case areas according to such criteria briefly explained above. These cities are examined first with respect to their flood events and flood loss histories. This examination is mainly based on official archives and records of DSİ. Contents of these archive files are provided as a process table in the appendix. Furthermore, some examples of the important documents and reports obtained from the archive files are given in the appendix. Table 1.3 depicts basic information about the selected case cities. Records on each city include several data sets:

- Official correspondence between local authorities and regional directorates of DSİ, between regional directorates and central departments of DSİ,

- Base maps and development plans from municipalities requiring consultancy about flood protection facilities, irrigation sites/facilities and 2 dimensional data about the actual flood prone areas on the map (no data about depth of flood water),

- Survey reports and flood protection plans of Department of Investigation and Planning of DSİ to decide whether it is feasible or not before designing a flood protection facility,

- Damage reports, flood extension area sketches and visual data about a particular flood event by Regional Directorates of DSİ,

- Legal documents such as Decrees, Acts and Protocols etc.

The second part of the research on case cities constitutes an analysis of their planning and development histories. This analysis is based on semi-structured questionnaires used in the interviews with planning and infrastructure departments of selected Municipalities and Bank of Provinces, as well as Private Planning Offices who have participated in the preparation of Territorial Plans and/or Development Plans of these cities. The aim of such analysis has been to establish the impacts of land-use decisions and explore the explicitly stated strategies on the occurrence of flood disasters. To what extent the land-use decisions and development strategies considered flood hazards has been another focus of concern.

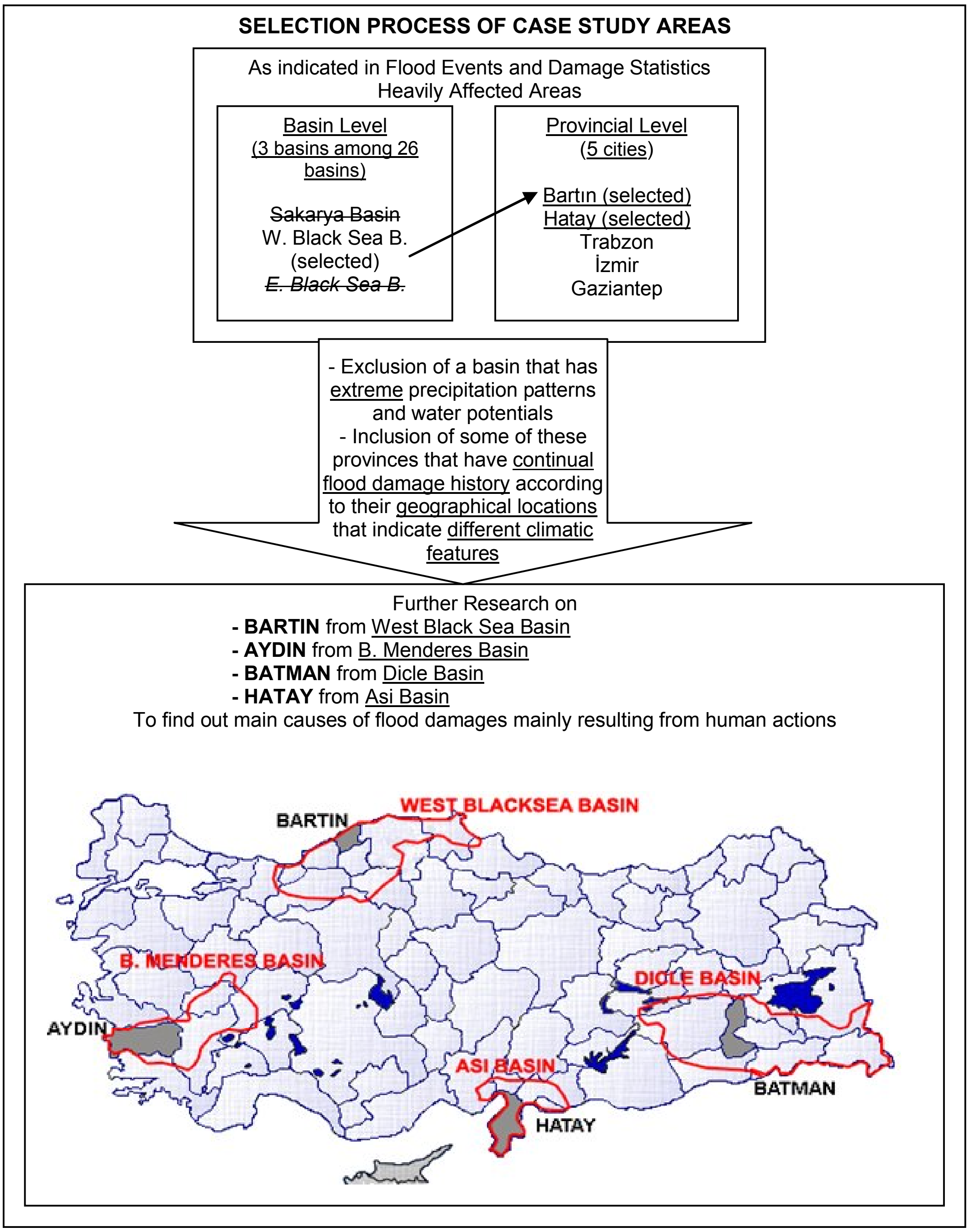

Figure 1.3: Selection Process of Case Study Areas

Table 1.3: General Information about Each Case

	SELECTED CASES			
	Bartın	**Batman**	**Aydın**	**Hatay**
Provincial Population (2008 Results of Address Based Population Registration System)	185.368	485.616	965.500	1.413.287
Provincial Population (2000 Population Census)	184.178	456.734	957.757	1.253.726
Mayor's Political Party (Before 2009 Elections)	AKP	DTP	AKP	AKP
Mayor's Political Party (After 2009 Elections)	MHP	DTP	CHP	AKP
Total Number of Municipalities in Province	9	12	54	76
Total Number of Villages in Province	265	270	493	362
Total Area of the Province	2140 km^2	4654 km^2	8007 km^2	5403 km^2
Name of the Major Basin	West Black Sea	Dicle	Büyük Menderes	Asi
Catchment Area (km^2)	29'682 km^2	51'489 km^2	24'903 km^2	10'685 km^2
Share of the Province in Total Catchment Area	38%	67%	32%	13%
Location of City	Downstream	Downstream	Downstream	Downstream
Annual Mean Precipitation (1971-2000)	1025,7 mm	473,2 mm	601,7 mm	1084,1 mm
Major Rivers that Regularly Flood	Bartın river and its tributaries; Arıt, Ova, Ulus, Kozcağız Creeks	İluh river and its tributaries; Çay, Savara, Aşağıkonaka, Şakuli	Büyük Menderes and it tributaries; Dandalas, Akçay, Çine	Asi, Afrin, Karasu
Sub-Provincial Municipalities Exposed to Floods / Total Number of Sub-Provincial Municipalities	2/3	3/5	14/16	8/11
Local Auxiliary Municipality Exposed to Floods / Total Number of Auxiliary Municipalities	3/5	2/6	10/37	7/64
Percentage of Municipalities Exposed to Floods	66%	41%	44%	19%

(Source: http://www.yerelnet.org.tr, DSİ Archive Files)

Furthermore, based on the DSİ designations and current maps of the cities, a detailed inventory of vulnerabilities have been determined. This was necessary to make assessments on the likely volumes of losses, their values and compare them with the costs of measures to reduce risks to check the viability of such measures.

The findings from case studies have led to the decision to conduct a further descriptive research, focusing on the institutional dimension. The disaster related tasks and responsibilities of governmental and non-governmental institutions were also examined in relation to events that took place. Whether or not some institutional deficiencies and problems such as missing links, inadequate cooperation and management strategies, and deficiencies in control mechanisms occur has been a major issue investigated. This part of the research is based on the review of legal texts, institutional laws, related documents, written materials and interviews with public officials. Comparing a number of countries cases that deal with flood risks Turkey's flood protection processes relating with development planning activities in urban areas are evaluated in order to make appropriate prospects and proposals for flood risk reduction.

1.4. THE STRUCTURE OF THE THESIS

The thesis is composed of **six chapters**. Following this introductory chapter **the second chapter** explores contemporary approaches on mechanisms of floods and inundations to establish the bases of flood risk management framework (FRMF). In this regard a literature survey on theoretical and practical studies on "flood risk management" has been made concentrating on issues of risk management, administrative and legal provisions, and planning tools in general.

In the beginning of **the third chapter** the adverse impacts of the rapid urbanization process of Turkey are reviewed. In the second part, based on long-term statistics of flood events and losses Turkey's flood vulnerabilities depending on geographic regions, river basins are investigated. This general picture of flood losses of Turkey provides us a basis from which case areas could be selected for further analysis in the following chapter.

Chapter 4 involves a descriptive research on selected riverine cities in order to find out what generalization could be made about the reasons of flood losses. Justifications for the four case areas selected, namely Bartın, Batman, Aydın and Hatay, with chronic flood losses are identified. This research focuses on the flood event histories of each case, based on official record files of the DSİ, which has recorded information on flood events complied at the provincial level since 1954. Parallel to flood histories, the city growth and planning processes are also examined to explore whether land-use designations led to the aggravation of the flood problems or not. At the end of this chapter common causes of flood disasters are categorized in urban planning terms. The results of the fourth chapter direct the research towards second stage where institutional organizations and legislative frameworks are investigated to reveal problematic areas while fulfilling tasks and responsibilities about flood 'protection' and 'management'.

Hence, **Chapter 5** gives us a general framework on flood protection works as defined by laws, including tasks and responsibilities of related institutions in Turkey. Additionally, this chapter involves deeper investigations on the development plan process, and how natural hazards, especially floods, are considered in the planning process. Based on the research results, a number of proposals and prospects are investigated with comparative costs. International experience on flood risk management legislation provides valuable tools of implementation for Turkish cities.

In the **final chapter**, there is a general assessment of the key findings of the research related to the main problem areas in the city and basin level, as well as at the institutional level. Prospects and policy implications are discussed and proposals made in mitigating flood risks in the Turkish riverine cities.

Finally, propositions for the re-organization of institutions and stakeholders and for the restructuring of current tasks and responsibilities are made. Performance standards and accountability to reduce flood risks by means of new planning tools and procedures are reconsidered. A road map for incorporating 'flood risk management approach' to the current planning system in Turkey is proposed together with an exposition of further outcomes of research.

CHAPTER 2

EXPLANATION OF THE MECHANISMS OF FLOODS AND INUNDATIONS: CAPACITY BUILDING IN SOCIO-SPATIAL PLANNING

Chapter 2 explores contemporary approaches to flood risk management. First of all, the literature on

- Impacts of global warming and climate change, particularly increasing in hydro-meteorological events and losses
- Conventional disaster management process and its critics, United Nations' policy shift against natural disasters
- Risk concept and the main components of risk management while dealing with natural hazards,

are examined for the comprehension of flood risk management system. Then, with their contributions; the fundamentals of flood risk management process are examined in the following steps:

- the definition of floods as a hydro-meteorological event
- the identification of flood hazard and vulnerability and the delineation of the areas that are prone to certain flood risks
- the assessment of flood risks by flood risk mapping
- mitigation strategies against flood risks

Hence, this chapter is crucial to establish the bases of flood risk management framework (FRMF) in the contemporary literature and practices.

2.1. NATURAL DISASTERS, GLOBAL WARMING AND CLIMATE CHANGE

The great impacts of so many great disasters have pointed out that in today's world communities, regions and nations can no longer afford to simply respond to and recover from natural disasters (Figure 2.1).

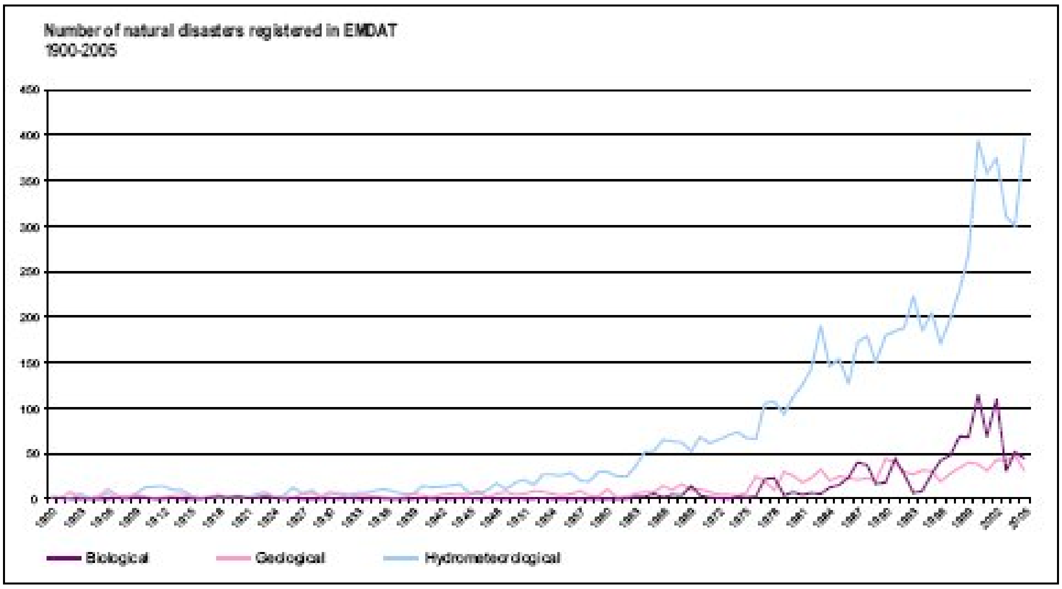

Figure 2.1: Number of Natural Disasters by Origin (1900-2005)
(Source: EM-DAT)

As through much of its history, the Earth's climate is continuously changing (Figure 2.2). Today it is getting warmer indicating that the average temperature of the Earth's surface has increased by about 1.2 to 1.4ºF since 1900 by research reports of the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA)[5]. Most of the warming in recent decades is very likely (90%) the result of human activities mainly due to burning fossil fuels as states in the Intergovernmental Panel of Climate Change (hereafter IPCC 2007) (Figure 2.3).

Increasing temperatures tend to increase evaporation which results in more precipitation (IPCC 2007). Average global precipitation has also increased as

[5] Source: http://www.epa.gov/climatechange/science/index.html

average global temperatures have risen. The following precipitation trends have been observed as informed by the IPCC:

- "Precipitation has generally increased over land north of 30ºN from 1900-2005, but has mostly declined over the tropics since the 1970s. Globally there has been no statistically significant overall trend in precipitation over the past century, although trends have widely by region and over time.

- There has been an increase in the number of heavy precipitation and flood events over many areas during the past century, as well as an increase since the 1970s in the prevalence of droughts, especially in the tropics and subtropics."

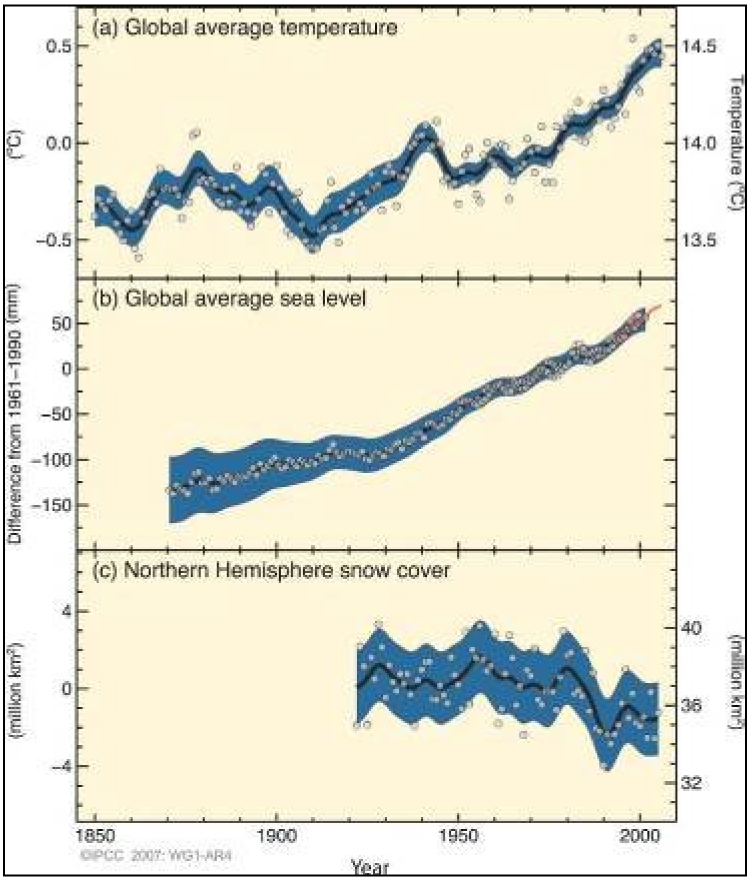

Figure 2.2: Changes in Global Average Temperature, Sea Level and the Northern Hemisphere Snow Cover *(Source: IPCC 2007)*

In the 20th century drastic changes on the globe have been observed due to the excessive consumption of fossil fuels by human activity. Severe environmental problems like degradation, pollution and ozone layer depletion, which in turn have led to global warming and climate change, are now main concerns of many countries of the world (IPCC 2007).

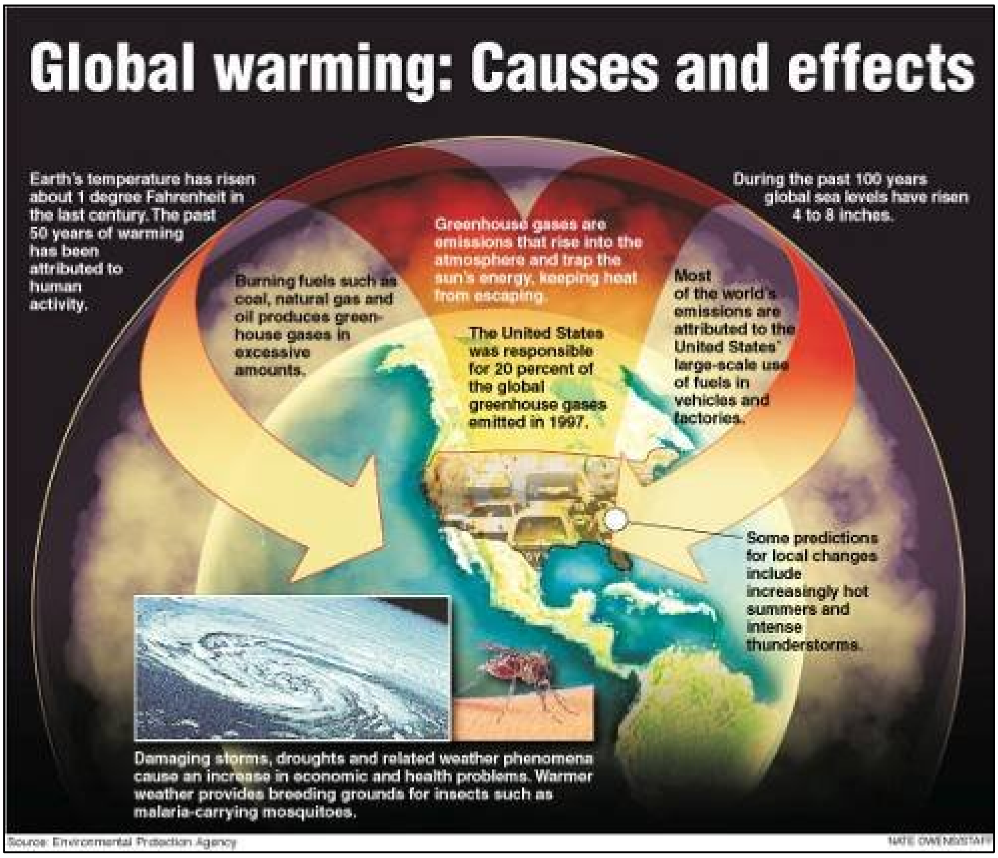

Figure 2.3: The Causes and Effects of Global Warming
(Source: Environmental Protection Agency)

Thus, according to Climate Change Synthesis Report of IPCC[6] weather-induced natural events like typhoons, storms, cyclones, heat-waves, floods and droughts fluctuations are going to increase in the occurrence and spread out more extensively in very near future. For example, it is evident that the number of flood disasters per year has increased since 1975 throughout the

[6] http://www.ipcc.ch/ipccreports/ar4-syr.htm

world (Figure 2.4). Ethiopia and Sudan drought in 1984, Bangladesh floods in 1987 and 1998, Mid-Europe river floods in 1998 and 2002, Western Europe Heat Wave in 2003, Hurricane Katrina in U.S., in 2005, Myanmar cyclone in 2008 are some of the disastrous events affecting great populations throughout the world. So, the number and magnitude of flood events tend to be aggravated due to global warming and climate change. It is expected to be more frequent floods causing more severe losses in the next decades.

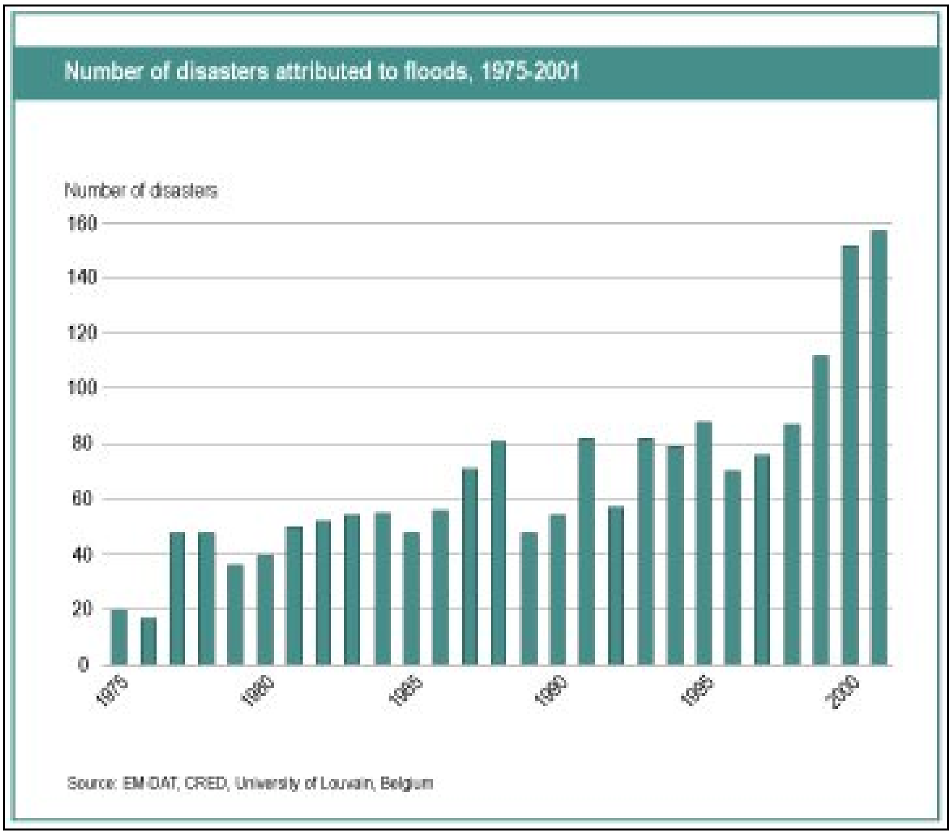

Figure 2.4: Number of Disasters Attributed to Floods between 1975 - 2001
(Pilon 2003, 6)

According to general findings of the analysis conducted by Lehner et al. (2006), typical 100-year floods are projected to occur more frequently in large areas of northern and northeastern Europe. As indicated in Figure 2.5 Lehner states (2006, 289) that ‘in future today’s 100-year floods may recur every 40 years’.

According to scenarios on future regional flood and drought characteristics, for example, maximum average discharge may occur about 1 month earlier than present day in large parts of northern and central Europe inducing earlier snowmelts. This is a major cause for floods in such areas. The impact of global change is manifested either through changes in the magnitude of discharges or in terms of temporal shifts of seasonal flow regimes (Lehner 2006). So these regional studies require more detailed country specific applications in order to obtain more accurate results about future projections.

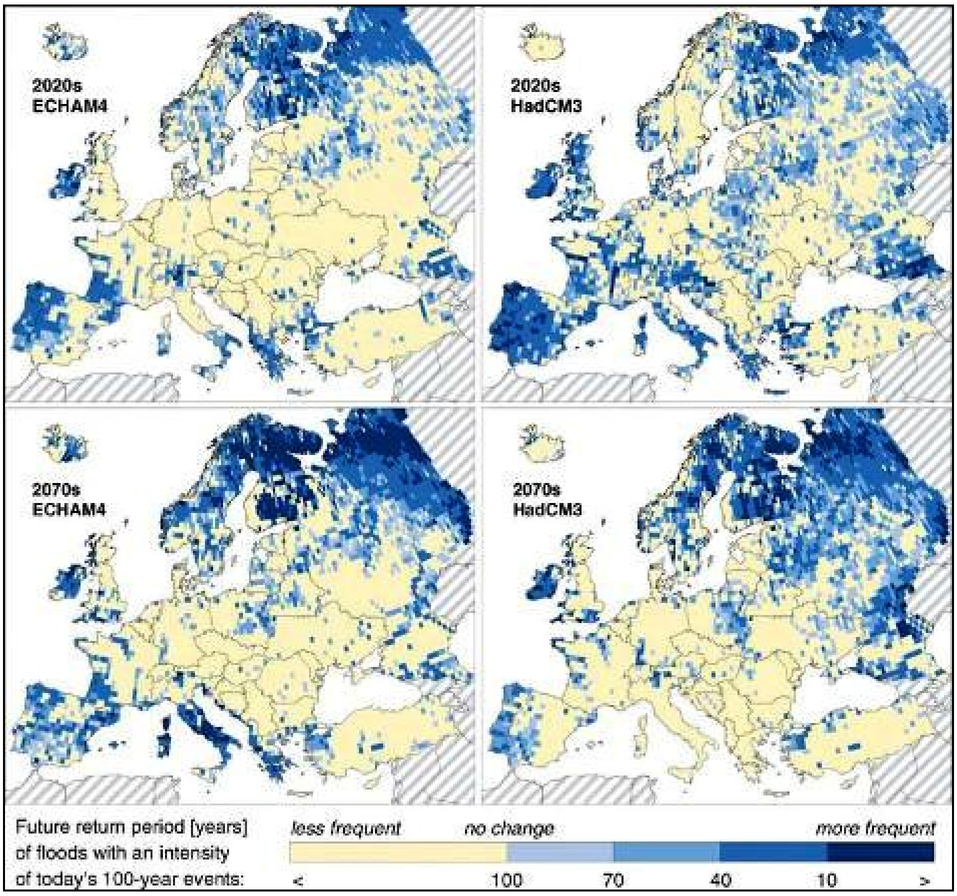

Figure 2.5: Change in Recurrence of 100-Year Floods[7]
(Source: Lehner et al 2006, 289)

[7] Based on comparisons between today’s climate and water use (1961–1990) and simulations for the 2020s and 2070s (ECHAM4 and HadCM3 climate models and Baseline-A water use scenario)

Droughts and desertification, on the other hand, are expected to be extensively spread out throughout the Earth. For example for European countries the future scenarios of droughts are shown in Figure 2.6.

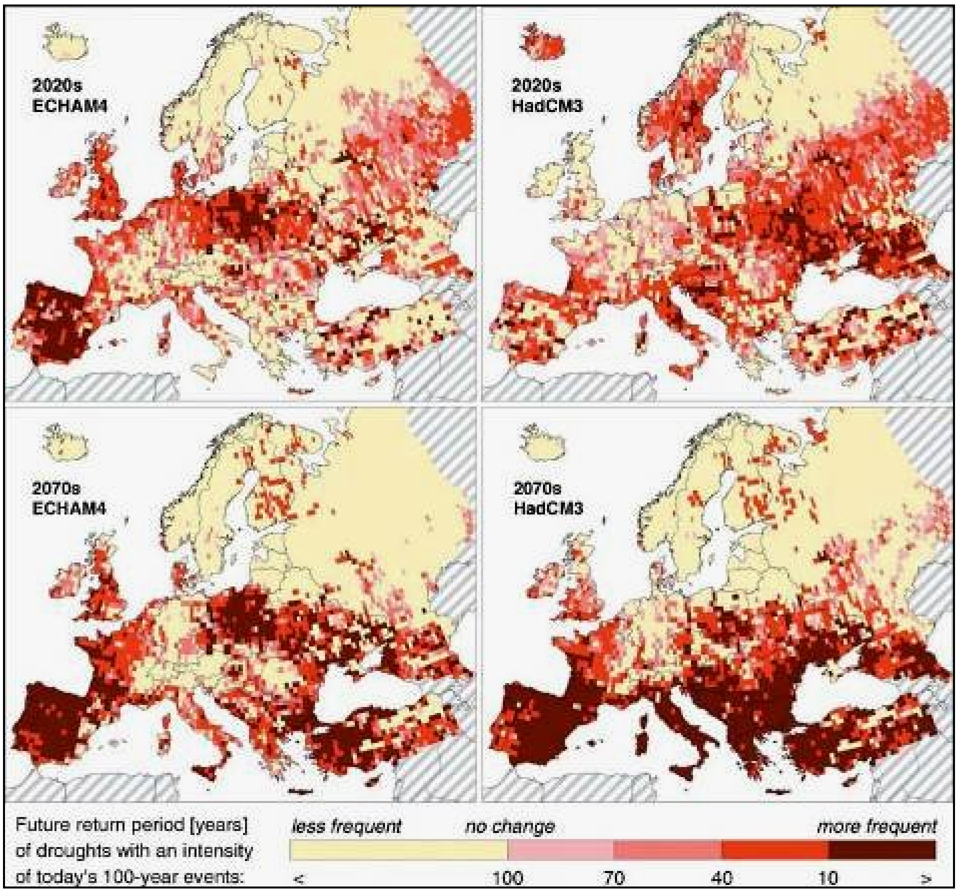

Figure 2.6: Change in Recurrence of 100-Year Droughts[3]
(Source: Lehner et al 2006, 290)

Due to the global warming and climate change the identification of how much change has occurred in hydrologic extremes has been an evolving subject that requires various research methods and techniques. For example, for Turkey Demir and others (2008) have finalized a simulation project that runs the model using 2071-2100 A2 scenarios. It is the first attempt to implement these future scenarios and obtain projections about Turkey and surrounding countries. According to these global warming scenarios it is estimated that total annual precipitation will decrease in next 70 years. The simulations based on 2071-2100 A2 scenarios estimate an increase of 5-6°C of mean temperatures in Turkey except coastal regions. Nationwide mean temperature is expected to increase 2-3 °C.

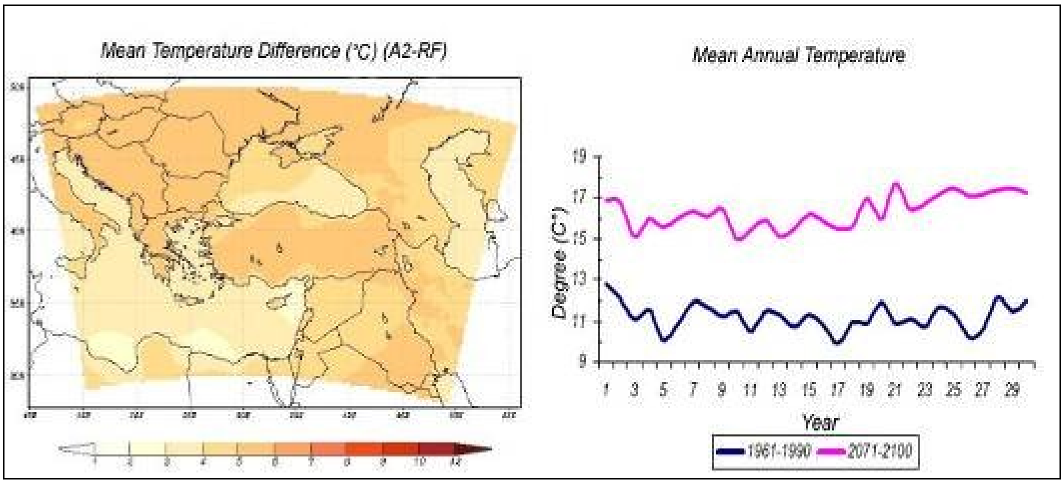

Figure 2.7: Mean Annual Temperature and Difference (°C)
(Demir and others 2008, 368)

Although change in precipitation regime in general shows itself as a decrease according to scenarios, regional extremes may probably be in increase. For example, along Aegean and Mediterranean coasts precipitation will probably decrease while it will increase along Black Sea coasts. However the amount of precipitation decrease will be more in eastern parts compared to west (maximum 40% decrease in western regions).

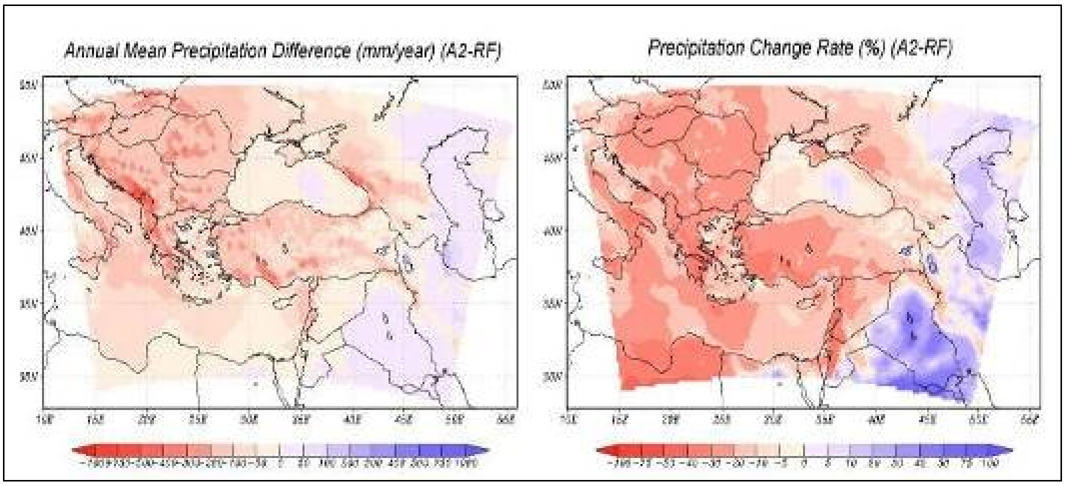

Figure 2.8: Changes in Precipitation Regime
(Demir and others 2008, 371)

2.2. CONVENTIONAL DISASTER MANAGEMENT CYCLE, ITS CRITICS AND UN'S POLICY SHIFT

In 90's United Nations' policy necessarily has shifted from *disaster response* to *disaster risk reduction* due to destructive impacts of many disasters last 30 years. Before this paradigm shift there was a common, conventional approach that investing mainly in post disaster response and recovery activities.

Disaster is defined as "a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources" by United Nation's ISDR terminology[8].

According to the conception of conventional approach natural hazards are defined as 'uncontrollable events societies regularly face' (Balamir 2007). Due to this conception disastrous results are considered as a fate that is a part of a cyclic process. By this conceptualization disaster management process is defined conventionally consecutive steps before and after the disasters; namely <u>Risk Reduction</u>, <u>Preparedness</u>, <u>Emergency Response</u>, and <u>Rehabilitation</u> and <u>Reconstruction</u> (Figure 2.9). These main phases require a

[8] ISDR Terminology (Source: http://www.unisdr.org/eng/library/lib-terminology-eng%20home.htm)

variety of specializations and complement each other in the course of conventional disaster management process. Although this cyclic model has helped to identify types of work in each phase, to develop corresponding methods and communication between these phases, it is not true to claim that an administrative and organizational form peculiar to this model have been presumed. This model merely points out that efforts in at least four separate groups must be considered in a society. In the world experience there are various administrative systems but it is recognized that in every country, efforts of dealing with disasters include similar works indicated in these activities as shown in Figure 2.9 (IEMS 2002).

Risk reduction efforts include measures that reduce or minimize the effects of disasters on a community. An initial assessment of hazard, vulnerability and risk ought to be carried out. In order to identify principles of suitable locations and high standard of constructions, to form the physical infrastructure of society, development of legal and economic methods ought to be fulfilled. Additionally, to mitigate impacts of disasters, necessary precautions that will be undertaken by individuals, local communities and organizations among the whole society ought to be defined. This can be achieved by institutional and educational methods (IEMS 2002).

"Economic measures to ensure diversification, and encouragement of widespread insurance; institutional measures to engender the political will and expertise to ensure mitigation and measures to establish a 'safety culture' through public awareness of risk" are the effort that ought to be also considered at this stage (Institution of Civil Engineers 1995, 23).

To be prepared against disasters there ought to be plans for response by coordination of national, regional and municipal governments, private and public organizations, communities and individuals, and communalization of training and equipment (Institution of Civil Engineers 1995, 23). This phase comprises works about developing and maintaining active SAR ability in order to overcome hazards and losses, to rescue threatened population and search missing population, to meet emergency requirements of effected population (figure 2.9). Moreover, efforts in this phase ought to put adequate supply aside for health, shelter and daily consumption that would be used in the response phase and determine the principles for distribution of this provision, and practice these arrangements and efforts for response stage. Therefore, state of preparedness contains keeping trained personnel and necessary equipment at appropriate locations managed with cooperation of official, private and community organizations (IEMS 2002).

Just after a disaster event, **responsive (emergent)** efforts, such as immediate determination of the dimensions and requirements of disasters, multi-directional communication, immediate access of sufficient amount of equipment and trained personnel consisting of health services and daily life support teams ought to be always on call. Therefore, absolute, unique authority and discipline based on experienced knowledge and communication abilities for efficient coordination is required. And this provision of response forces ought to be under local authority with local sources. In addition to this, support of upper level authorities ought to be ready when needed (IEMS 2002). In short, this phase aims to save life, protect property and deal with immediate damage and disruption including implementing disaster reaction plans; activating the counter-disaster system; search and rescue; providing emergency food, shelter, medical assistance; survey and assessment; evacuation measures; protection of property against looting, etc. (Institution of Civil Engineers 1995, 23).

Following the emergent activities, the physical and psychological **rehabilitation** of individual and group of sufferers ought to be performed (IEMS 2002). On the other hand, there ought to be efforts assisting communities' return to normal level of functioning with restoration and rehabilitation works. In other words, to restore local economic liveliness subsidization of commercial and industrial activities ought to be encouraged. After that, **the long-term replacement (reconstruction)** of destroyed buildings and infrastructure ought to be carried out. After the application of disaster experience in future research and development programs, development that is planned to ameliorate the impact of subsequent disasters ought to be ensured (Institution of Civil Engineers 1995, 23).

The conventional policy that defines natural hazards as 'uncontrollable events societies regularly face' are essentially criticized by Balamir (2007). According to him several assumptions of this model demands in-depth attendance and counter-argumentation. This model, as shown in figure 2.9, conceptualizes separate phases in the experience of a natural hazard and denies the need for a comprehensive management policy as Balamir (2007) states. By this way it also confines mitigation (risk reduction) activities 'only to a particular phase; unjustifiably over-emphasizing the emergency and post-disaster management phases' (Balamir 2007). Besides, this model assumes that there is a central/singular authority capable of monitoring whole cycle of events. Therefore, the conventional approach ignores the participatory process involving all related stakeholders; even local communities and individuals.

Hence, disaster management, which is implemented to reduce or eliminate damages caused by a disaster, has to be efficient both in emergency management which includes mainly search and rescue (hereafter SAR) works and main components of risk management. It plans necessary actions right after the disaster, compensate and replace the loss of lives and property. It may also get essential features that cover required works of before and after the disaster and aim to decrease losses to acceptable levels by the comprehensive structure of risk management approach (Balamir 2000, 2).

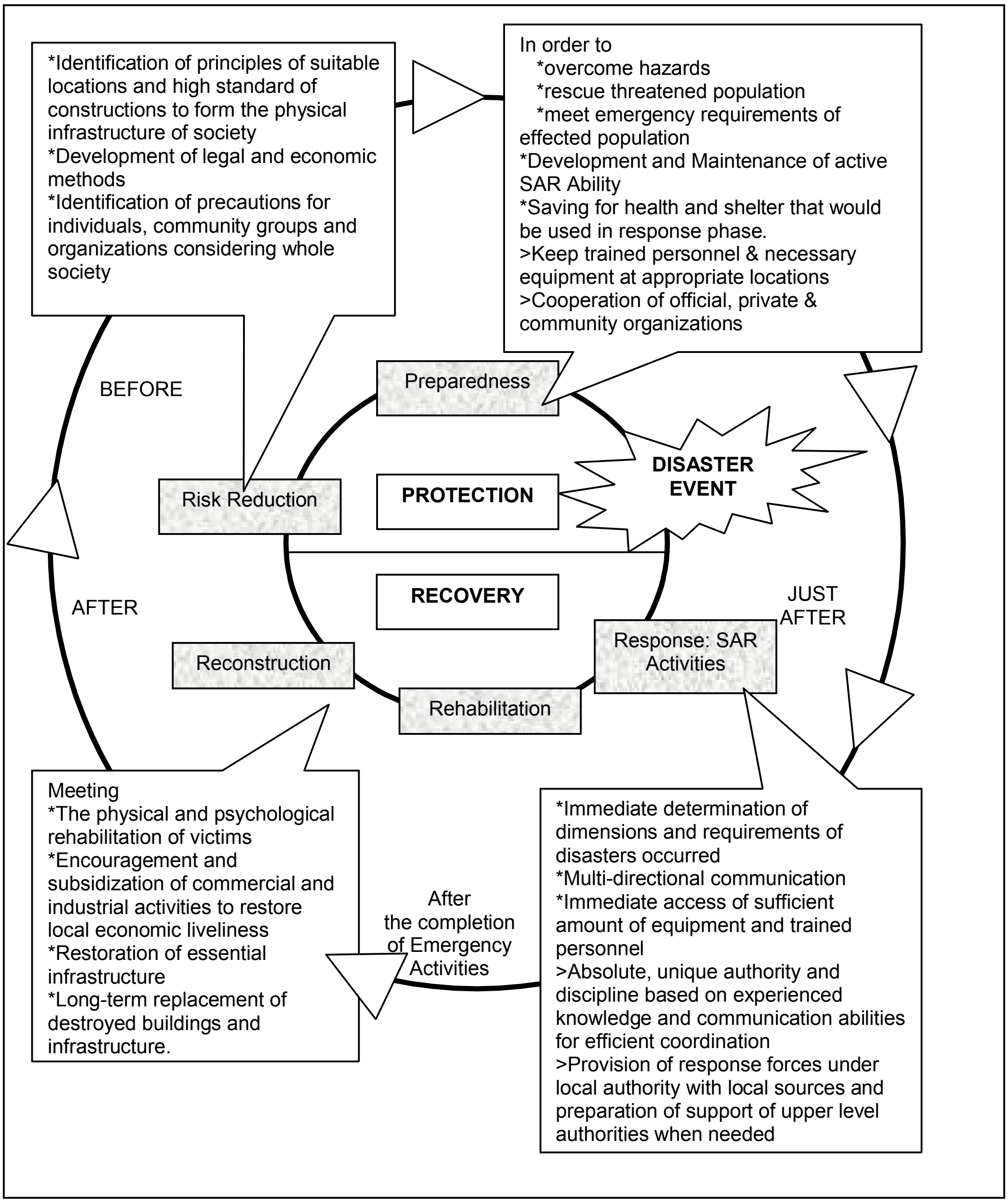

Figure 2.9: Review of Cyclic Model in Disaster Management Process
(Originated from Severn 1995 and Redrawn by the Author)

As Balamir (2007) states that disaster policy must also be considered with its basic components: ‘emergency management’ and ‘risk management’, which require distinct types of expertise. ‘Mitigation planning’ should not only be one of the phases of traditional disaster management, rather it should be structured upon a continuous and comprehensive set of integrated activities. He claims that “as mitigation efforts are better organized in time, it is only rarely that hazardous events encountered will be considered as disasters” re-drawing the disaster cycle Figure 2.10.

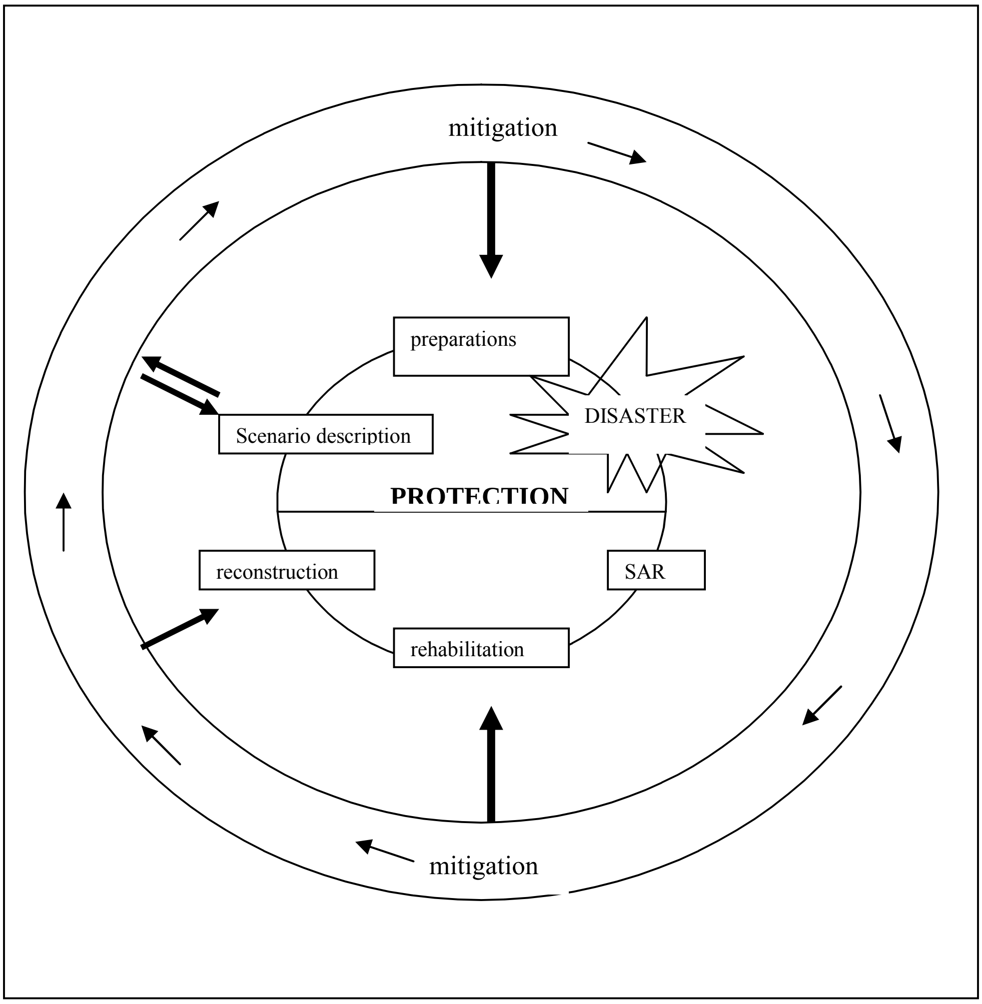

Figure 2.10: Disaster Cycle *(Source: Balamir 2007)*

According to this new policy, proactive works that consist of several measures foreseeing possible effects of disasters should require greater attention than disaster of response activities. Therefore, it is claimed that the burden of response activities are to be relatively decreased, because built environment and society will become more resilient to possible disasters by the help of proactive activities in the mitigation and preparedness before the disasters actually occur.

United Nations has launched some actions for the adaptation of this new policy throughout the world with the slogan of 'Think Global Act Local'. Declaration of 'International Decade for Natural Disaster Reduction' (1990-99), Foundation of 'International Strategy for Disaster Reduction' (2000), Declaration of 'Hyogo Framework for Action' (2005-2015) to build the resilience of nations and communities to disasters are some of these actions of UN (Albrito 2008, 2).

Since many countries have explored new ways of mitigating the global impacts of climate change and natural disasters, 'Climate Change Adaptation' is commonly embraced as an opportunity for Disaster Risk Reduction (hereafter DRR) by UN-ISDR as Albrito claims (2008, 10). Broad consensus also reached on the need to engage local and regional authorities in DRR processes because there is growing evidence that DRR is a local issue and that more needs to be done at local and sub-national levels.

While disseminating their policy, United Nations' ISDR defined priority areas for action aiming to reduce disaster risk. <u>One of them</u> is setting up/strengthening 'regional and local governance' within institutional and policy frameworks. For this reason, it is critical to make <u>a commitment</u> for multiyear, multidisciplinary integration of vulnerability and risk reduction into development planning and policies. To achieve this integration main steps need to be taken; such as:

- setting up national strategies and legislation including regional/local strategies
- increasing institutional capacities with establishing technical and multi-sectoral local committees

- decentralizing responsibilities and resources among local authorities and communities

Second priority area, which is about risk assessment and risk monitoring, requires determination of ‘acceptable risks’ depending upon data, information and shared resources. Third priority area, which is reducing underlying risk factors, requires urban risk management and plans, planning and land-use commitment especially in compliance to regulations and codes building on risk assessment, locally applicable insurance or related financial instruments with variations of micro-finance and micro-credit tied to DRR, enforcement of regulation for wider infrastructure protection, investments in human capital for the improvement of recovery capacities and safety nets, and applying existing advanced technologies focusing on local scales (such as GIS applications, telecommunication systems, remote sensing) (Albrito 2008, 5-7).

Therefore, it is claimed that response activities are to be relatively decreased, because built environment and society become more resilient to possible disasters by the help of proactive activities in the phase of mitigation and preparedness before the disasters actually occur.

2.3. CONTEMPORARY REAPPRAISAL OF NATURAL HAZARD RISKS AS A SOCIAL PRODUCT

In today’s world unlike the 19th century world of industrial societies many social and technological actions may have unpredicted effects on not only at its physical proximity, but also in systems that have no direct relation with it. For example; economic bottleneck in Southeast Asia can disrupt world stock exchange markets; ‘mad cow disease’ in a farm of England may transform into a global health and political issue; designed and released a computer virus may cause the collapse of international communication networks; Chernobyl nuclear disaster may affect several generations of communities located at vast geographical regions etc... In other words, a set of risks and hazards, the likes of which we have never previously faced can no longer be limited in time –as future generations are affected– and in space –as they cross national boundaries (Lash & Wayne 1992, 2).

Since risks are gradually going to have intricate impact in today's social systems, unexpected results and vital crises are likely with unprecedented linkages that surpass boundaries. Owing to pervasive and complex interaction structures of social systems and factors like globalization, multi-directional communication, social decompositions, shrinking of governments any tiny change in this system may probably cause universal disasters or severe crises (Balamir 2000, 1).

The transformation of the 19th century industrial societies into a new global society, described as 'risk society' by Beck in 1992, has been accelerated by the progress in information-communication technology. According to him, in this inevitable phase, resulting from the scientific and industrial development of modern society, many changes have occurred in the world order form state structures, and from labor and class, to family structures.

Related with the threatening forces of modernization, nuclear power plants, biological and chemical wastes, environmental degradation, ozone layer depletion, global warming, renewable internet viruses, global terrorism, natural hazards etc… are risks and insecurities of our century. Hence, it will not be possible to overcome these crises on hazards with the improvement of traditional procedures, division of labor, subsystems individually. Although they have low probability to occur, scales and impacts of their consequences cannot be easily anticipated. This is because we don't have one more world laboratory same as we have to test and empirically observe the results. Due to intricate features, chain effects and irreversibilities of today's crises different, total, foresighted and innovative forms of approaches are necessary (Balamir 2000, 1). In other words, a systematic way of dealing with these hazards and insecurities is required. In its most comprehensive form that is the concept of risk (Beck 1992, 21).

Today we live in places that are much vulnerable than the past. Nevertheless the increase in natural hazard risks is the product of our actions during the transformation process of industrial society into 'risk society', as Beck claims. For instance, the process of urbanization has been a common feature in the development of civilizations throughout history, as communities have chosen to settle in favorable locations and to focus their commercial, political and cultural activities around central points. However, settlements that have developed around areas offering societal and commercial benefits are at risk from natural events. In many countries many of the natural events like heavy rains, earthquake, snow melting, hurricanes, volcanoes, landslides, tsunamis, typhoons etc. are turning to natural disasters causing severe loss of life and property. In short, abrupt population growth due to informal urbanization, omission of preparation of local governments to meet demands and necessities (like provision of housing) of the growth and uncontrolled location decisions of additional population are some factors that have set the vulnerable environment for today's society.

To be aware of 'living in risk society' is the first step that should be taken in order to develop new policies, new forms of comprehension towards risks. In today's 'risk society' risks cannot disappear but can be diminished. Therefore, it is necessary to explore new ways to deal with these risks.

2.4. KEY CONCEPTS: RISKS, FLOODS AND MANAGEMENT SYSTEMS

2.4.1 Risk Concept and Risk Management

Risk, originally designed in the area of modern business administration, is defined as the probability of suffering harm or loss, and *risk analysis* is a body of knowledge that evaluates and derives the probability of the adverse effects of a natural process, technology, industrial process or an agent (chemical, physical, etc.). Then it has been implemented in different sectors; like finance, health, insurance, security, engineering, industry, transportation, and environment (Merz, Thieken & Gocht 2007, 235).

According to Flanagan & Norman (1993, 45) risk management is a system which aims to identify and quantify all risks to which the business, project or planning stages are exposed so that a conscious decision can be taken how to manage the risks.

With regard to natural disasters, *risk* is more specifically described as the probability that natural events of a given magnitude and a given loss will occur. In simple terms, it is a probability that a hazard will turn into a disaster.

Therefore, it encompasses two independent aspects: *hazard* and *vulnerability* and conventionally is expressed by the notation:

[RISK= HAZARD X VULNERABILITY] (ISDR Terminology, Kaplan & Garrick, 1981; Mileti, 1999).

Hazard, in general terms, is defined as "a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation" (ISDR Terminology). The occurrence probability of an extreme event that may cause a disaster is also called as hazard (Plate 1997, 116). So each hazard is characterized by its location, intensity, frequency and probability.

When there is an element that is exposed to any specific hazard, we can talk about the *vulnerability* of this asset against this hazard. The vulnerability depends on "the conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards" (ISDR Terminology). That is to say, the vulnerability or susceptibility of a land plot is directly associated with its use. It is a way to describe the sensitivity of a specific land use to the potential hazard, whenever its probability is extremely low. In other words, a same land use should have the same vulnerability whatever its location in a disaster-prone area or not (Gendreau & Gilard 1998, 242).

These two aspects and their interactions that construct the disaster risks should be identified first before making any assessment by which the options (alternatives) are determined for mitigating these risks. Thus, the *risk management* that is conceptualized as a sequence of actions is used as the main instrument of management while preventing from damages of disasters (Plate 1997, Balamir 2002).

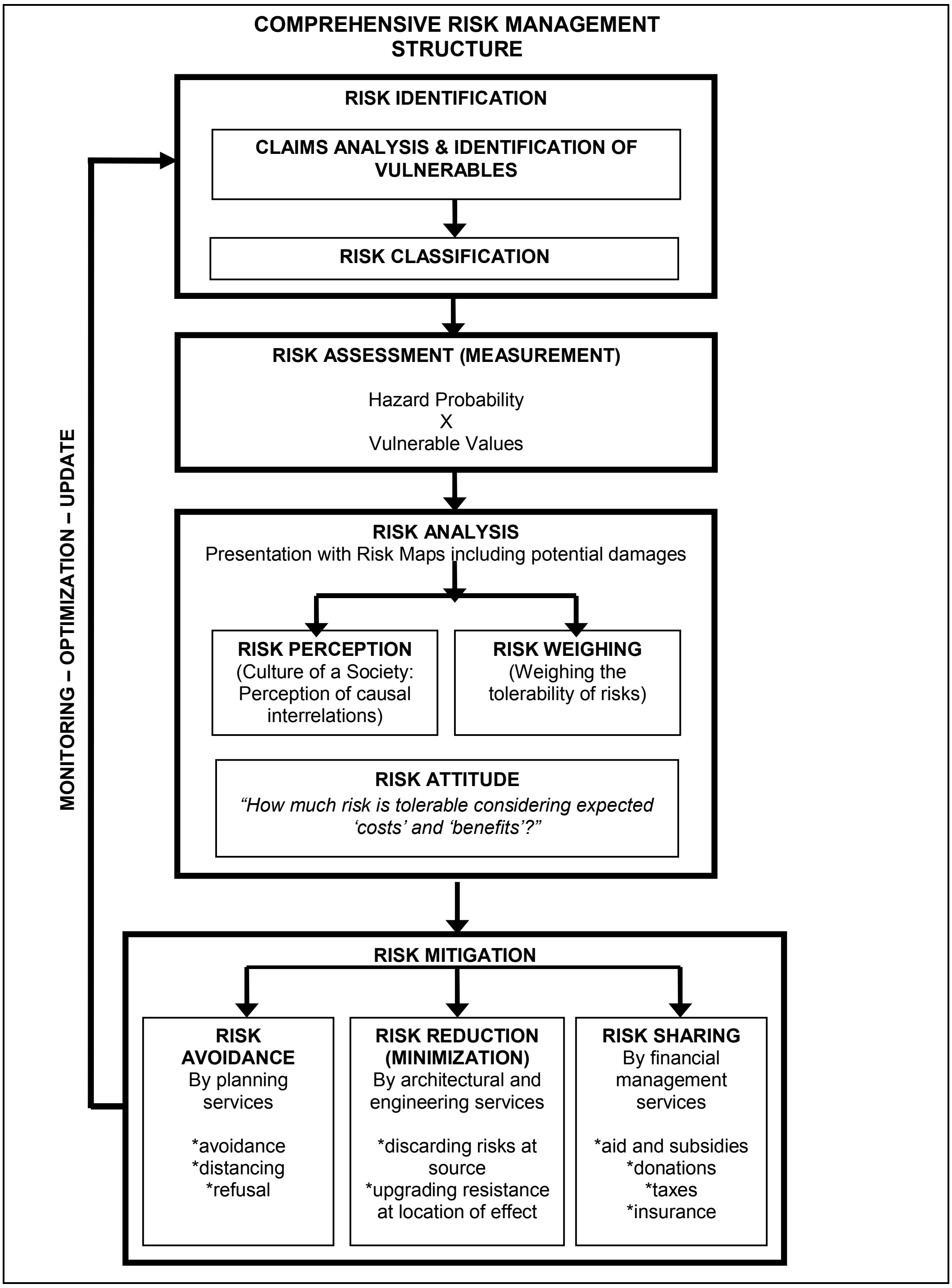

Figure 2.11: Risk Management Structure and Phases in General
(redrawn by the author, Sources; Flanagan & Norman 1993, Plate 1997, Balamir 2000, 2002, Schanze 2006)

Framework of the risk management system includes different sequential stages; in specific terms, risk identification, risk classification, risk assessment, risk analysis, risk attitude and risk mitigation (Figure 2.11).

As shown in figure 2.11 at the first stage the source(s) and type of risks are identified. Then according to the type of risk and its effects they are classified. In the analysis stage the consequences associated with the type of risk, or the combination of risks is evaluated by using analytical techniques and represented by *maps*. The measurement of their degree of significance (therefore of their priorities), and determination of costs of risk reduction investments and benefits that are achieved in return are achieved in the assessment stage (Balamir 2000, 1, Schanze 2006, 7).

The results of risk analysis can be assessed “quite differently by the society depending on individual and collective *perception* as well as on the *weighing of the tolerability* of certain risks” (Schanze 2006, 8). It is necessary to use the ‘objective’ (more precise supported with available theories and methods) risk analysis that is complemented by ‘subjective’ assessment done by individual and collective perception and weighing of risk as a societal behavior. Thus, “risk perception and risk weighing are considered in a two step approach of risk assessment” (Schanze 2006, 8).

How individual or collective imagination of a probable negative consequence constructs the risk refers to the perception of the risk. Since the perception of risk does not already include decision on how to deal with this risk to decide on a level of risk as probable ‘costs’ which can be tolerated in relation to certain opportunities as ‘benefits’ is managed by the risk weighing stage. Then the overall question is: *How much risk is tolerable considering ‘costs’ and ‘benefits’?* (Schanze 2006, 9).

If risks have been assessed as ‘not tolerable’, it is crucial to explore strategies to mitigate them because the impacts of risks are directly or indirectly influenced by the attitude of decision-makers. This stage is mainly about how risk(s) are managed either by transferring risks to another party or by retaining them (Flanagan & Norman 1993, 46; Balamir 2002, 26). Risk Avoidance, Risk Reduction, Risk Sharing are the different choices of risk mitigation. Some authors (Flanagan & Norman 1993) call these risk response however these choices include the works that should be done before the event. For this reason, it is more accurate to use the term: risk mitigation rather than response.

First choice of the risk mitigation activities gives the first priority to land use planning services to avoid the most of the risks of natural hazards. For example, settling on vulnerable regions can be avoided. If there is any, they can be transferred from these sites to safer areas. Also hazardous functions that lead to chain effects in a settlement can be prohibited by planning decisions.

In the second step risks may be reduced in their source(s) (removal) or in their impact area (resistance) maintained by the architectural and engineering services. "Even if minimized with the fulfillment of these prior steps of action, risks may not be entirely discarded" (Balamir 2002, 46). For this reason, there may always be some residual risks that should be shared within parties involved, so as to reduce its impacts on one singular party using proper insurance system, aids, donations, cross-financing and extra taxes etc… So in this third step, the re-distribution of resources financial management services and experts who are qualified in financial, public administration, public relations and insurance are required (Balamir 2000, 2 and 2002, 46).

In the field of urban planning for disaster-prone settlements, the combination of these choices may be determined according to possible scenarios. For instance, in the case of earthquake disasters in urban areas risk management includes not only features of individual buildings but also other physical and social processes. In addition to relation between buildings and ground features risk management should consider multiple variables that differ from one place to another and affect each other in order to identify constraints and weaknesses of urban areas. Moreover, cities are ever changing social, economic and administrative entities. So the risk distribution depends on a complex interaction among all of these variables. To mitigate earthquake risks in urban settlements it is necessary to examine this complex interaction and to evaluate possible scenarios before taking any measures and using appropriate instruments (Balamir 2002, 26).

2.4.2 Flood Hazards and Risk Management

Floods are one of the most threatening natural hazards for human settlements. This is apparent from the increase in damages in the last sixty years due to a series of floods throughout the world (Munich Re Group 2008).

In fact, there is a mounting trend worldwide in the number of natural disasters and their total economic impacts as illustrated in figure 2.12. Flooding, in particular, gives rise to losses over one-third of the total estimated costs and is responsible for two-thirds of people affected by natural disasters (Figure 2.13). And it is the most destructive type of natural disaster that strikes humans and their livelihoods around the world affecting both the least developed and most developed countries. Nevertheless, it is the citizens of the least developed nations that suffer the highest toll from the occurrence (Pilon 2003, 4).

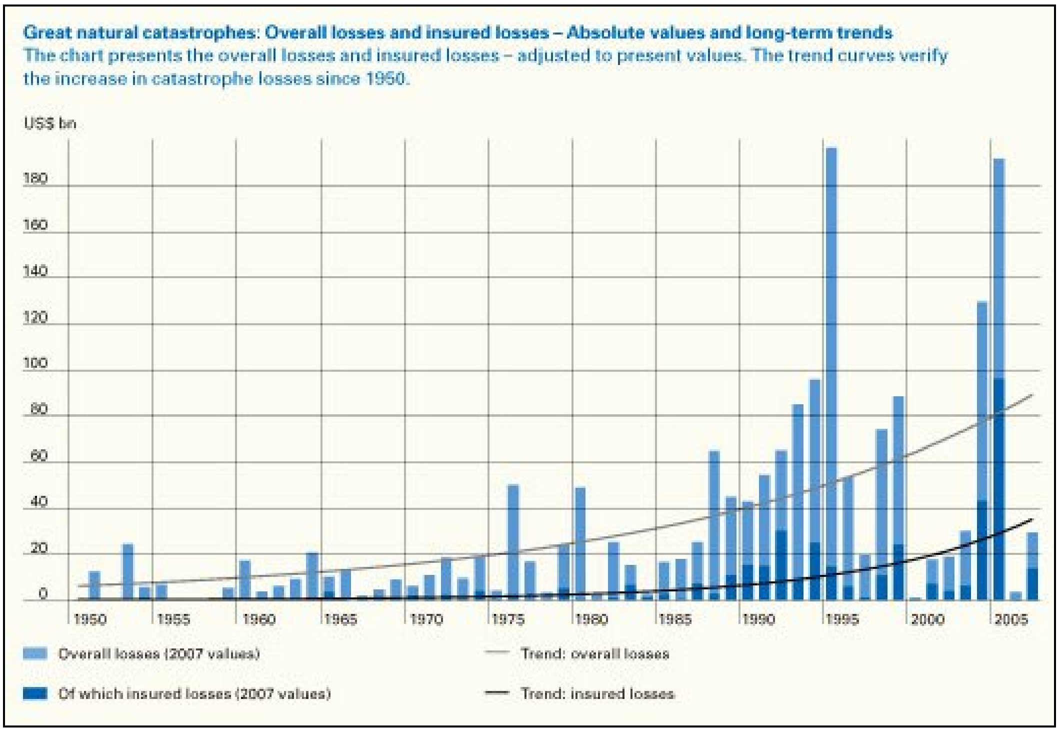

Figure 2.12: World Economic Losses between 1950 and 2007 from Great Natural Catastrophes
(Source: Munich Re; 2007)

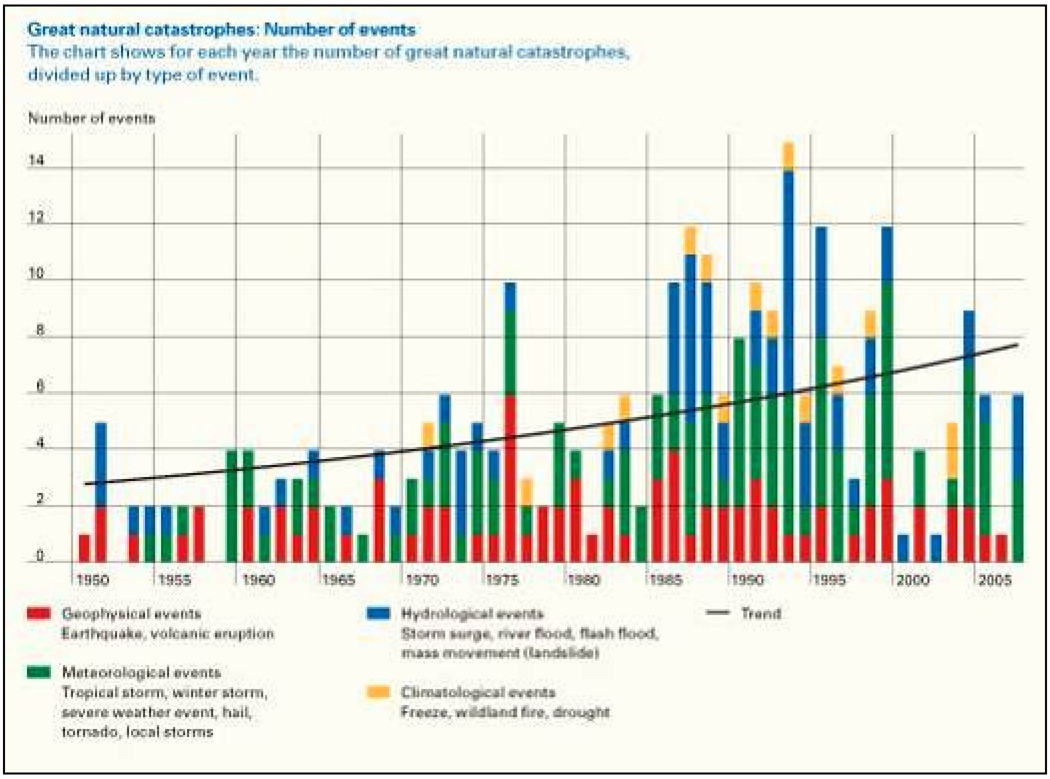

Figure 2.13: Number of Great Natural Catastrophes between 1950 and 2007
(Source: Munich Re; 2007)

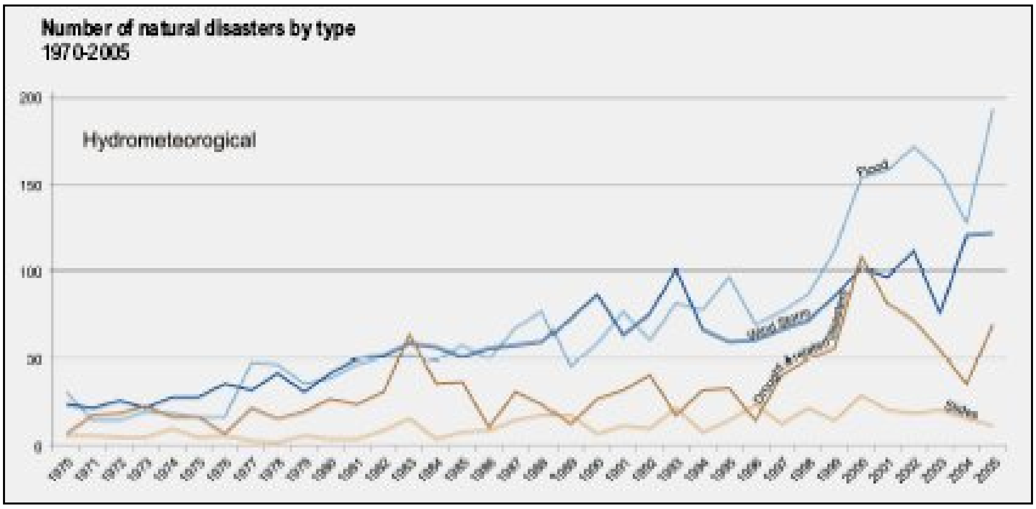

Figure 2.14: Number of Hydro-Meteorological Disasters (1970-2005)
(Source: EM-DAT)

In response to the devastation arising from water-related natural disaster, particularly flooding (Figure 2.14), a series of three international workshops and symposia were held and sponsored by United States National Oceanic and Atmospheric Administration (NOAA) and the United Nations Department of Economic and Social Affairs; namely,

- The Flood Forecasting and Disaster Response Workshop, Honduras, April 1999; following the devastation in the region stemming from Hurricane Mitch.
- International Symposium on Flood Forecasting for the Americas, Brazil, November 1999
- International Symposium on Water-related Disaster Reduction and Response, Thailand, August 2001

With the participation of so many countries the findings of those three sessions were used to publish ‘the Guidelines’ (Pilon 2003, ii) that can assist in planning and implementation of actions for reducing flood losses leading to more healthy and resilient societies on the Earth. In this part of the thesis the main strategies of the guidelines some of that are mentioned above are examined.

In this part the concepts about flooding and flood risk management are reviewed so as to clarify the reasons of *a flood event* and the contributions of the need for risk management and disaster management activities onto the flood risk management system. In turn this may indicate common issues in dealing with the flood risk and the concept of flood management framework in the current world literature.

2.4.2.1. Terms and Concepts Related with Flood Risk

2.4.2.1.1. The Definition of ‘Flood’

Floods that can shortly be defined as “a temporary covering of land by water outside its normal confines” by Munich Re (1997) can also be defined as in specific terms “temporary inundation of normally dry land areas from the overflow of inland or tidal waters, or from the unusual and rapid accumulation or runoff of surface waters from any source” by FEMA (1986).

Floods that occur in small and large river basins, in estuaries, at coasts can be classified according to the cause of events, such as winter rainfall floods, summer convectional storm induced floods, snow-melt floods, sea surge and tidal floods, tsunamis, rising groundwater floods, urban sewer floods, dam break or reservoir control floods (Schanze et al. 2006, 2).

2.4.2.1.2. Precipitation-Runoff and Steps of Flood Hazard Delineation

In order to understand fundamentals of floods it is necessary to comprehend the basics of *hydrologic cycle* that covers "the cyclic movement of water from the sea to the atmosphere by evaporation, and then by precipitation back to the earth where it runs to the sea through streams or through groundwater flow" as shown in figure 2.15 hypothetically (Usul 1994, 1).

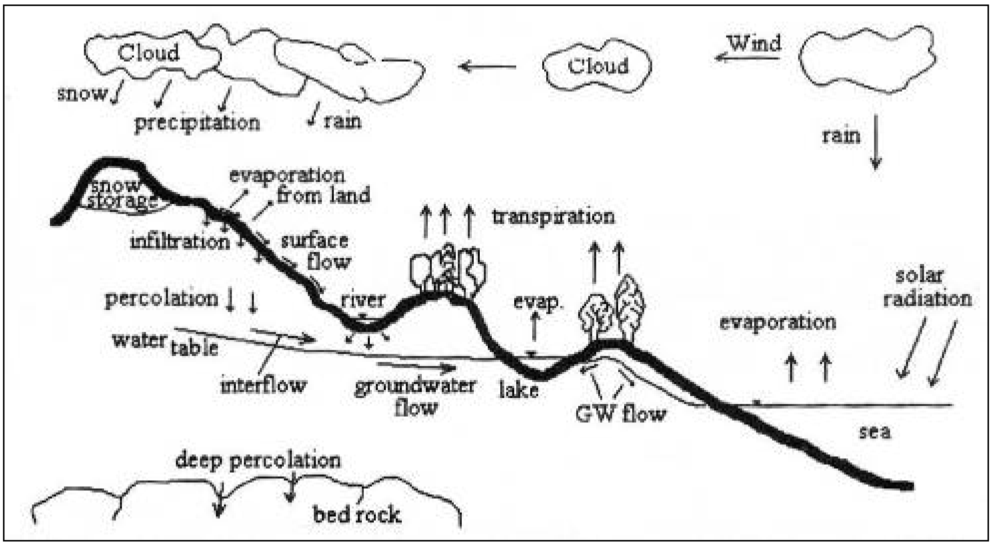

Figure 2.15: The Hydrologic Cycle
(Source: Usul 1994, 2)

Some elements of hydrologic cycle; namely *precipitation*, *stream flow*, *evaporation* and *infiltration* (see Glossary) are critical to investigate while dealing with flood hazards.

Within a specified period of time and in a given area *flood hazard* is generally defined as *the probability of the occurrence* of potentially damaging flood events (ITC 2004 and Merz 2004). “Potentially damaging means that there are elements exposed to floods which could, but need not necessarily, be harmed” as Schanze states (2006, 2).

Places influenced by flood hazard are generally determined both by the morphology and previous flooding occurrences. By the help of the hydrological data collection and analysis, the establishment of systematic patterns for the rainfall runoff is possible which helps to govern flood events. The depth and intensity of precipitation, river discharge, snow depth and density, lake level, infiltration rate, ground water table level, water quality, evaporation rates, etc. can be empirically measured for a certain period of time. For these variables the average values, extreme values, and time histories are observed and collected for a considerable period of time and for a specific area (such as river basins, coastal areas) due to their variations in time and space (Usul 1994, 4).

Giving different discharges and their associated exceedance probability, the flood frequency curve at a discharge gauge, can be an example of a *flood hazard statement* (Merz 2004, 5). However, flood hazard statements do not convey information about the consequences of such floods in society, built environment or natural environment. Since these consequences depend, among others, on *the intensity of the flood*, flood hazard statements should quantify the intensity of the process that go beyond a flood frequency curve.

The intensity of flood depends on some variables that are based on either the physical features of the terrain, or past and present hydro-meteorological rainfall data. Merz (2004) lists these critical variables as follows:

- the inundation depth (scenarios by the discharges from a flood frequency curve)
- flow velocity (geomorphology)
- the duration of the flood situation (rate of soil infiltration, drainage capacity)
- the rate of the water rise (rainfall intensity)

With the help of hydrology science and hydraulics two main factors that are fundamental variables for the delineation of flood plains are determined by hydrology and hydraulic analyses (FEMA 2003).

The quantity of water that must pass a given point is called discharge according to flood frequency and calculated by hydrologic analysis

The geometric configuration, 'roughness' of the channel and adjacent over bank area that must carry that water is delineated by hydraulic analysis in order to determine how much of the floodplain is required to pass the given flood discharge.

2.4.2.1.2.1 First Factor: Flood Frequency-Discharge Calculations

According to hydro-meteorological studies, 2, 5, 10, 25, 50, 100 and 500-year maximum rainfall values and flood hydrographs are calculated by intensity-duration-frequency curves that belong to rain-gauge stations that collect stream flow data for a particular time period. However, it is not necessary to have data that are collected during these years. For instance, a 100-year flood does not mean 'flood that happens once during a century', rather it actually means that a "1-in-100-chance flood": a 100-year flood is of a size that statistics show has a 1-in-100 (i.e., 1%) chance of occurring in any year. A 100-year flood, indeed any flow of water in a stream, is characterized by a term called *stream discharge*. It is often expressed as "Q" and is defined as the volume of water that passes through a cross section of a stream per unit time (Pipkin, Trent and Hazlett 2005; Kadıoğlu 2008)

Therefore, flooding that is considered to be a random and unpredictable phenomenon; historical records can be analyzed statistically to predict how often floods of a specified size can be expected to occur. Although, the wide range of intensity of floods in a specific area and the variation in return periods (*recurrence interval*) make difficult to estimate the next occurrence, it ought to be possible to take precautions in many vulnerable flood-prone areas with respect to various return periods. The recurrence interval is *a statistical assessment of the average time* that passes between floods of a certain magnitude. The critical fact ought not to be forgotten that the wider range of return period in precipitation (generally rainfall) the most destructive effects in flood-prone areas (BCWD 2000).

2.4.2.1.2.2 Second Factor: Cross-Section of Stream- Watershed Analysis-Depth of Water

Hydraulic analysis using computer models help to determine how much of the floodplain is required to carry the certain flood discharges. This information provides a 'cross-section' of the floodplain. In turn, it gives also the information about the *depth of water* that is flood elevation, as well as the delineation of *floodway* (see Glossary) (EMI-FEMA 2003).

However, the complexity of *drainage basin* (*watershed/catchment area*) hydrological cycles and river systems is such that predictions become difficult. Since channel networks and basin shape may both worsen flood events by concentrating the flood waves, *watershed analysis* is critical for stream discharge. Models must not only take into account static factors such as geology (soil conditions, infiltration capacity), basin shape, stream network (figure 2.16), but also account for a number of dynamic factors; such as land use and vegetation – both of which can change in the short term (seasonal) and long term (as a basin is urbanized or farmed more intensively) due to their impacts on infiltration capacity and run-off (Frampton 1996, 32).

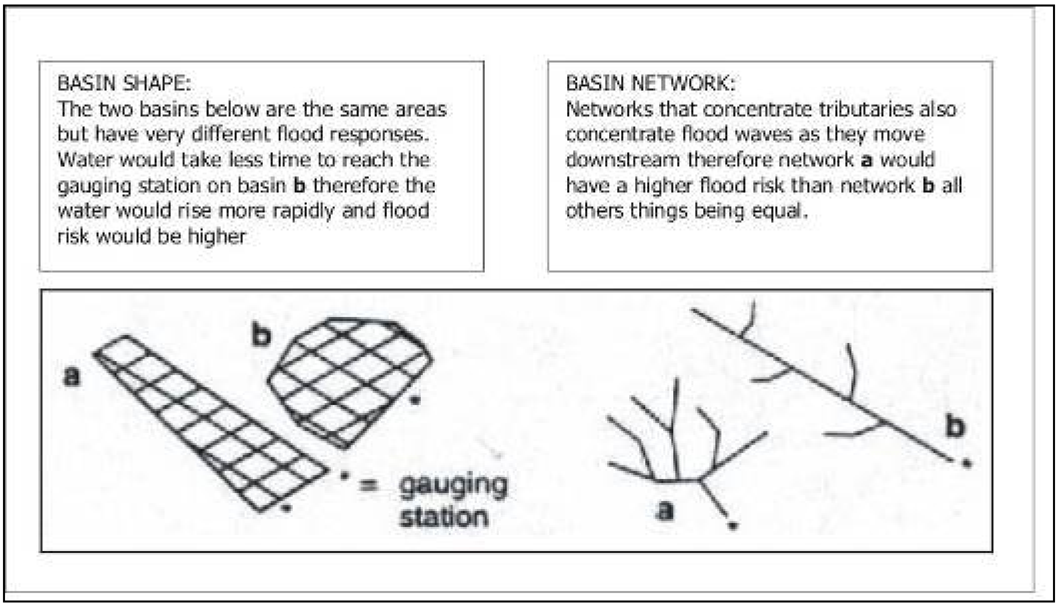

Figure 2.16: Impact of Basin (Watershed) Shape and Networks on Flood Risk

The river channel is a part of the hydrological cycle where flood hazard occur, however floods can be encouraged by the storage conditions in any of the other storages shown in Figure 2.17. So the nature of the channel store; like its drainage basin conditions has an influence on flood risks (Frampton 1996, 32).

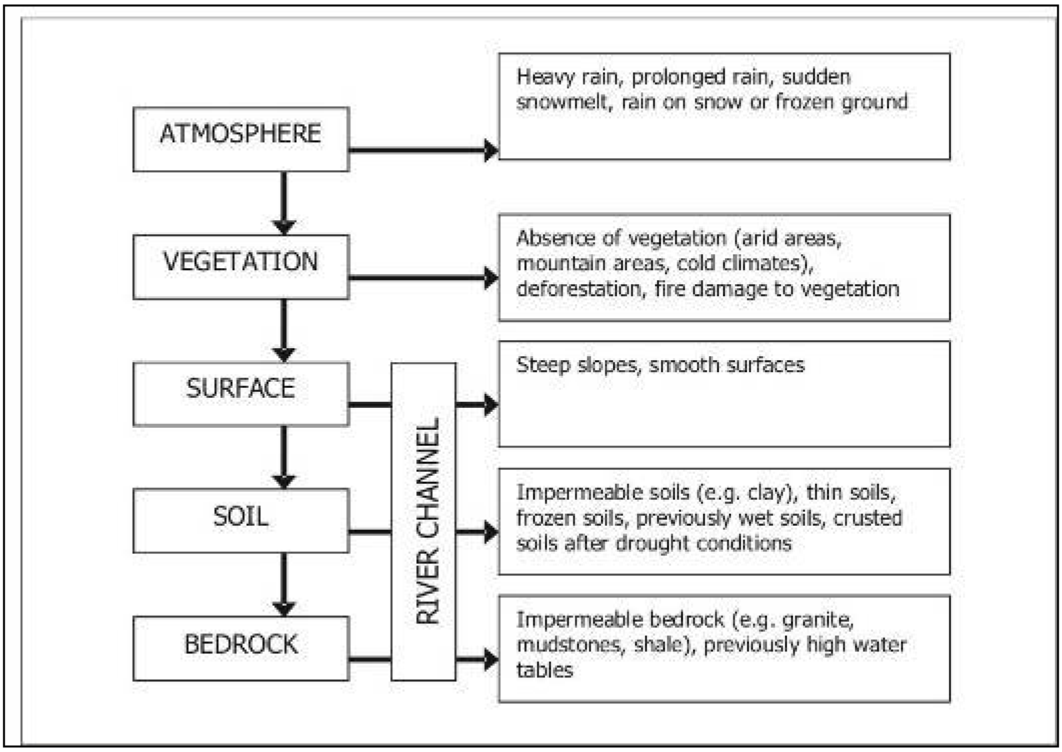

Figure 2.17: Storage Conditions in the Other Stores that Probably Increase Flood Risk
(Frampton 1996, 31)

2.4.2.1.2.3 Delineation of Floodway, Flood fringe and Floodplain

To delineate an area probably affected by floodwaters, a 'design' event is required. There are various approaches for estimating the design event that is based in essence on 'acceptable' risk, although this concept of acceptable risk was not explicitly recognized at the time of adaptation (Pilon 2003, 25). Approaches that are used for estimating the impact areas of design flood are:

- A historical worst-scenario that happened in the basin, or could plausibly have happened;
- Hypothetical worst possible flood that is called Probable Maximum Flood;
- A probability-based analysis wherein systematic records and historical information on past floods are used to develop a relation of probability of occurrence versus magnitude

The last one; the frequency based approach is the predominant method used in most floodplain delineation studies. The peak flood discharge and corresponding water level are determined for various frequencies of occurrence or return periods of events (Pilon 2003, 25).

According to results of hydrologic and hydraulic analyses the borders of *floodway*, *flood fringe* in a *floodplain* boundary that belongs to a certain flood discharge (such as a 100-year flood), as well as depth of water on the floodplain area (floodplain elevation) are determined as illustrated Figure 2.18, 2.19 and 2.20.

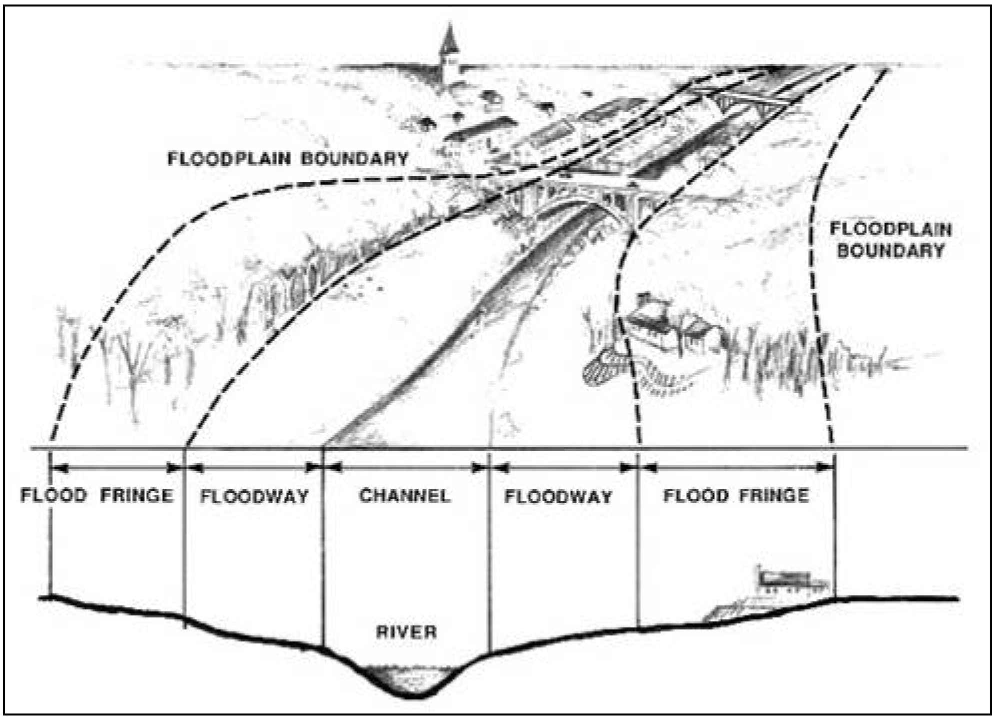

Figure 2.18: Delineation of Floodway, Flood Fringe that Compose Floodplain Boundary
(Source: http://www.dnr.state.mn.us/shorelandmgmt/guide/floodplain.html)

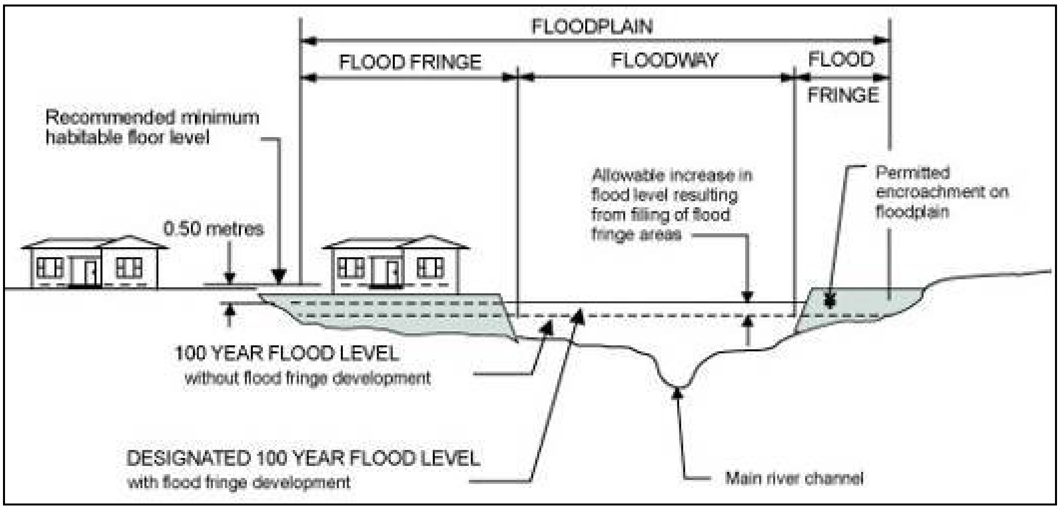

Figure 2.19: Schematic Floodway
(Source: Water and Rivers Commission of Australia 2000)

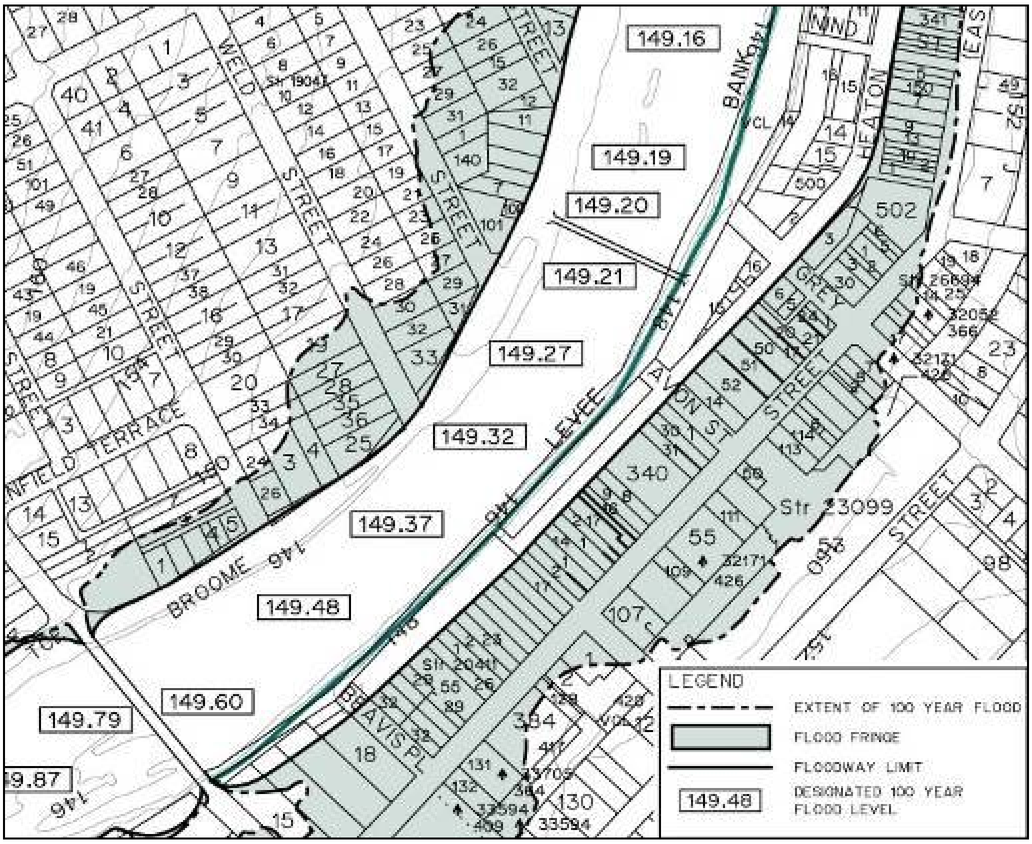

Figure 2.20: An Example of a 100-Year Flood Elevation
(Source: Water and Rivers Commission of Australia 2000)

2.4.2.1.3. Identification of Flood Vulnerability and Flood Risks

Damage by flood hazard within the flood-prone area depends on the *vulnerability* of exposed elements, such as populations, infrastructure and structures (Schanze 2006, 2; Pilon 2003, 27).

According to Merz (2004 7) *vulnerability* is composed of two elements, *exposure* (or damage potential) and *susceptibility* (loss). “Who or what will be affected by floods?” is the question examined by the exposure analysis. *The number or the value of elements* which are at risk indicates the exposure. For example, for the building stock in a flood prone area for the 50-year flood, the exposure may be quantified by the total assets of all buildings within the 50-year inundation area (Figure 2.21).

Analysis of *susceptibility*, on the other hand, explores the question “How will the affected elements be damaged?”. It is usually described by relative damage functions. Such functions give the degree of damage if the building is flooded. As Merz (2004 8) states that “most damage models have in common that the direct monetary damage is estimated depending on the use of the building and the inundation depth. Such depth-damage functions are seen as the essential components upon which flood damage assessments are based and they are internationally accepted as the standard approach to assessing urban flood damage”.

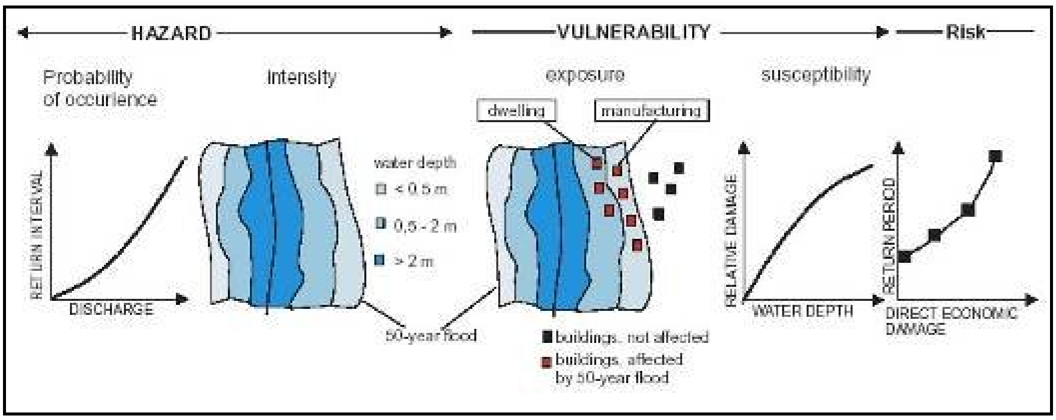

Figure 2.21: Schematic Hazard-Vulnerability-Risk Relation
(Merz 2004, 24)

So as the type of flood event affects, the constitution of the elements at risk also have effects on flood vulnerability. According to Schanze (2006, 2) flood vulnerability can be identified in <u>three basic categories</u> for the principle of sustainability. One is the **economic vulnerability** that indicates “direct and indirect financial losses by damage to property assets, basic material and goods, reduced productivity and relief efforts”. **Social and cultural vulnerability**, on the other hand, “refers to loss of life, health impacts (injuries), loss of vitality, stress, social impacts, loss of personal articles, and loss of cultural heritage”. Third concern area is **ecological vulnerability** that deals with anthropogenic pollution of water, soil and ecological systems.

As ISDR (2004) state that the convolution of flood hazard and flood vulnerability [**Flood Risk = f(Hazard; Vulnerability)**] creates flood risk as Merz (2004, 8) defines as the probability that floods of a given intensity and a given loss will occur in a certain area within a specified time period.

In this way, risk always implies an abstract but quantitative measure. As shown in Figure 2.21, risk results from the <u>interaction of hazard and vulnerability</u>. For flood risk, particularly, a model proposed by Institution of Civil Engineers ICE (2001, 15) in order to conceptualize the physical and social processes behind. According to this model (figure 2.22) called *Source-Pathway-Receptor-Consequence* (SPRC) there is a simple causal chain linking the hydro-meteorological events either in inland or at coast (sources) through the discharge and inundation (pathways) and the physical impacts on elements at risk (receptors) to the assessment of the effects (consequences) as Schanze states (2006, 3).

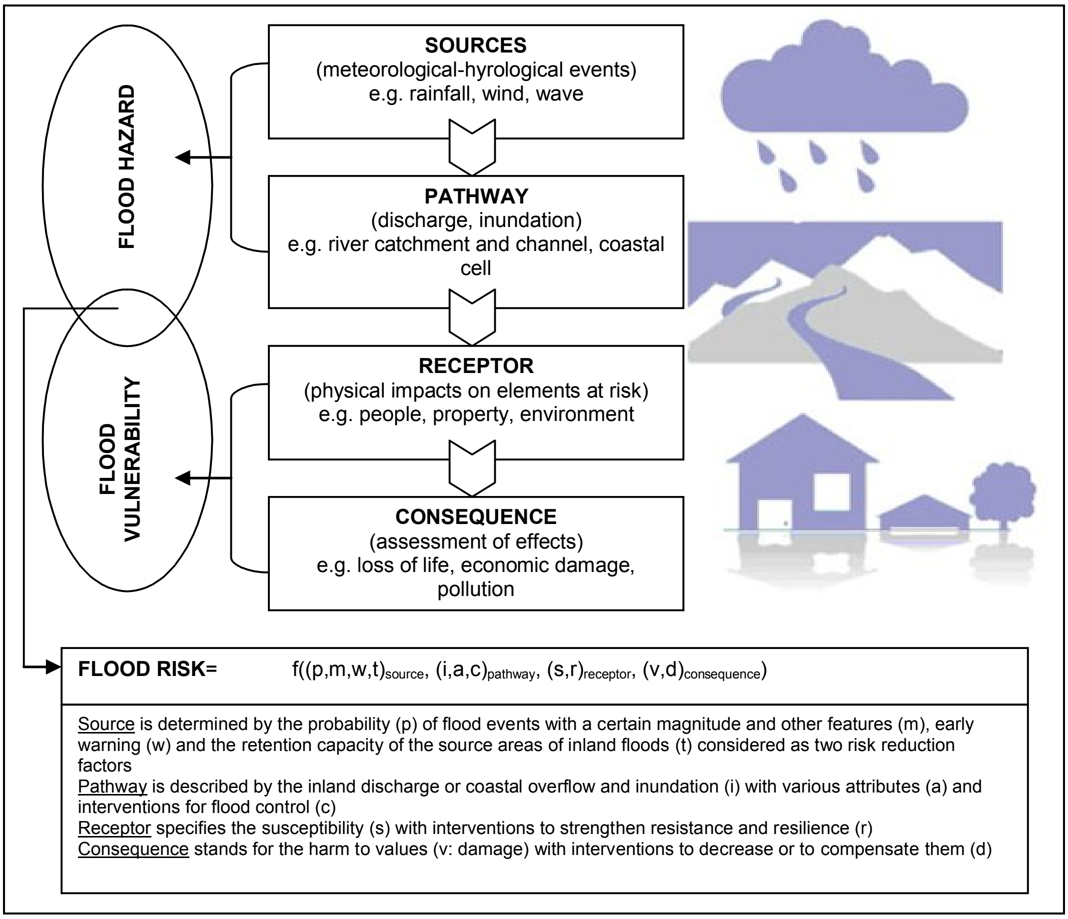

Figure 2.22: SPRC-Model

(redrawn by the author, Sources: ICE 2001, 16, Schanze 2006, 3)

A certain risk level can be reduced by decreasing the intensity of hazard, such as increasing the water retention capacity of the catchments. On the contrary, the reduction of the assets in the flood plain, or installation of a flood warning system may decrease the vulnerability (Merz 2004, 9). Therefore, by this model it is assumed that the flood risk system includes all related, elements and processes within hydraulically connected areas; such as river catchment for inland floods, coastal cells for coastal floods. However, it is certain that there are complex interrelations between pathways, interventions for flood control and the exposure of vulnerable elements in the reality.

2.4.2.2. Flood Risk Analysis and Mapping

Mapping of flood risk that defines the area at a certain risk degree creates a basis for all flood risk reduction programs and subsequent actions. They provide a more direct and stronger impression of the spatial distribution of the flood risk than other forms of presentation such as verbal description, diagrams. Maps are valuable for presenting and assessing the local flood situation, and they convey information for many applications in flood defense and disaster management" (Merz 2004, 1).

Since maps often have a legal connotation in terms of zoning and measures undertaken, they need to be prepared as accurate and credible as possible. They also need to be both legible and readily available for creating public awareness and for using in emergency response activities (Pilon 2003, 28).

Flood Hazard Maps show the intensity of flood situations and associated exceedance probability. In other words, it indicates the inundation area for a scenario with a certain return period (figure 2.23). For example, 'a 100-year flood' is a statement of the *probability* that a flood will occur which brings at least as much as the predicted precipitation once during that period; it does not mean that it predicted to occur regularly every 100 years. There may be two '100-year floods' within a 5-year period, or no '100-year floods' for 200 years, but the probability is that there will be one such flood on the average of once every 100 years (FEMA 1986). These probabilities for 2, 5, 10, 50, 100, 500-year floods can easily be computed if the available data are confident enough. The larger return periods have the more destructive impacts.

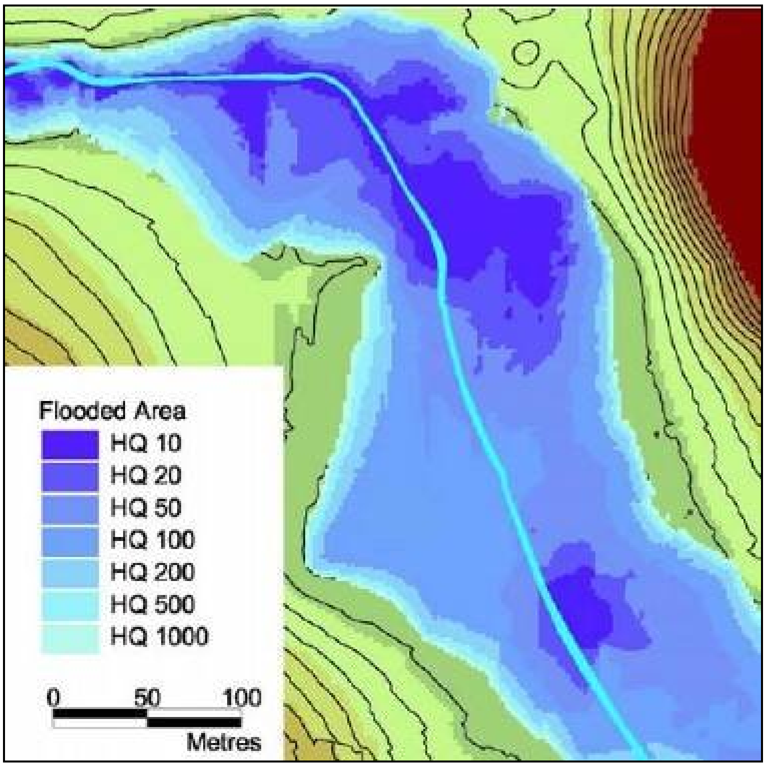

Figure 2.23: Flood Hazard Map Indicating 10, 20, 50, 100, 200, 500, 1000-Year Inundation Areas *(Merz 2004, 25)*

Through modern computational and geographic information systems, these inundation maps can be generated in real-time and can be part of hydrological forecast system with predetermined hydrologic models on a certain terrain (Pilon 2003, 28).

On the other hand, in order to illustrate the social consequences of floods, the built environment and the natural environment, flood danger maps or hazard maps have to be combined with information about vulnerability. These maps are called **Flood Vulnerability Maps** as shown in Figure 2.24.

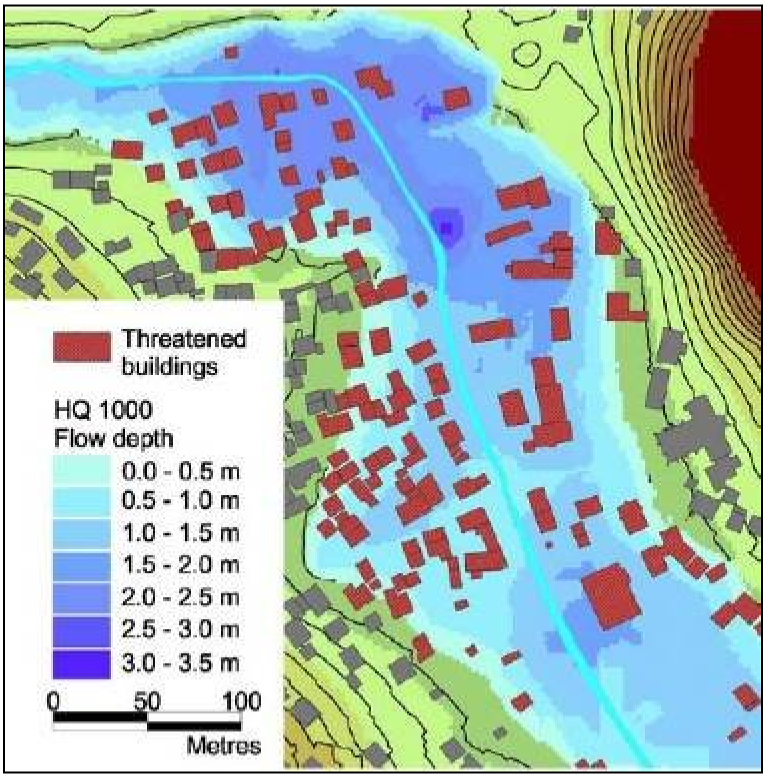

Figure 2.24: Flood Vulnerability Map Showing Threatened Buildings
(Merz 2004, 26)

From the combination of hazard and vulnerability maps **Flood Risk Maps** show the spatial distribution of risk with respect to the potential damage (Figure 2.25). In this map the risk is related to the areas of the land-use plan. These maps can be used to flood mitigation techniques, like determination of insurance premiums, new proposals and decisions about land use.

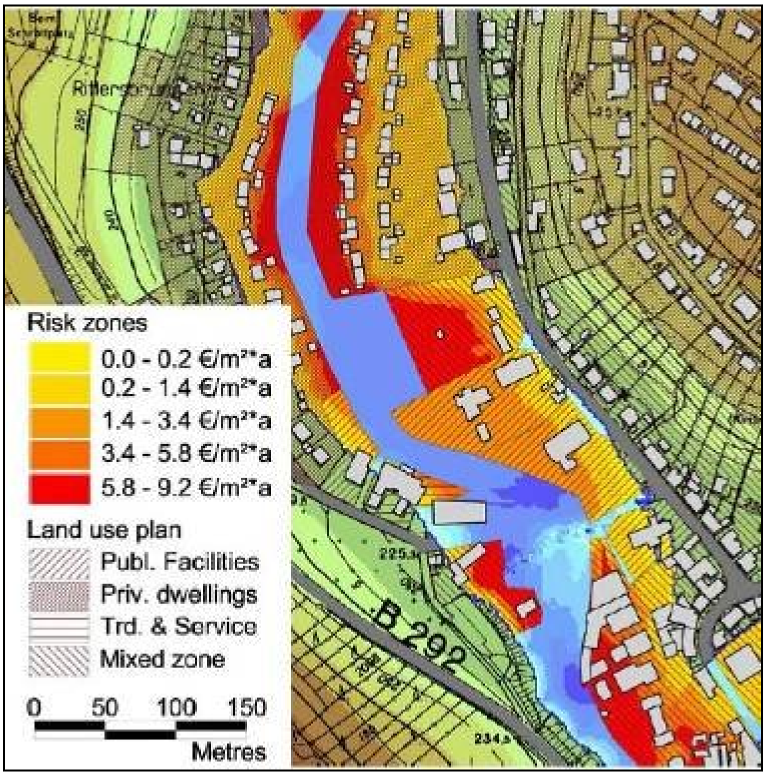

Figure 2.25: Flood Damage Risk Map Including Land Uses
(Merz 2004, 27)

Hence these maps on flood risks provide a strong communication to residents in areas of potential risks and decision-makers in planning actions and assistance before any flood event (Figure 2.26).

The zones that show various risk levels on these maps can be used for various purposes that are determined for several protection strategies towards these various risk levels. For example, some flood-plains that are frequently inundated can be used for parks, nature areas or ecological reserves, while less frequent and low risk areas can be used for residential purposes, however they ought to be constructed and located according to flood water level[9] so as to be protected for that level of risk. Nevertheless, there is always a residual risk that we should know and prepare all the time.

[9] This level is called 'Base Flood Elevation (hereafter BFE)' in U.S., in these zones properties ought to be constructed above this level in order to be protected. (for BFE; see Glossary)

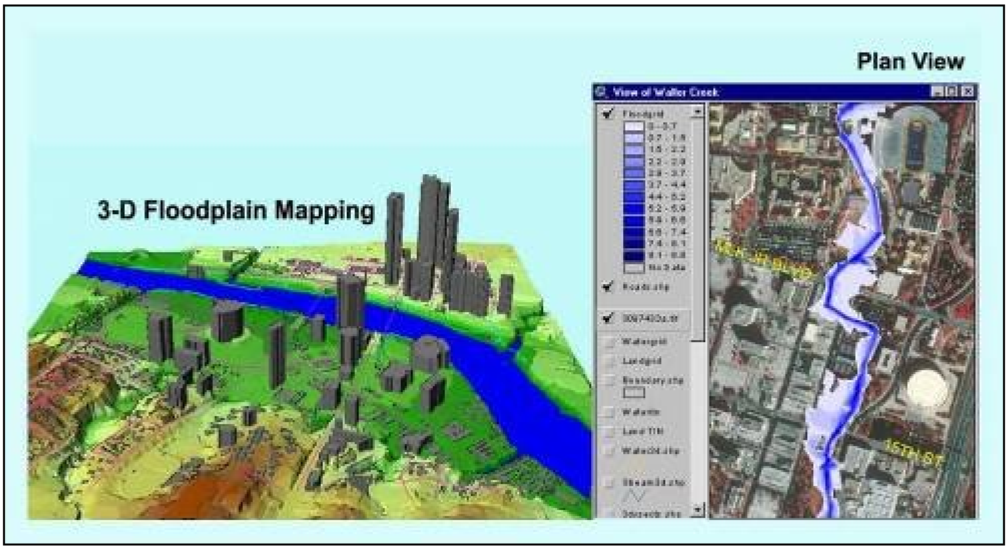

Figure 2.26: 3-D Model and Plan View of Floodplain Mapping
(Source:http://www.ce.utexas.edu/prof/maidment/grad/tate/research/OralPres.ppt)

2.4.2.2.1. Hydraulic - Hydrologic Modeling and Software Support

Due to great developments in advanced computational technology today, a number of tools are available to array and demonstrate various information for the use of technical experts, to explain flood loss reduction programmes to decision-makers, and to notify the public about real-time forecasts and early-warnings. Updating the information, developing scenarios and providing visual and quantitative results regarding the state of conditions are worthwhile features of these tools.

Today Geographic Information Systems (GIS) that provide a computer based information and manipulation system are combined with hydraulic models that are provided by computerized programs; such as HecRAS so as to generation of flood inundation maps that can be conveyed to residents in the floodplain (figure 2.27) and are useful for depicting the probable impact of approaching flood (Pilon 2003, 30). However, before the generation of flood inundation maps a good representation of the basin topography is required as a base. A digital elevation model (DEM) or digital terrain model (DTM) for a basin can be produced as a part of GIS.

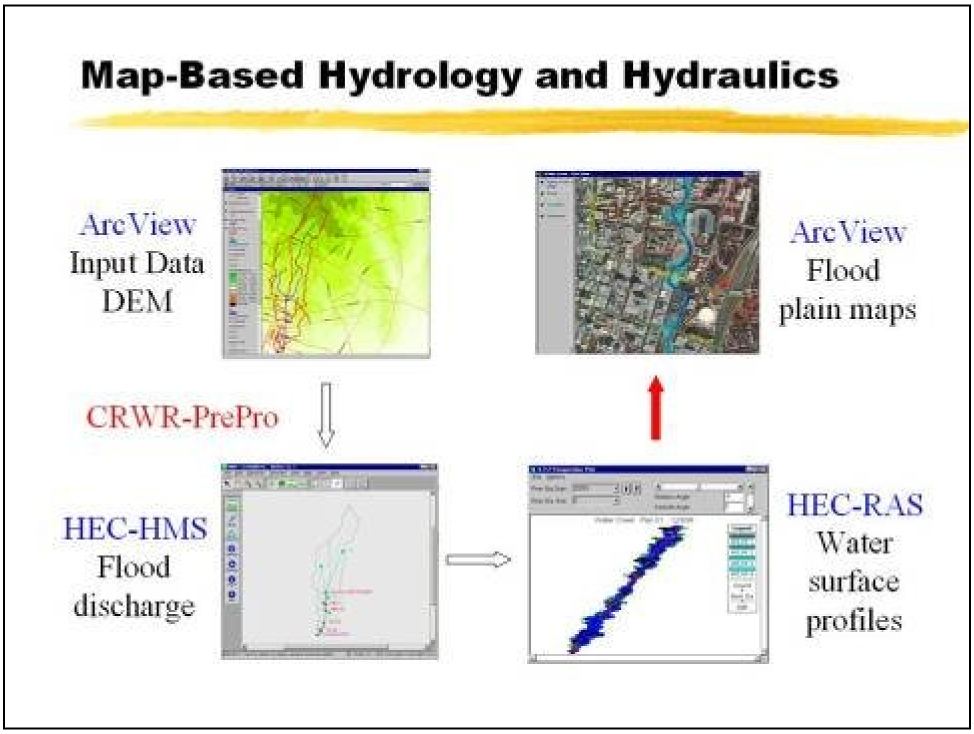

Figure 2.27: Process on Map-Based Hydrology and Hydraulics
(Source:http://www.ce.utexas.edu/prof/maidment/grad/tate/research/OralPres.ppt)

"Information from a variety of sources and scales can be combined as a series of layers, provided that the information can be identified in terms of the common denominator of the location" (Pilon 2003, 30). For example, to estimate infiltration rates for forecasting purposes information on vegetation cover can be combined with information on the land slope and soil type.

2.4.2.3. Flood Protection and Flood Risk Mitigation

The most-widely used flood protection method through ages is the construction of embankments parallel to both banks of a stream or sea in order to resist the highest flood water level that have been observed thus far. Nevertheless, it is experienced that structural (engineering) measures; such as construction of levees (embankments), channel alterations, riverbed reclamations, dams, etc…, which are used to keep flood away from settlements, provide temporary solutions creating more destructive flood disasters during future events. Furthermore when flood control constructions are built up, maintenance and monitoring stages become low priority concerns. Either these constructions do not solve the flood problem entirely, or so-called successful structures may lead to encourage encroachment in other areas, besides progressive invasion of floodplains and relentless growth of losses. This has been experienced in many places throughout the world. Mississippi River Flood in 1993, for instance, was a milestone in U.S. for abandoning the policy which is completely based on investing on flood-control structures as Cigler states (1996, 192).

According to Cigler (1996, 193) “containing water in a narrow and high channel to protect farms and urban areas, on the other hand, has the opposite effect”. That kind of interventions based on direct physical actions, such as river reclamations and construction of levees, cause more destructive impacts on floodplains due to increase in speed of runoff water and height of river water level in time. “In essence, the river adjusts in response to human tampering with the floodplain and these adjustments induce humans to make constant and costly upgrades in structures” as claimed by Cigler (1996, 193).

In short, the flood management approach that is only based on the structural measures may seem to solve problem in the short term, however it leads to even more severe impacts in the long-run. It’s proved in so many cases that the structural interventions to protect life and property from high flood waters cannot always be the safe enough. For example, at water levels, which are below the design level, failure or collapse of the flood protection structure is also possible because various mechanisms may play critical role for the failure. There is always unknown but predictable mechanisms that require wider scope than that of the structural measures could provide. Hence, *the concept of risk* and *the risk management approach* provide this wider scope that includes systematic and harmonized implementation of both structural and non-structural measures.

Therefore, structural measures require a complementary part which includes interventions based on mechanisms leading to measures indirectly influence human behavior. With them, the traditional engineering perspective of flood risk management gains the societal point of view which seems to be crucial for the consideration of the decision makers of interventions. For these interventions a collective term is non-structural measures.

These non-structural options, based upon the realistic understanding that floods are inevitable, aim to use cost-effective measures to keep people away from waters that may probably give rise to floods. This policy approach includes regulations (zoning and other land-use regulations like land acquisition, permanent property relocation; elevation and other flood-proofing of buildings), education, a variety of financial incentives (flood insurance), and also technical assistance of capacity building tools (flood warning systems, disaster preparedness, and response planning). In short, this approach is an attempt to reduce the flood hazard for people and property, with a commitment to long-term risk management of all factors that affect flood risk. In order to achieve this, a management system is required having clear objectives, accountability, monitoring, and flexibility that affords change in response to new information or circumstances (Cigler 1996, 193).

"Despite the apparent need for a more balanced approach toward floodplain 'management' through wise combination of structural and non-structural options, flood 'control' (just applying structural techniques) has been the dominant philosophy" (Cigler 1996, 193). Hence the main question rose by Cigler (1996, 193) is how a 'balanced' approach should be achieved by societies (Figure 2.28).

FLOOD CONTROL (structural)
vs.
FLOODPLAIN MANAGEMENT (non-structural)

Flood Control	**Floodplain Management**
"Confine, limit or control the runoff characteristics of a watercourse through structural means such as dams and levees."	"Identity and recognize hazards associated with the runoff characteristics of a watercourse and develop floodplain safely."

Figure 2.28: Structural and Non-Structural Measures
(FEMA, 2003)

If flood risks have been assessed as 'not tolerable', it is crucial to explore strategies to mitigate them because the impacts of risks are directly or indirectly influenced by the attitude of decision-makers.

Risk Mitigation, is mainly about how the risk(s) are managed either by transferring risks to another party or by retaining them (Flanagan & Norman 1993, 46; Balamir 2002, 26). As the priorities of risk mitigation, Risk Avoidance, Risk Reduction, Risk Sharing are used in flood risk mitigation process as well (Figure 2.29).

First priority of risk mitigation activities gives the first priority to planning services, such as plan preparation/implementation/control/revision activities, to avoid settling or maintaining investments or public facilities on high-degree flood risk prone areas. If there is any, they can be transferred from these sites to safer areas. Also hazardous functions, like chemical factories that may lead to diffuse toxic material with flood water, can be prohibited by planning decisions.

In the second priority risks may be reduced in their source(s) (removal) or in their impact area (resistance) maintained by the architectural and engineering services. For these activities; such as flood control structures, levees, reservoirs, dams, etc., the term called '**structural measures**' is commonly used in the literature. It refers to interventions of 'flood defense (control)' that is based on direct physical actions. Due to the traditional engineering perspective this term of flood management had been predominantly used.

After these two groups of actions that aim either to avoid or to minimize the flood risk, there are always some residual risks that should be shared within parties involved, so as to reduce its impacts on one singular party using proper insurance system, aids, donations, cross-financing and extra taxes etc. So in this third priority, the re-distribution of resources financial management services and experts who are qualified in financial, public administration, public relations and insurance are required. By building and efficiently allocating funds for both pre-flood and post-flood requirements, as well as maintaining equity between fund-providers and between fund-users the residual risks can efficiently and effectively be shared within all parties involved (Balamir 2000, 2 and 2002, 46).

In the field of urban planning for disaster-prone settlements, the combination of these choices may be determined according to possible scenarios that "can be understood as conceptualized futures for the flood risk system" (Schanze 2006, 12). For instance, in the case of flood disasters in urban areas risk management includes not only features of individual buildings but also other physical and social processes and their interactions; such as ongoing process of climate change, population change and increase in GDP etc… So it is necessary to examine these complex interactions and to evaluate possible qualitative-quantitative scenarios before the formulation of strategic alternatives with appropriate measures and instruments (Balamir 2002, 26; Schanze 2006, 12).

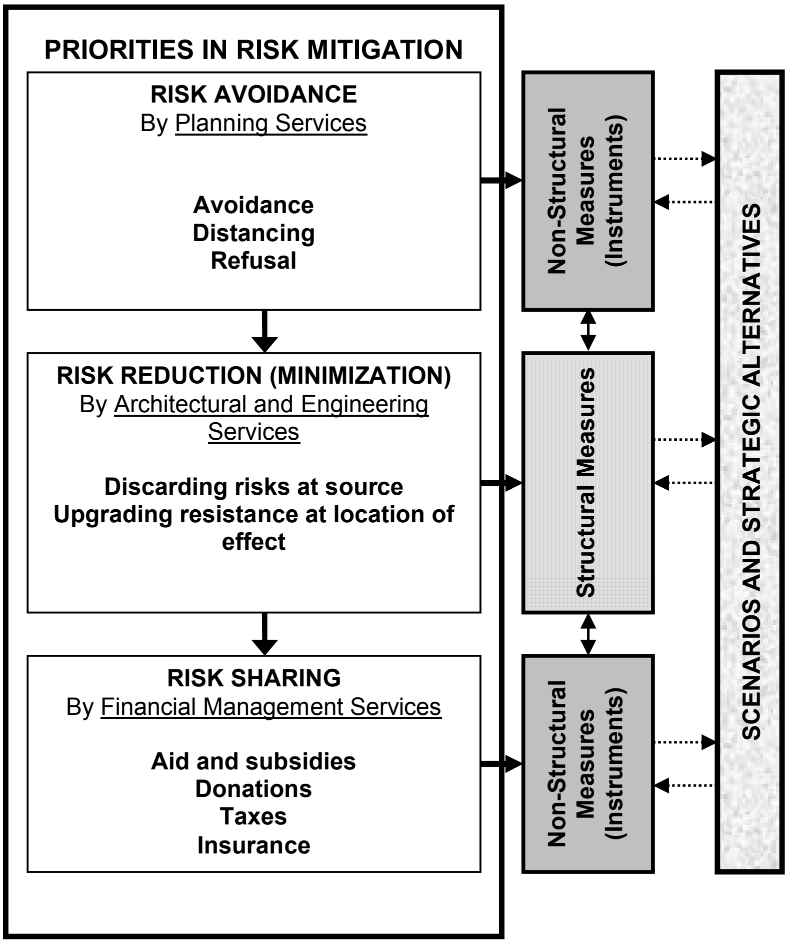

Figure 2.29: Priorities in Risk Mitigation
(Redrawn by the author, Sources: Balamir 2001; Schanze 2006)

2.4.3 Fundamentals of Flood Risk Management Process

'Risk management' is a fundamental input "geared to the evaluation of schemes for reducing but not necessarily eliminating the overall risk, as in many cases risk cannot be entirely eliminated". The shift to proactive management of natural disasters involves the identification of the risk (hazard potential and vulnerability), the assessment of the risk whether it is tolerable or not (figure 2.30), the development strategies to reduce that risk and implementation of policies and programmes to these strategies into effect, as defined in figure 2.31 (Pilon 2003, 24).

According to the framework based on the assessment of flood risks specific mitigation measures can be identified, and measures selected ought to be implemented for the reduction of the flood risks that are determined as intolerable (Pilon 2003, 24).

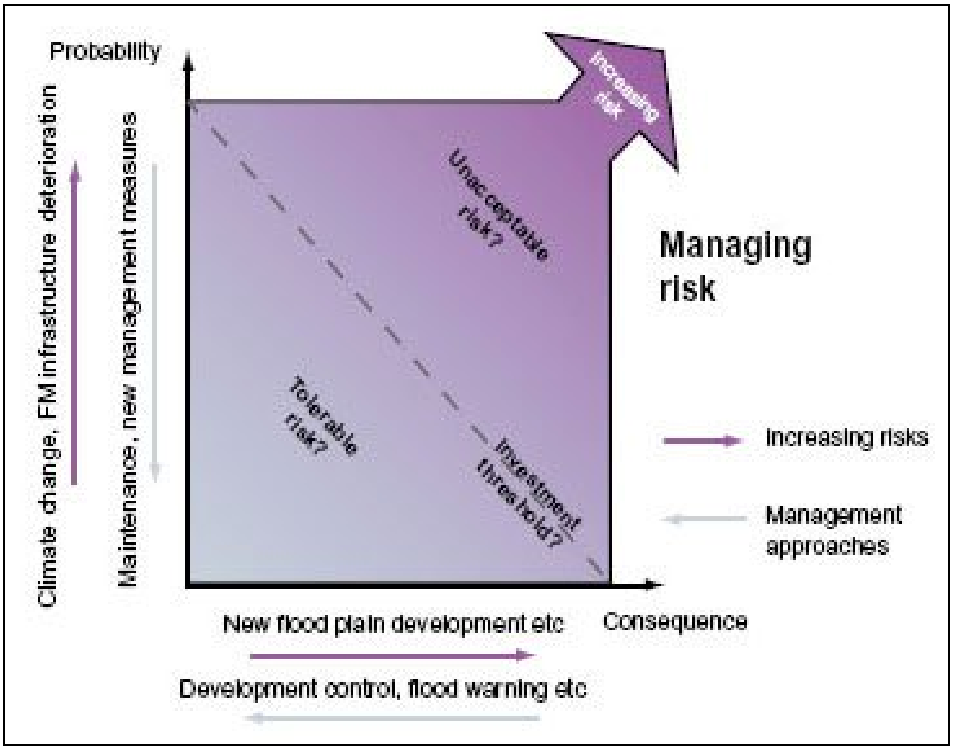

Figure 2.30: Tolerable or Not?
(Source: Pitt 2008, 109)

Since the causal chain links all elements in hydro-meteorological system as explained in SPRC-Model, flood risk management is commonly defined as ‘holistic and a continuous societal analysis, assessment and reduction of flood risk”. In other words, it is considered “comprehensive and dynamic” process.

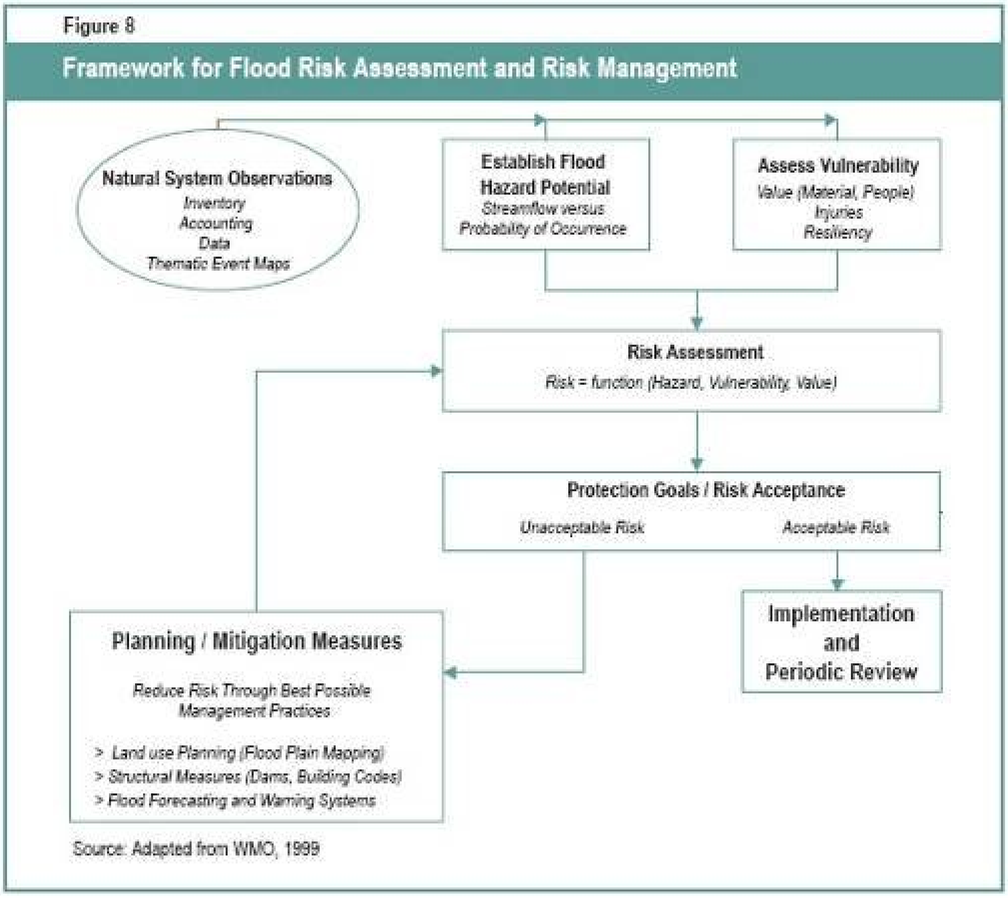

Figure 2.31: Framework for Flood Risk Assessment and Risk Management
(Pilon 2003, 24)

2.5. CONCLUSION: THE NEED FOR INTEGRATED BASIN MANAGEMENT TO COMBAT FLOOD DISASTERS

For centuries floods have threatened human settlements besides other natural disasters. However, it has been observed that the number of hydro-meteorological disasters have increased worldwide in recent years and have become the most widespread and threatening type of natural hazards. Today it is expected that due to the global warming and climate change, the intensity and frequency of floods may increase, and the impact areas may be widened in the near future. As a matter of fact, a hydro-meteorological event, flooding is vital for the continuation of habitat and ecological cycle of surrounding areas. When this cycle is interrupted by human settlements, flood events turn into flood disasters damaging life and property.

The most-widely used flood protection method through ages is to construct embankments parallel to both banks of a stream or sea in order to resist the highest flood water level that have been thus far observed. However, it did prove in so many cases that the structural interventions to protect life and property from high flood waters cannot always be the safe enough. For example, construction of levees (embankments) provides temporary solution creating more destructive flood disasters during the next events. There is always unknown but predictable mechanisms that require wider scope than that of the structural measures provide. Hence, *the concept of risk* and *the risk management approach* provide this wider scope that includes **systematic and harmonized implementation of both structural and non-structural measures (planning instruments)**.

Due to rapidly increasing world-wide toll on human and economic losses the human settlements can no longer afford to simply respond to and recover from natural disasters, such as re-construction of levees, dykes, reclamations etc. The only way to reduce post-disaster efforts and costs is to invest in the **proactive measures** that aim to take measures before the natural event happens. So this policy shift gives an opportunity to break the cycle of event-disaster that traditionally covers pre-, during- and post-disaster activities and focus on activities to mitigate disaster risks.

The localities influenced by flood hazard are generally determined by physical features of the basins (watersheds), and previous flooding occurrences in the basins. Since these places are located within a hydro-meteorological system, flood risk management is commonly based on '**holistic and dynamic' processes**. By the help of the hydrological, geo-morphological, land-use data processing and analysis, the establishment of systematic patterns for the rainfall-runoff has been possible in order to simulate and forecast flood events for a considerable period of time and for a specific area. **More detailed and older hydrological data on a specific watershed provide more accurate results on the probabilities of flood occurrence and determination of impact areas.** Although, flooding is considered to be a random and unpredictable phenomenon, historical records on a specific basin can be analyzed statistically to predict how often floods of a specified size can be expected to occur and which parts of the basin would be affected at what intensity. The findings of these models, in turn, may give essential inputs for designing flood control measures (dams, embankments/levees, flood walls etc.) and implementing land use planning decisions (e.g. retention/detention basins, green paths, roof gardens, recreational activities, upper basin forestation, and natural reserves etc.) in the framework of **integrated basin management.**

The zones with various risk levels on these maps can be used for several purposes and to determine protection strategies to combat risks. A certain risk level can be reduced at the source of a hazard, such as increasing the water retention capacity of the catchments, frequently inundated flood-plains as parks, nature areas or ecological reserves, while prohibiting the locating of assets in these flood plains. On the other hand, less frequent and low risk areas can be used for residential purposes, however they ought to be constructed and located above the pre-determined flood level. Nevertheless, there is always **a residual risk** that we should know and prepare all the time, for instance, with the installation of a flood warning system and establishment of effective and efficient insurance program.

Nowadays the prevailing approach is **'living with floods'** rather than keeping floods away from the human life. That's why; flood risk management explores new methods to live with floods, with the help of spatial planning rather than to focus on flood protection that depends simply on engineering solutions. It is admitted that it is not possible to prevent the occurrence of flood events, but it is possible to reduce the risks through spatial planning. Many experiences in various countries and regions of the world have proved that water management that includes flood management could be strategic instrument beyond being just a regulatory task. Spatial planning no longer considers the water management as an external technical exercise. At the same time, the ways to live with floods could possibly be found when the water element is considered as complementary, multi-functional area. However, it is necessary to explore **how various countries employ methods to integrate water (flood) management with spatial planning** as will be examined in subsequent chapters of the thesis study.

Consequently, this chapter reveals the fundamentals of FRM process (figure 2.32) that is based on risk management components and disaster management phases. It is necessary to comprehend the contemporary framework and the basics of FRM to review and establish viable methods to institute a comprehensive approach in Turkish case.

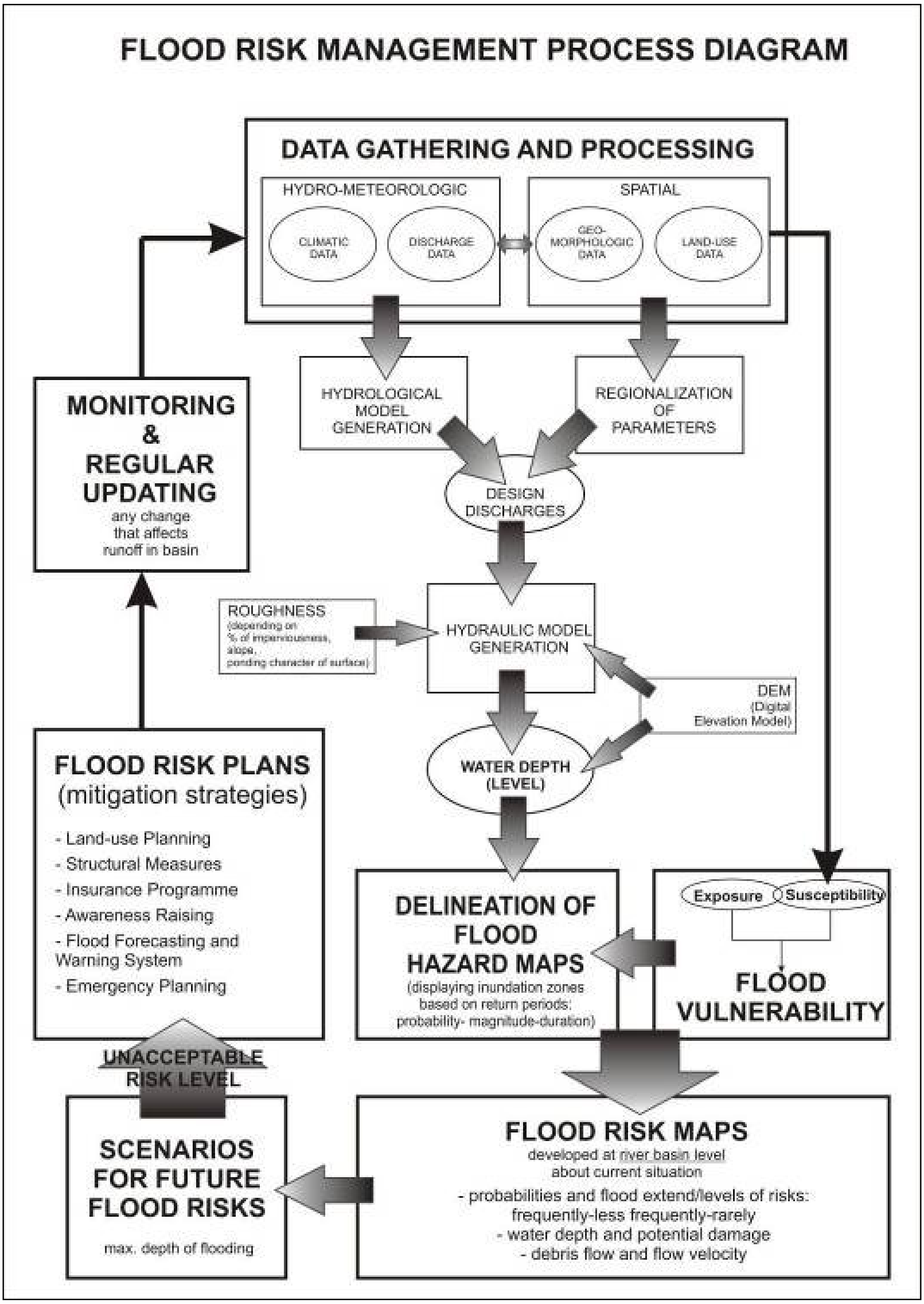

Figure 2.32: Flood Risk Management Process
(drawn by the author)

CHAPTER 3

THE CONTEXT OF VULNERABILITIES IN TURKEY

This chapter intends to review the geographical scope of the flood vulnerabilities of the Turkish context. The review is made in two steps. In the first step, the urban experience in Turkey and its relationship with the concepts of risks and hazards are examined. Locations of settlements are all subject to potential hazards as historical heritage. The experience of rapid urbanization after 1950s in Turkey ended up with uncontrolled developments in vulnerable areas such as lower valleys, water basins, flood-plains, etc. In the second step, using long-term statistics concerning flood events and losses, floods and their impacts in Turkey are explained. Throughout this discussion major flood events that caused essential losses in major river basins and provinces are described. This chapter reviews the adverse impacts of the rapid urbanization process in Turkey, and draws a general picture of flood losses in Turkey. This provides us the necessary criteria to select the case areas studied in depth.

3.1. URBANIZATION PROCESSES IN TURKEY

Rapid urbanization in Turkey is due to population increases in urban areas as a result of flows of rural population. A corollary of this rapid population increase has been a series of comprehensive transformations regarding the cultural, institutional and economic attributes of the cities (Balamir 1999). These transformations constituted the main features of urbanization process in Turkey. Chart 3.1 given below depicts the rapid increase in urban population and its shares in total, especially after 1950.

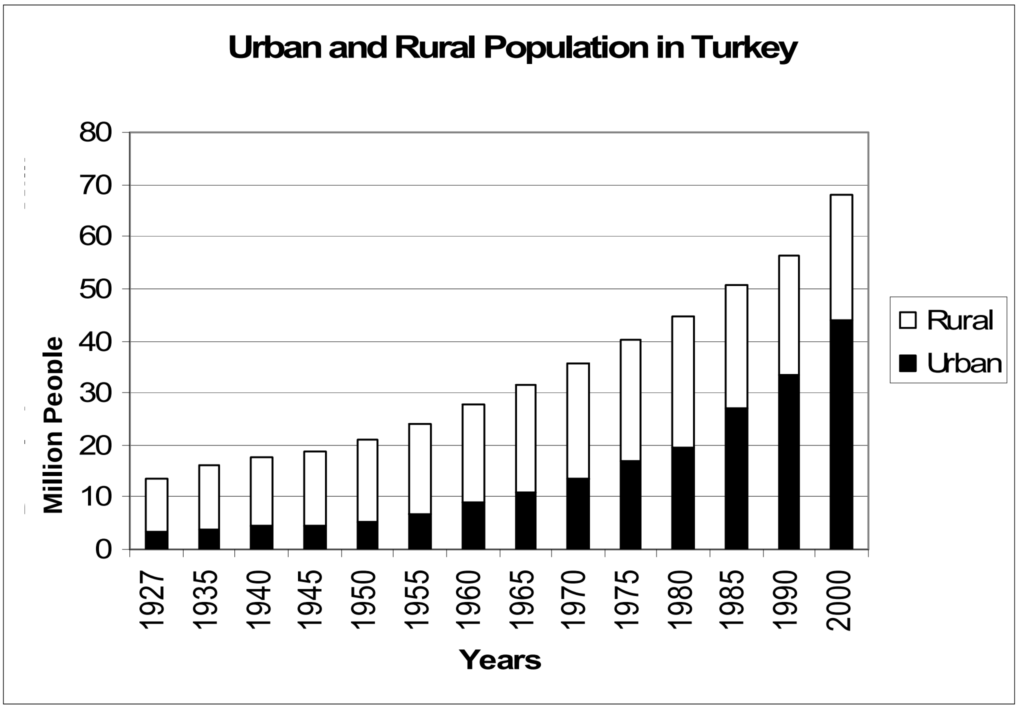

Chart 3.1: Change of Urban and Rural Population By Years (1927-2000)
(Source: TÜİK 2000)

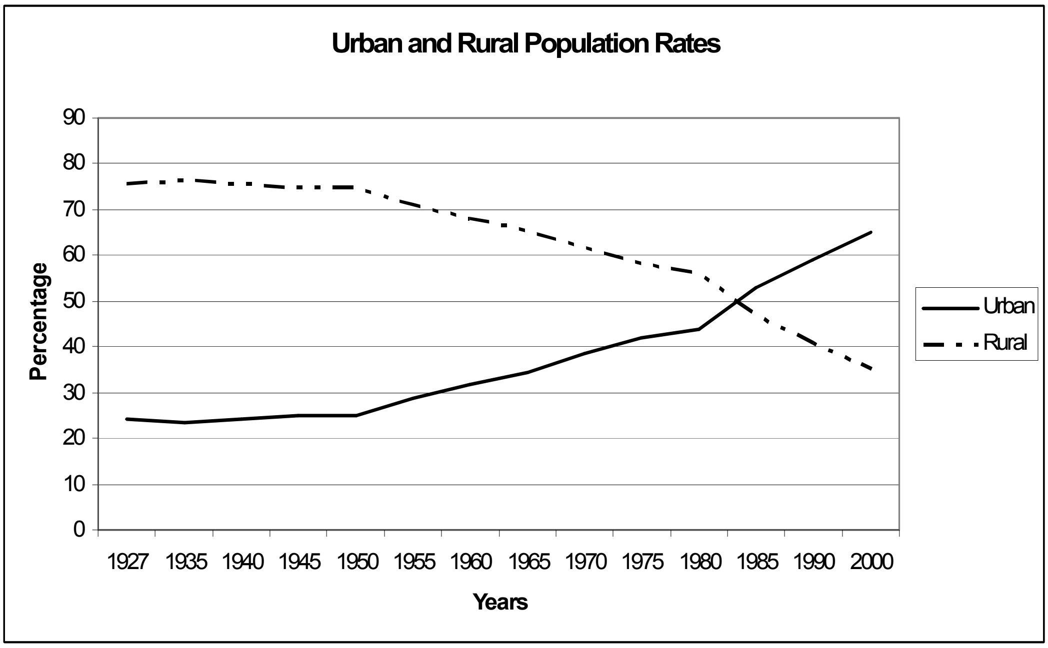

Chart 3.2: Shares of Urban and Rural Population in Total (1927-2000)
(Source: TÜİK 2000)

Rapid population increase in urban areas necessitated increases in housing and public facilities. However neither the state nor the market has effectively responded to this situation in Turkey. Sheltering, the basic need of the migrants was not met by formal and regular processes of housing production. Squatters, and unauthorized developments under such circumstances, emerged as a dominant type of low income housing in a very short period of time and they became almost one of the main features of Turkish cities. The reason behind the rapid expansion of illegal housing is as a result of the state's attitudes towards the field of urbanization especially to low income housing during 1960s and 1970s (Balaban 2008, 81). Balamir (2002, 158-159) in this discussion emphasizes the incapability of local and central authorities of guiding and providing housing developments due to scarcity of resources. On the other hand Buğra (1998, 307) stresses the absence of a formal policy on low income housing as the main reason behind the expansion of squatter housing.

Under these circumstances, cities in Turkey have undergone major transformations, performed through joint efforts of the different sections of urban citizens. Balamir (1992, 1999 and 2002) points to three different property relations that emerged in this transformation. According to him, these property relations emerged to overcome capital scarcities and have been very effective to accelerate and widen the entire urbanization process. The first and the second type of property relations he mentioned are related to construction and transformation of squatters and unauthorized settlements. Balamir (1999, 337: 2002, 159) defines the first type as "process of appropriation" which refers to the initial step of squatter development in Turkey. Appropriation is defined as the process through which mostly vacant public lands are invaded for instant occupation. The second type of property relations triggered unauthorized development of every type in Turkey and is defined as "apportionment" (Balamir 1999, 162; Balamir 2002, 338). This type is defined as an informal shared ownership which includes the subdivision and sale of mainly cadastral and agricultural lands to unauthorized builders.

Appropriation is wholly an illegal process when compared to apportionment, which includes some lawful steps. Both the acquisition of lands and the construction of squatters within the process of appropriation are illegal and irregular (Balamir 1999, 337). Nevertheless acquisition of land as a share of a large cadastral land in the process of apportionment was not an illegal step. The construction activity itself has been illegal in that process (Balamir 1999, 338). Both of these illegal types of property relations behind the development of squatters gained regular or semi-legal status in time under the tolerance of the state in Turkey. Several amnesties have transformed squatter owners as legal occupiers, providing them title deeds or certificates prior to title deeds. Besides, uncertainties in the process of apportionment were removed in 1975 after the decision of the high court, which confirms the disposal rights of shareholders on specific locations of shared lands (Balamir 2002, 164).

The third type of property relations, which dates back to mid 1950s, dominated the production of regular housing in Turkish cities. Balamir (1999, 339; 2002, 170) conceptualizes this type as “process of appurtenance”. Appurtenance as a model of cooperation between land-owners, builders and house buyers facilitated the construction and share of multi-unit residential blocks. The substantial contribution of appurtenance to the physical transformation of cities is unprecedented (Balamir 1999, 339). Similar to appropriation and apportionment, appurtenance has emerged as an informal but innovative way of housing production. However the rapid expansion of this tenure system in the whole country and the involvement of large number of households into the system ended up with a political consensus for the recognition of this system. The state adopted the Flat Ownership Law in 1966 to secure the rights acquired in this tenure system. After 1966 the freehold tenure in independent parts of buildings became a legal and formal way of house ownership (Balamir 2002, 171). We have to mention that the first and the second type of property relations necessarily evolve into the third type in time. For this reason, appurtenance should be regarded as the main factor responsible for the dense and permanent development of Turkish cities (Balamir 1999, 339-340).

In order to understand the extent of domination of appurtenance in housing production the change in number residential apartment blocks in total stock should be checked. Table given below depicts the annual numbers of construction permits (residential buildings only) granted by local councils. The share of apartment blocks in total residential buildings rose from 7.7% in 1955 to 35.4% in 1980 and finally to 43% in 2000. Almost half of all residential buildings were apartment blocks in 2000. The rapid and massive increase of apartments after 1960 is due the domination of appurtenance as a way of city building and urban life style.

Table 3.1: Numbers and Shares of Houses and Apartments in Total Residences (According to Construction Permits)

Years	Amount Of Houses	Amount Of Apartments	Amount Of Residential Buildings	Share of Houses	Share of Apartment Blocks
1955	39,380	3,275	42,655	92.3%	7.7%
1960	32,595	3,294	35,889	90.8%	9.2%
1965	35,363	6,146	41,509	85.2%	14.8%
1970	40,555	15,558	56,113	72.3%	27.7%
1975	40,702	18,432	59,134	68.8%	31.2%
1980	39,948	21,901	61,849	64.6%	35.4%
1985	34,157	27,636	61,793	55.3%	44.7%
1990	69,291	40,107	109,398	63.3%	36.7%
1995	73,525	53,772	127,297	57.8%	42.2%
2000	40,074	30,218	70,292	57.0%	43.0%

(Source: Balaban 2008, 85)

There are several reasons for the emergence and development of appurtenance as a tenure system in Turkey. Balamir (1999, 339) points to the limitations in urban land supply and rapid increase of land prices in urban areas. According to him, intensive investments creating multi-storey apartment blocks on small plots have been a way of creating large numbers of dwelling units on relatively small amounts of land. Besides, Balamir (1975, 1992, 1999, 339; 2002, 172-173) also indicates that appurtenance has been developed as a response to the lack of capital and investments in the production of urban space. He (2002, 172) states that “the process of appurtenance in Turkey generates new capital rather than consuming existing investment resources or capital transferred from another sectors of the economy”. Accordingly this process of development led to intensive investments, revalued urban land and to property production even in excess of requirements.

It is widely accepted that the favorable conditions in manufacturing sector before 1980 kept large-scale capitalists away from the activities regarding the production of urban space. Under such circumstances urban built environment was largely produced by the efforts of petty developers. Appurtenance conformed to this situation, and constituted the effective model under which petty developers working with limited amounts of capital could operate. Therefore appurtenance as a tenure system in Turkish context has been a peculiar way of overcoming the problems caused by the lack of capital resources.

Three different forms of property relations that emerged and developed in the early stages of Turkish urbanization were developed as informal solutions and evolved into legal, regular or at least semi-legal forms in time. The main dynamic behind them all was the scarcity of capital devoted to the production of urban space. Third, in all of these property relations different combinations of the efforts of urban dwellers, land owners and petty developers are observed.

With changes in the dynamics and factors affecting the urban process Turkey has entered into a new phase in urbanization after 1980. Essential changes in legal and administrative dimensions of urban planning system and of housing policy have taken place. Besides, the volume of the production of urban built environment increased rapidly. In this period, actors operating in the production of urban built environment proliferated. Not only the state but also large-scale capital started to take part in urban processes (Balaban 2008, 98). However these changes did not transform the structure of urban space created under the aforementioned property relations (Balamir 1999, 341). All of these property relations have remained in this new phase of Turkish urbanization. Moreover, appurtenance became even more widespread as appropriation and apportionment have transformed into appurtenance with squatter regularization and amnesties and rehabilitations.

There are several features of urban development that took place under the aforementioned property relations in Turkey. Among them, a specific one needs to be mentioned here. That is the vulnerability of current urban stock to various hazards. Majority of the current urban stock in Turkish cities is composed of buildings and structures constructed through either of these property relations. Their different combinations are likely as well. Illegally built structures via appropriation and apportionment mainly suffer from being located in hazardous areas and from the quality of construction. Legally built ones via appurtenance create intensive and permanent urban areas, which cannot to be renewed or altered easily. These areas are also facing the problems of being worn-out and of low construction quality. Throughout this process settlements historically located on potential hazards have become more vulnerable and risky areas. The rise in the valuation of urban properties has contributed to this adverse situation. Today what we have in Turkish cities is an intense urban environment vulnerable to natural hazards.

3.2. CURRENT CLIMATE SITUATION AND IMPACT OF CLIMATE CHANGE IN TURKEY

In this part of chapter a general review on Turkey's climate and geographical structure in order to describe flood potentials induced by precipitation factor.

Turkey is divided into seven geographical regions. Each of these regions differs with respect to factors such as natural features (topography, climate, vegetation and geomorphology), human geography (population and settlement typology) and economic activity. These regions namely are Marmara, Black Sea, Aegean, Mid-Anatolia, East Anatolia, Mediterranean and Southeast Anatolia. They are not administratively autonomous regions. Yet they display different geographical features such as precipitation patterns, climatic conditions and physical settings.

Figure 3.1: Physical Setting of Turkey
(http://www.meteor.gov.tr)

Turkey is situated in between temperate and subtropical climate zones. Although it is mainly under the impact of Mediterranean climate, it has significant differences in regional climates due to surrounding seas. Having parallel mountain ranges to the coasts, diverse landscape and geomorphologic elements prevail. Coastal areas in the country have milder climate due to littoral conditions. On the other hand, inland and eastern Anatolian plateau experience continental climate (hot summers and cold winters with limited rainfall) due to the blocking effect of the Northern Anatolian Mountains and the Taurus Mountain Ranges containing the temperate character of the seas.

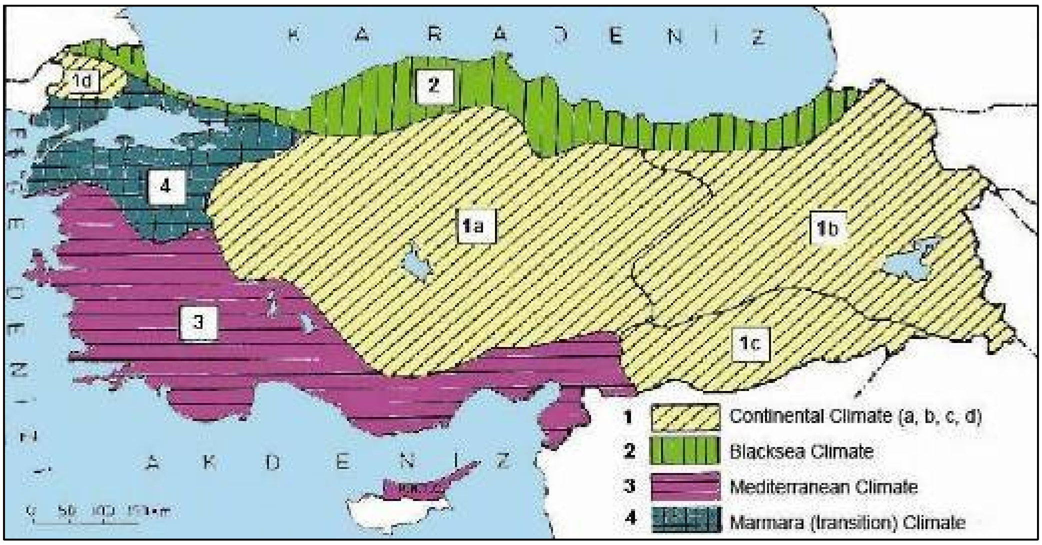

Figure 3.2: Climatic Regions of Turkey
(http://www.meteor.gov.tr)

As shown on the figure given above, Aegean and Mediterranean coasts are in the same climatic zone. They have cool, rainy winters and hot, moderately dry summers. Annual precipitation in these coastal areas varies from 580 to 1300 millimeters, depending on location. On the other hand, Black Sea coast receives the greatest amount of rainfall. As shown in Table 3.2 Black Sea region has the highest precipitation with respect to annual mean precipitations. The eastern part of Black Sea region annually receives 2200 mm and is the only region in Turkey that receives rainfall throughout the whole year. In Eastern parts of Anatolia, elevation of mountains exceeds 2500-3000 meters Northern Black Sea Mountains and Caucasian Mountain block the rain clouds, and therefore this region displays the continental climate features with long and very cold winter (http://www.meteor.gov.tr).

Table 3.2: Climatic Figures of Main Regions of Turkey

	January Mean Temp. (C^0)	July Mean Temp. (C^0)	Annual Mean Temp. (C^0)	Annual Mean Precipitation (mm.)	Annual Mean Relative Humidity (%)
Black Sea	4.2	22.1	13	842.6	71
Mediterranean	6.4	26.8	16.3	725.9	63.2
Marmara	4.9	23.7	14	595.2	73
Continental(1a)	-0.7	22	10.8	413.8	63.7
Continental(1b)	-4.2	24.2	10.2	579.4	60.2
Continental(1c)	3.7	29.8	16.4	565.7	53.6
Continental(1d)	2.8	23.9	13.2	559.7	69.6

(Source: http://www.meteor.gov.tr)

As shown in Table 3.2, Black Sea Region has the maximum annual mean precipitation than other regions, which makes this region more fragile than the other regions due to heavy rainfalls. On the other hand, the areas existing in Continental (1a) climate are less fragile than the others because of the relatively dry character of the region. However, such interpretations require additional data on the local variables that contribute to flood losses.

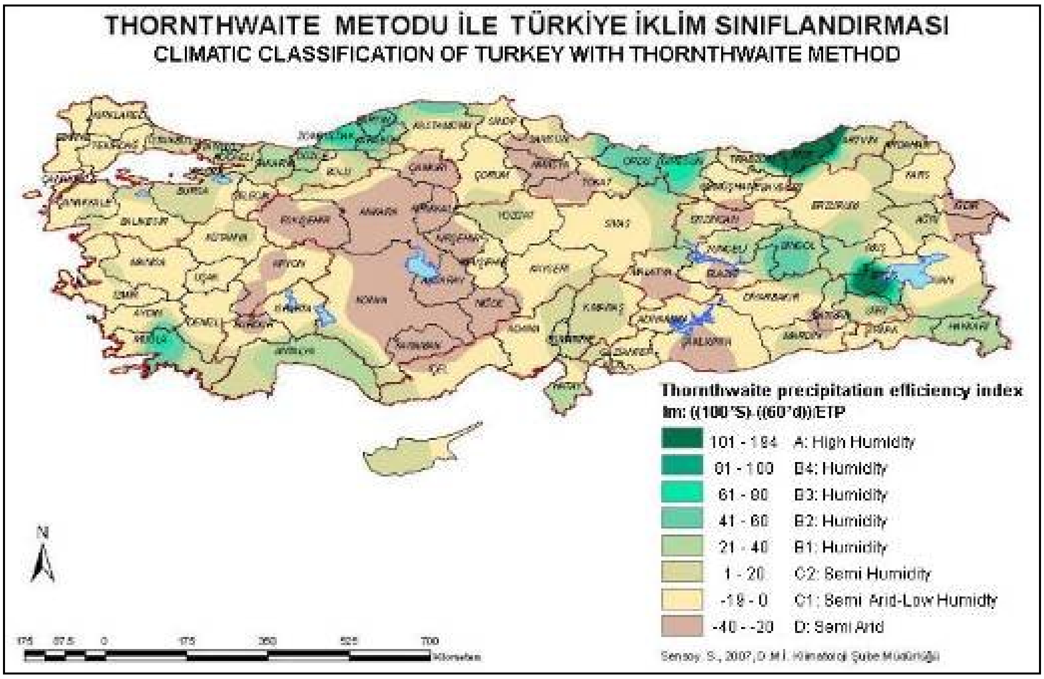

Figure 3.3: Climatic Classification of Turkey with Thornthwaite Method
(http://www.meteor.gov.tr)

Turkey’s semi-arid climatic feature differs among geographical regions. Although annual average precipitation amount in nationwide is 643 mm, it decreases to 250 mm in Southeastern Anatolia region, and reaches to 3000 mm in East Black Sea region (Source: DSİ). Figure 3.4 indicates the mean annual rainfall distribution in different regions in Turkey.

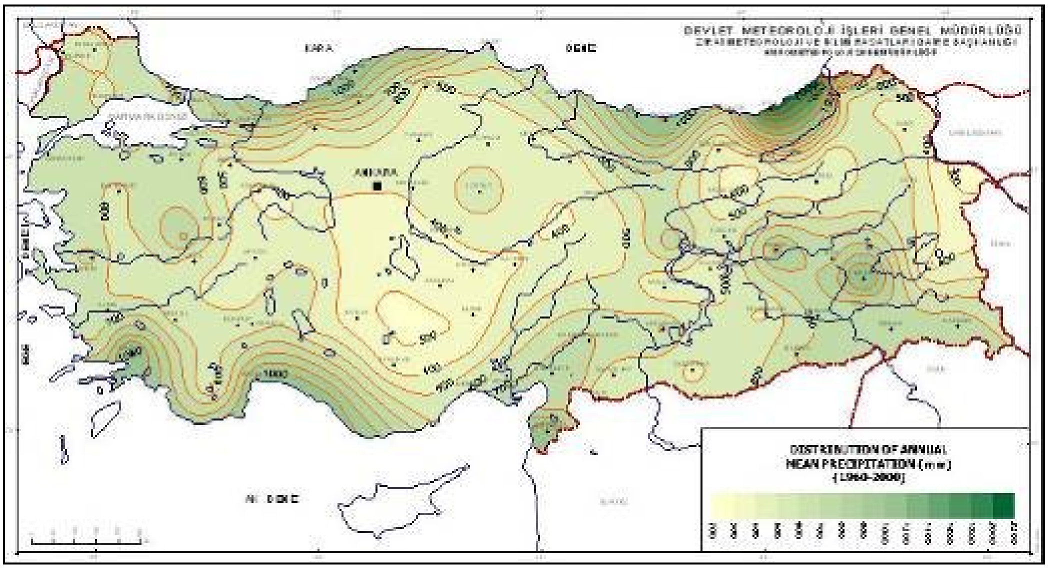

Figure 3.4: Geographical Distribution of Mean Annual Precipitation (mm) (1960-2000) *(Source: GD. of State Meteorology)*

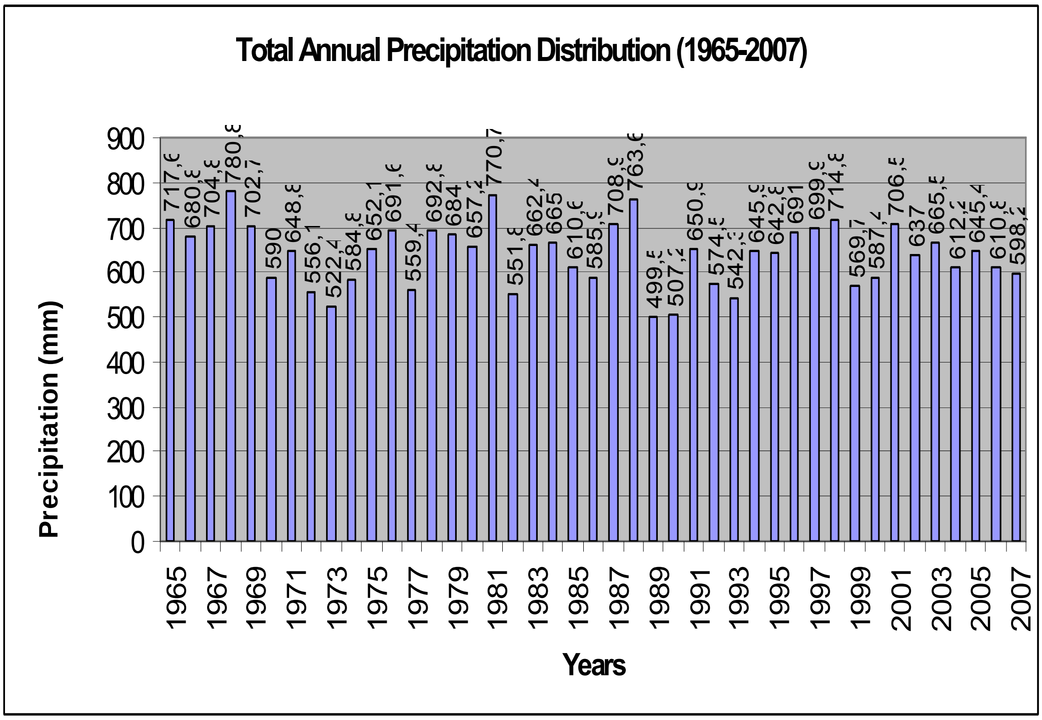

Chart 3.3: Total Annual Precipitation Distribution of Turkey (1965-2007)
(Source: GD. of State Meteorology)

Due to the global warming and climate change the identification of how much change has occurred in hydrologic extremes has been an evolving subject in the world literature that requires various research methods and techniques.

For example, for Turkey Demir and others (2008) have finalized a simulation project that runs the model using 2071-2100 A2 scenarios. Since it is the first attempt to implement these future scenarios and obtain projections about Turkey and surrounding countries, the following estimations are only based on that project of Demir and others.

Since 2001 total annual precipitation has been decreasing as indicated in Chart 3.3. According to global warming scenarios (Demir and others 2008) it is estimated that total annual precipitation will decrease in next 70 years. The simulations based on 2071-2100 A2 scenarios estimate that mean temperatures will increase 5-6 °C in Turkey except coastal regions. Nationwide mean temperature is expected to increase 2-3 °C.

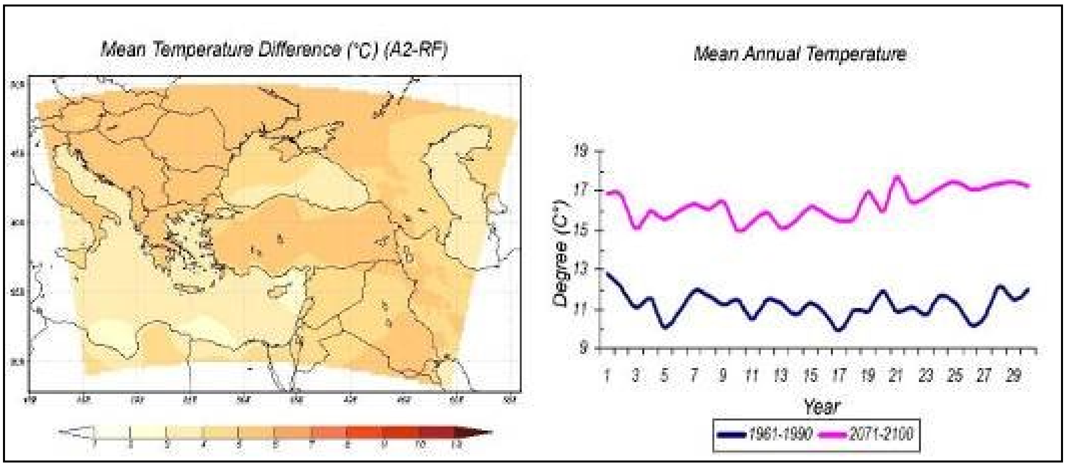

Figure 3.5: Mean Annual Temperature and Difference (°C)
(Demir and others 2008, 368)

Although change in precipitation regime in general shows itself as a decrease according to scenarios, regional extremes may probably be in increase. For example, along Aegean and Mediterranean coasts precipitation will probably decrease while it will increase along Black Sea coasts. However the amount of precipitation decrease will be more in eastern parts compared to west (maximum 40% decrease in western regions).

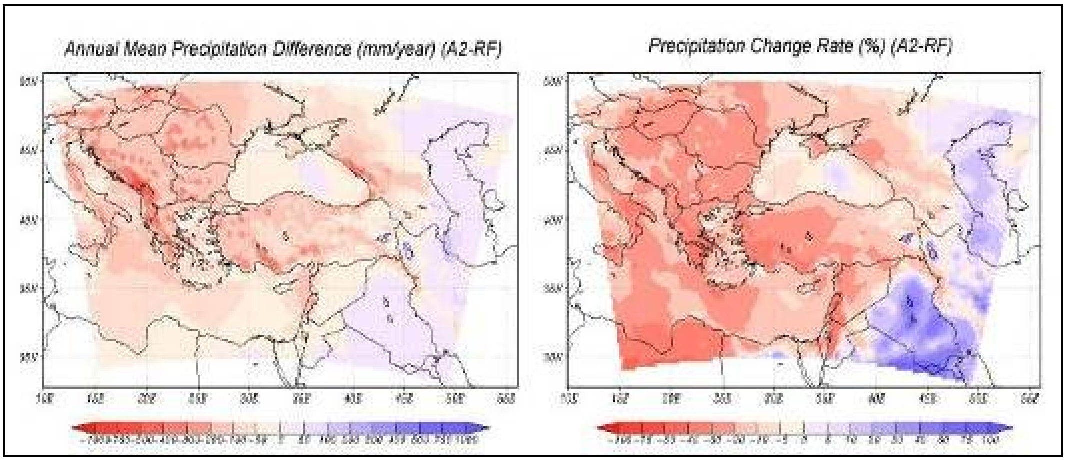

Figure 3.6: Changes in Precipitation Regime
(Demir and others 2008, 371)

In winter season precipitation is expected to decrease in southern and western regions whereas in summer seasons it is projected to be increasing. Particularly during autumn season precipitation will increase especially in eastern parts of Turkey (Demir and others 2008, 371).

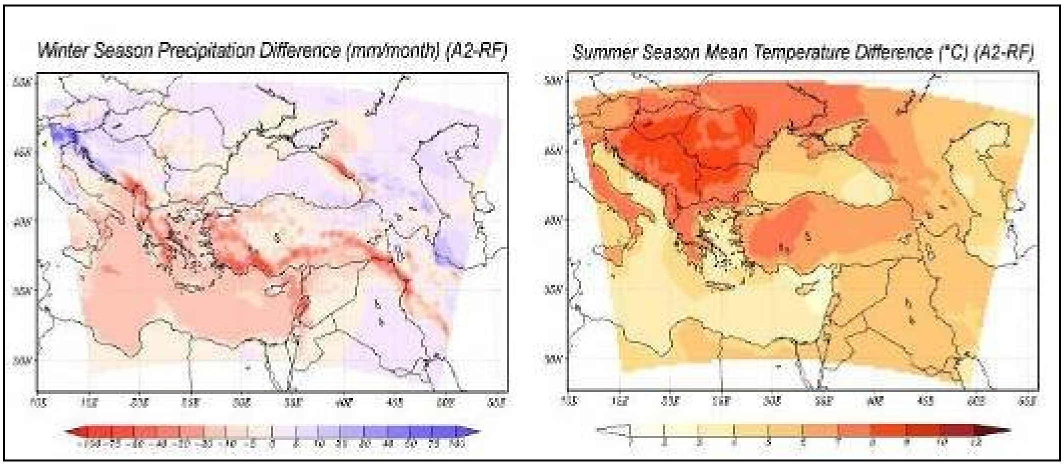

Figure 3.7: Summer and Winter Season Precipitation Difference
(Demir and others 2008, 369)

The change in the general climate conditions will manifest itself as changes in the occurrence and the scale of floods. However, there is a lack of study to show how much the increase in climatic conditions affects the flood frequencies and scales. As shown in the chart 3.4, monthly frequency of flood events has been changed during the last 30-35 years. For instance, floods frequently occurred in December and January during the period between 1955 and 1971 (DSİ Yearbooks). However, floods have been frequent in summer season (June and July) between 1972 and 1988. Finally the period in between May and June emerged to be the most frequent in terms of flood occurrence between 1989 and 2005. This shift in flood occurrences by months could be explained by climate change and its impacts on precipitation regimes. However, it is not possible to show the direct relation between impacts of climate change and flood frequencies.

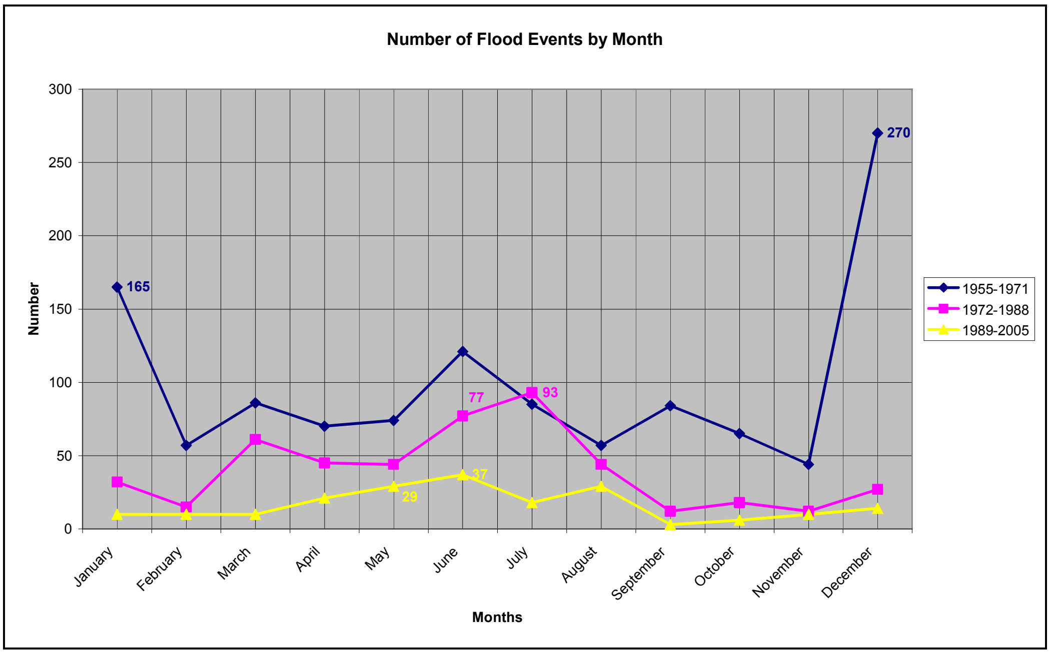

Chart 3.4: Number of Flood Events by Month (51 years)
(Source: DSİ Yearbooks)

3.3. FLOOD EVENTS AND LOSSES IN TURKEY

In this section we will investigate the chronological records on flood events and losses in Turkey obtained from international and national data-bases and related institutions such as 'UN Development Program on Disaster Risks', The International Emergency Disasters Database (EM-DAT), and General Directorates Disaster Affairs (AİGM), State Hydraulic Works (DSİ), Turkish State Meteorological Service (DMİ).

With statistical review flood profile of Turkey regarding events will be clarified in a historical context. Second, the statistical review will provide the information necessary to select the case study areas. Therefore the review will first focus on the analysis of the nationwide statistical data along with the impacts of global climate change in order to reveal the existing situation in Turkey regarding floods. One step further the consequences of flood events occurred in different geographical regions and river basins in Turkey will be explored. In this step the frequencies and losses of past flood events by provinces and major river basins will be displayed at distinct geographical and climate feature. This will enable the selection of a sample of case study areas representing different conditions in Turkey.

3.3.1 Disaster Losses in General

The 'UN Development Program' has observed that earthquakes are the most and floods are the second effective natural events in generating damages in Turkish settlements. Chart 3.5 indicates the annual averages of disaster events such as droughts, earthquakes, floods and tropical cyclones between 1980 and 2000. Although flood hazards may not have as much impacts as earthquakes on people's life and property they cause considerable losses. As shown on Table 3.3 annual number of people physically exposed to a flood hazard is considerably high.

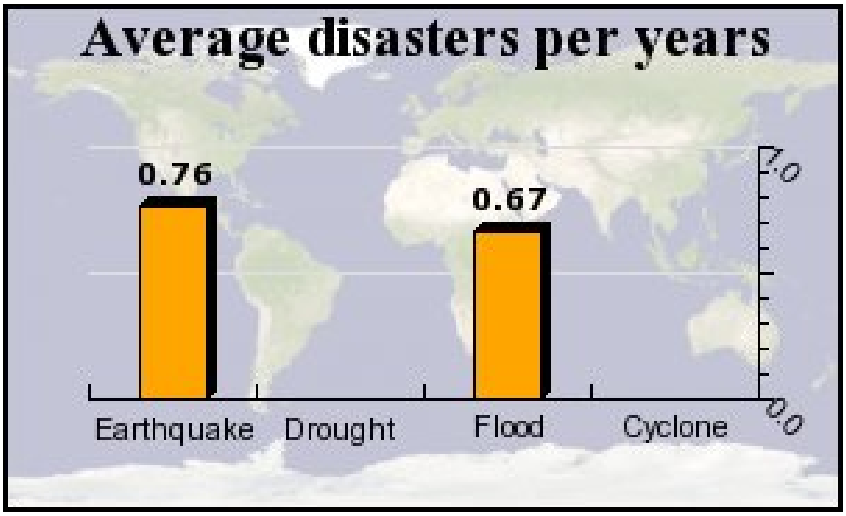

Chart 3.5: Average Disasters per year in Turkey (1980-2000)
(Source: http://gridca.grid.unep.ch/undp)

Table 3.3: Descriptive Figures per Disaster Type (1980-2000)[10]

	Disasters per year [nb/year]	Casualties [killed/year]	Physical exposure [nb/year]	Relative vulnerability [killed/mio. exp.]
Droughts	-	-	-	-
Earthquakes	0.76	949.9	2'745'757	345.9
Floods	0.67	20.9	1'883'782	11.1
Tropical Cyclones	-	-	-	-

(Source: http://gridca.grid.unep.ch/undp)

Figures provided by the General Directorate of Disaster Affairs (AİGM) indicate that 14% of all disaster events occurred between 1955 and 2008 are floods (Gökçe and others 2008, 11). As shown on Chart 3.6 among all disaster types floods are the third frequent type after landslides and earthquakes in Turkey.

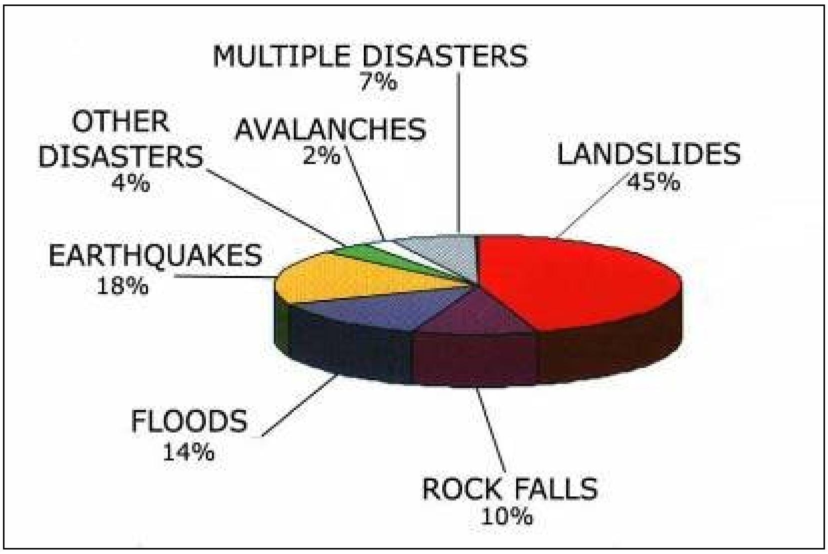

Chart 3.6: Distribution of Disaster Events in Turkey by Types (1955-2008)
(Source: Gökçe and others, 2008: 11)

[10] Relative vulnerability: This proxy of vulnerability is obtained by dividing the average number of killed by the physical exposure, then multiplying the result by 1 000 000 (http://gridca.grid.unep.ch/undp).

Another information regarding natural disasters is the International Emergency Events Database (EM-DAT 2009). For a disaster to be recorded into this database, at least one of the criteria[11] defined has to be fulfilled. This database indicates that floods are the second frequent type (24%) among all disaster types in Turkey. It reports that **1274** persons were killed, **180** persons were injured and **1'743'386** persons were affected from flood disasters since 1900 (Table 3.4). In the last decade **439** persons were killed and **1'677'936** persons were affected from several flood events.

Table 3.4: Distribution of Disasters Recorded in Turkey (1900-2008)

Disaster Type	Number Of Events	% By Disaster Type	Number of Killed	Totally Affected Population	Injured Population	Est. Damage (US$ Million)
Earthquake (seismic activity)	71	49,31	88.538	6.874.596	92.866	22.941.400
Epidemic	8	5,56	613	204.855	0	0
Extreme temperature	7	4,86	100	8.450	450	1.000
Flood	**35**	**24,31**	**1.274**	**1.743.386**	**180**	**1.645.500**
Mass movement dry	1	0,69	261	1.069	69	0
Mass movement wet	8	5,56	404	13.275	185	26.000
Storm	9	6,25	100	13.639	139	2.200
Wildfire	5	3,47	15	1.150	0	0
TOTAL	144	100,00	91.305	8.860.420	93.889	24.616.100

(Source: EM-DAT 2009)

Urban river floods as the main concern of this thesis seem to be the most widespread hydro-meteorological hazards in Turkey. Except a single province, **80 provinces** and **22'157** disaster victims and survivors have been affected from separate flood events in Turkey (Figure 3.8). According to the General

[11] Basic criteria for recording data-base: 10 or more people reported killed; 100 people reported affected; a call for international assistance; declaration of a state of emergency.

Directorate of Disaster Affairs (GDDA) records[12] total number of flood events have been **4067** since 1955 (Gökçe and others 2008, 37).

According to the figures of SHW, which records only major floods**, 1232 persons** lost their lives in **1930** separate **events** and approximately **23 million hectares of land surface** were inundated by flood-waters during the past five decades (1955-2008). Within that period annually **36 flood events** have occurred, **23 persons** were killed by floods and **430'000 hectares** were inundated. According to yearbooks published by DSİ (1998), financial losses of floods occurred between the years 1970-1997 are calculated as 15'021'716 x 10^5 TL/year as values of 1998. Material losses; such as animal perish, are calculated as 219'196 units in total (1970-1997). The financial losses of flood events occurred during the period of 1989 and 2007 are estimated approximately 2 billion dollars by State Hydraulic Works.

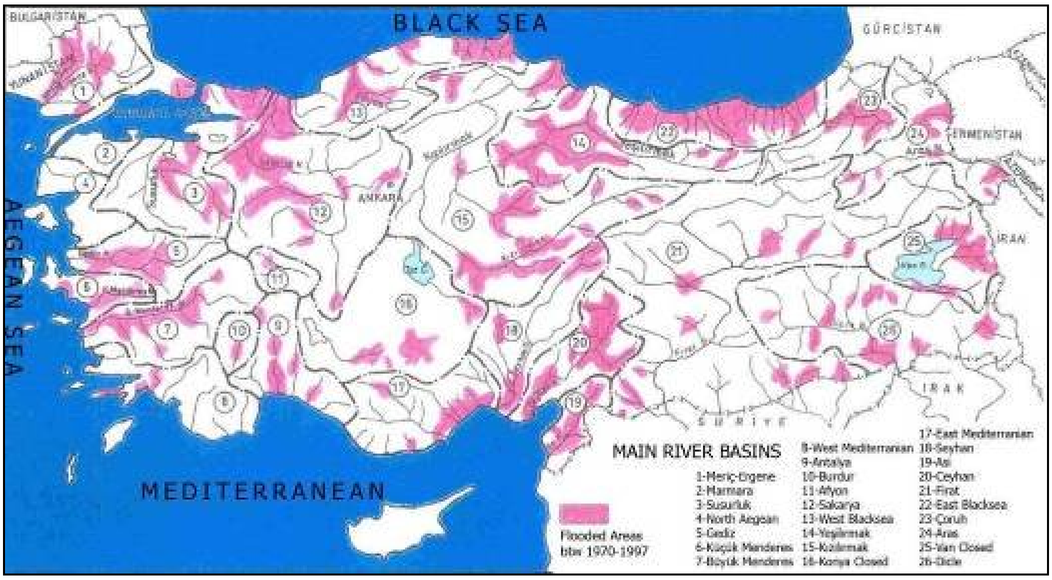

Figure 3.8: Major Rivers, Basins and Flooded Areas of Turkey (1970-1997)
(Source: DSİ)

[12] Numbers of victims and survivors are calculated from the houses that are decided to move to another location by AİGM. Number of events is calculated from the number of survey reports of AİGM.

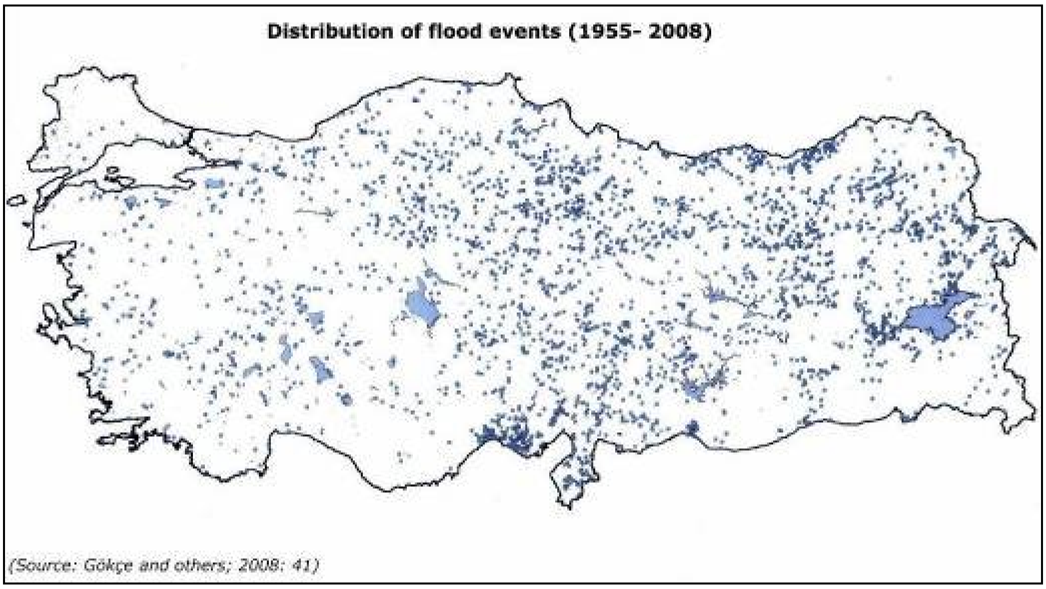

Figure 3.9: Distribution of Floods
(Source: Gökçe and others, 2008: 41)

As clearly observed in figures of the different databases, flood events occur widely in Turkey. Figure 3.9 given above displays all flooded locations recorded by GDDA since 1955. According to the map coastal zones such as East Black Sea and East Mediterranean seem to be the regions extremely vulnerable to floods.

The high frequency of flood events between 1955 and 1980 is substantial (Table 3.5 and Chart 3.7). The annual average number of floods occurred within that period was 65. However the frequency seems to have decreased after 1980. The reason for such a decrease is the improvement in the technical infrastructure regarding floods. To be more specific, the increase in construction of flood protection dams (total 67 units) should be considered. Chart 3.8 indicates the figures in dam construction. Eroğlu (2006, 13) states that in addition to dams, 4’116 units of facilities have been constructed to protect 787’858 hectares of land from floods since 1955. In spite of the technical improvements and the decrease in frequency of floods, the number of flood victims continued to increase (peak at 1995) in urban areas. The impact area of these floods has been substantially large such as the one in 1995. Flooded areas reached approximately to 2 million hectares (Chart 3.9).

Table 3.5: Major Flood Events and Losses by 5-Year Periods

Periods	Years	Number of Flood Events	Casualties (killed/ period)	Flooded Area (ha.)
1	1955-1959	164	312	3'978'983
2	1960-1964	533	108	4'631'296
3	1965-1969	473	72	5'818'533
4	1970-1974	215	140	373'786
5	1975-1979	160	85	1'173'820
6	1980-1984	96	41	1'734'661
7	1985-1989	56	22	169'685
8	1990-1994	74	85	256'500
9	1995-1999	28	225	2'204'900
10	2000-2004	52	54	1'418'230
11	2005-2008	98	91	1'255'200
TOTAL	**1955-2008**	**1930**	**1232**	**22'758'094**

(Source: DSİ, 2008)

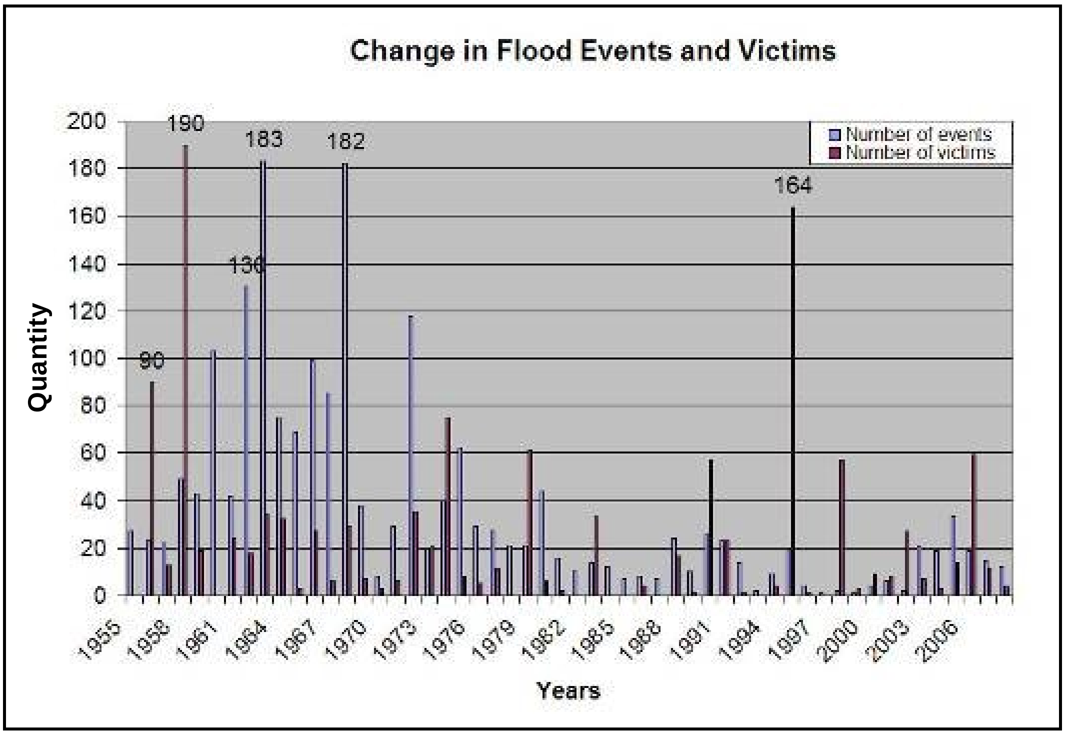

Chart 3.7: Change in Numbers of Flood Events and Victims (1955-2008)
(Source: DSİ)

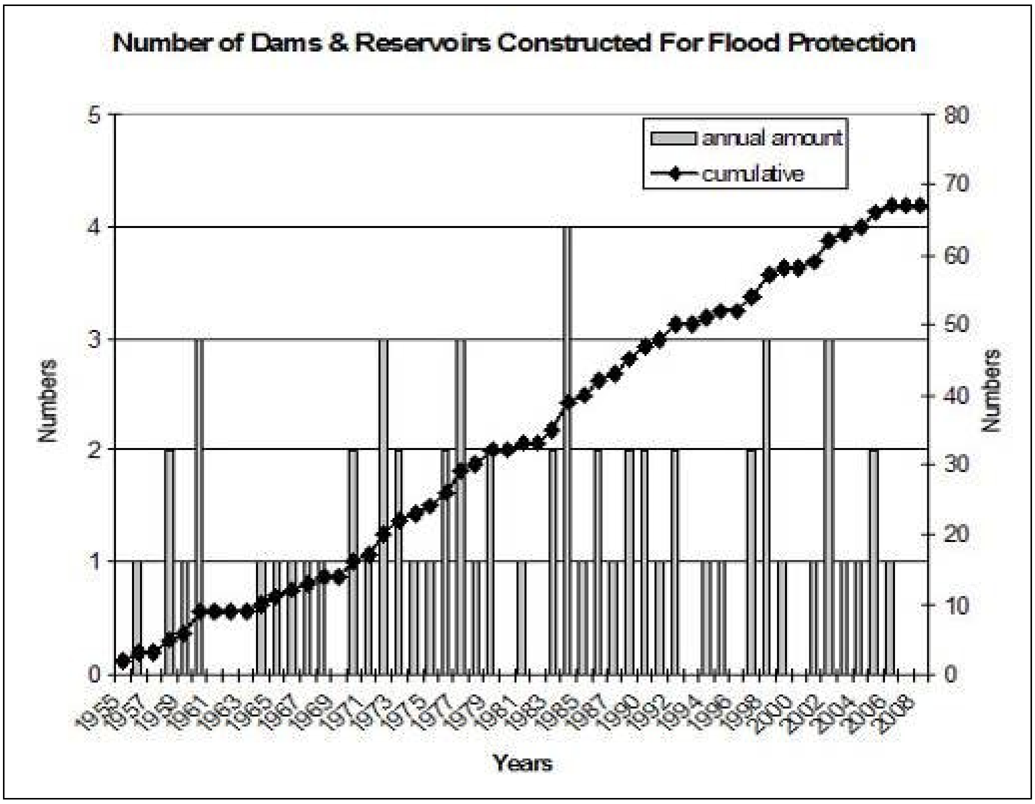

Chart 3.8: Number of Dams & Reservoirs Constructed For Flood Protection
(Source: DSİ)

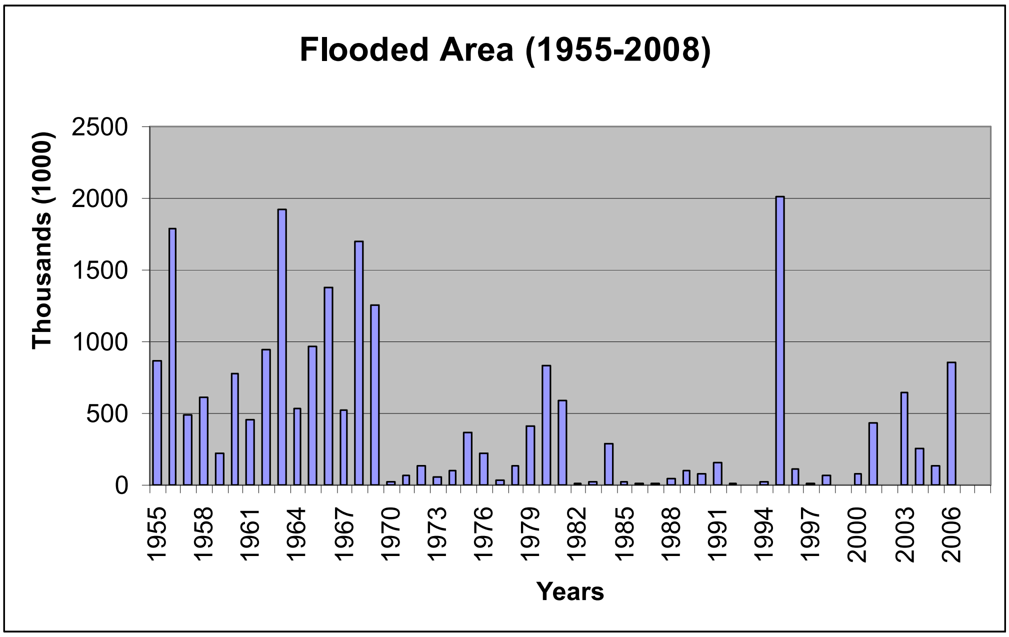

Chart 3.9: Total Flooded Area (ha.) in Major Floods
(Source: DSİ)

3.3.2 Flood Events and Losses by Major River Basins

In Turkey there are 26 major river basins. Figure 3.8 indicates the areas suffered from flood events by river basins during the period of 1970-1997. As clearly seen on the figure the whole country is under the threat of river flooding. However the most flood prone areas are in Black Sea, Mediterranean and West Anatolian regions due to the interaction between geomorphologic and climatic features explained in Chapter 3.2.

In the period of 1970-2005 the most frequent flood events occurred in Sakarya Basin (12^{th} Region), East Black Sea Basin (22^{nd} Region) and Kızılırmak Basin (15^{th} Region) as Table 3.6 and Chart 3.10 indicates. The highest number of persons killed by flood events is observed in East Black Sea Basin (22^{nd} Region) between 1970 and 2005. The largest area affected by recent floods is observed in the West Black Sea Basin (13^{th} Region) due to the floods of May 1998.

Table 3.6: Damage Statistics about Major River Basins (1970-2005)

No	Basins	# of Flood Events	# of Killed	Flooded Area (ha)
1	Meriç-Ergene	15	4	62’838
2	Marmara	41	4	9’263
3	Susurluk	71	0	32’910
4	North Aegean	51	3	35’421
5	Gediz	13	0	12’450
6	K. Menderes	17	76	50’649
7	B. Menderes	21	18	5’896
8	West Mediterranean	9	5	410
9	Antalya	19	95	2
10	Burdur Lakes	11	2	953
11	Akarçay	12	0	31’963
12	Sakarya	**114**	19	8’644
13	West Blacksea	29	14	**15’158’795**
14	Yeşilırmak	58	60	22’905
15	Kızılırmak	75	23	6’334
16	Konya Closed	31	6	25’830
17	East Mediterranean	16	19	2’005’512
18	Seyhan	19	5	42’973
19	Asi	24	12	28’739
20	Ceyhan	44	5	79’892
21	Fırat	70	34	13’123
22	East Blacksea	91	**132**	9’901
23	Çoruh	7	3	467
24	Aras	19	4	7’118
25	Van Closed	15	0	434
26	Dicle	44	61	10’974
	TOTAL	**936**	**604**	**17’664’396**

(Source: Aksu and others 2006, 52)

According to the figures provided by GDDA (Gökçe and others 2008, 42) the highest number of victims and survivors[13] are observed in Fırat (777 persons), Kızılırmak (666 persons), Yeşilırmak (460 persons) and Dicle River Basins since 1955 (Figure 3.10). The largest area affected by the flood event in the period of 1970-1997 is Ceyhan Basin (20th Region); approximately 160’309 hectares land was affected (Chart 3.11). However, the largest area affected by recent floods between 1997 and 2005 is observed in the West Black Sea Basin (Table 3.6).

[13] Numbers of victims and survivors are calculated from the dwellings that removed to another location by AİGM.

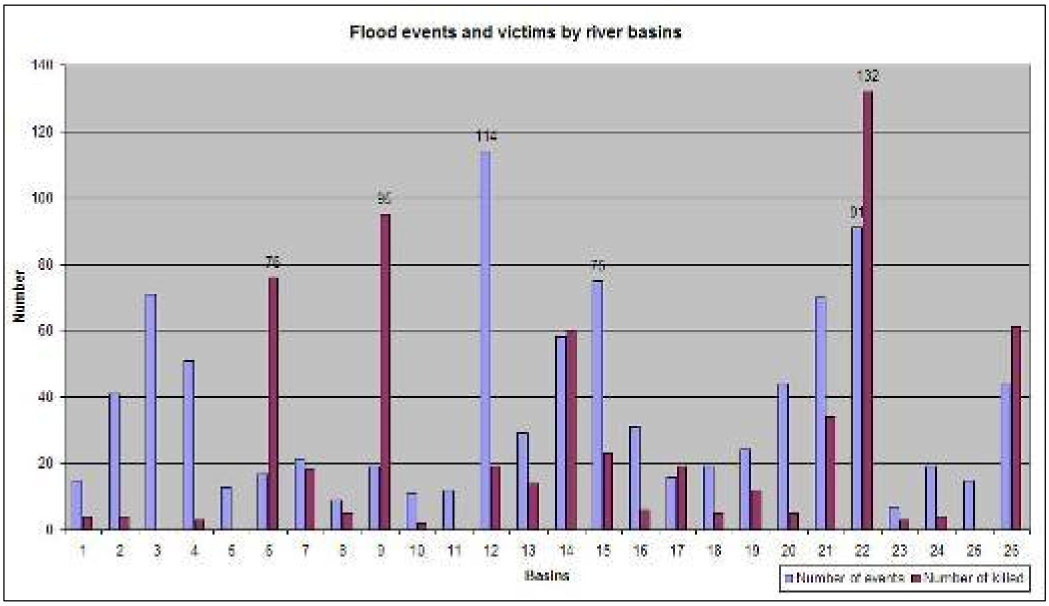

Chart 3.10: Flood Events and Victims by Major Basins (1970-2005)
(Source: Aksu and others; 2006: 52)

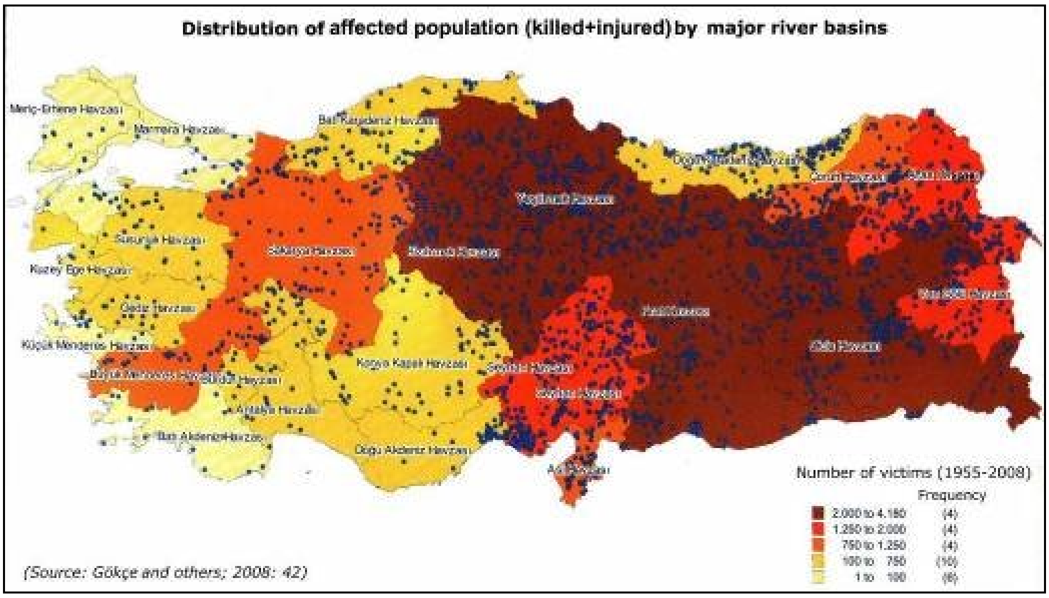

Figure 3.10: Distribution of Affected Population by Major River Basins
(Source: Gökçe and others 2008, 42)

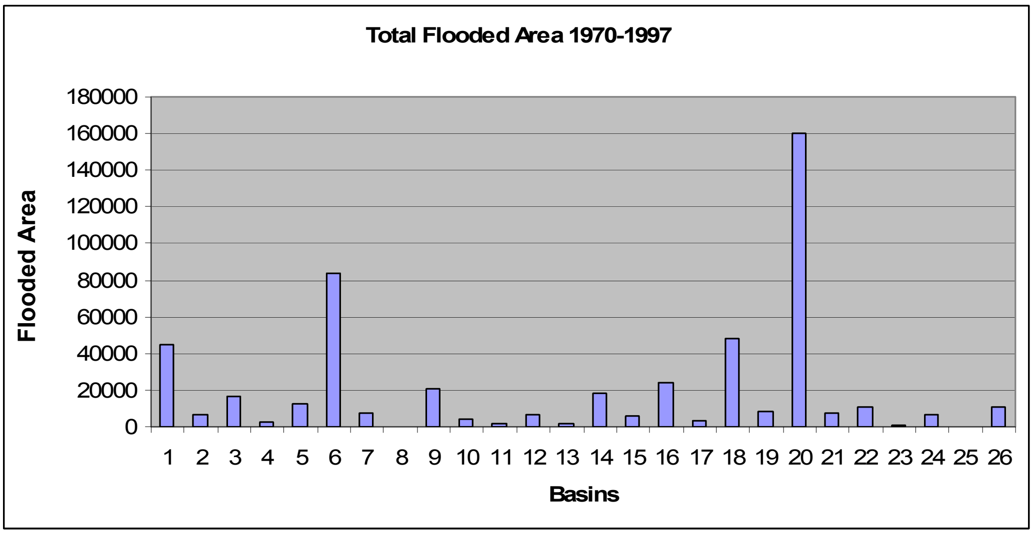

Chart 3.11: Total Flooded Area (ha.) by Basins (1970 and 1997)
(Source: DSİ, Flood Records Vol. 8)

In Turkey, the aerographic effect of mountain ranges, parallel to the Black Sea and Mediterranean coasts leads to greater magnitude of rainfalls due to the northwest and south depressions. Moreover, in flood prone spring periods ice melting from higher altitudes, excessive and convective rainfalls in inner areas cause greater numbers of floods.

Turkey's geographical regions have different geomorphologic structure. These features are also effective on microclimates, precipitation magnitudes and successive flood events. The Black Sea Region among other regions exhibits unique geomorphologic and microclimatic structure. Many of the flood events observed in that area have same characteristic impacts such as steep slopes and impermeable soil type. Particularly Eastern Black Sea Basin has the highest mean precipitation comparing other basins (Table 3.7). Due to such circumstances most of the rainfall contributes higher runoffs causing flash floods and higher flood losses in such regions.

Table 3.7: Climatic and Water Potentials of Basins

			Annual Mean Temperature						Annual Mean Precipitation		Turkey River Water Potential				
Basin No	Basin Name	Catchment Area (km^2)	0 m.	200 m.	500 m.	1000 m.	1500 m.	2500 m.	# of Stations	mm.	Annual Mean Discharge $10^9 m^3$	Annual Mean Flow mm	Annual Mean Flow Rate m^3/s	Annual Mean Productivity $lt/s/km^2$	Share in Water Potential
1	Meriç-Ergene	14560	14,4	13,2	11,6	-	-	-	48	604	1,22	83,8	38,5	2,6	0,7
2	Marmara	24100	14,4	13,2	11,6	-	-	-	78	728,7	8,05	334	255,2	10,5	4,3
3	Susurluk	23765	14,4	13,2	12,8	-	-	-	51	711,6	5,08	213,8	161	6,8	2,7
4	North Aegean	9032	17,8	16,6	14,4	-	-	-	39	624,2	2,09	231,8	161	7,3	1,1
5	Gediz	17118	17,8	16,6	14,4	11	-	-	45	603	1,84	107,5	58,6	3,4	1
6	Küçük Menderes	7165	17,8	16,6	14,4	-	-	-	25	727,4	1,13	157,7	35,8	5	0,6
7	Büyük Menderes	24903	18,5	17,2	15,2	12	8,7	-	68	664,3	3,06	122,9	97,1	3,9	1,6
8	West Mediterranean	22615	19,1	17,9	16,1	13	10	-	54	875,8	10,15	448,8	321,1	14,2	5,4
9	Mid-Mediterranean	14518	19,1	17,9	16,1	13	10	-	44	1000,4	10,57	728,1	335,1	23,1	5,7
10	Burdur Lakes	8764	-	-	15,3	12	8,8	-	19	446,3	0,45	51,3	14,3	1,6	0,2
11	Akarçay	8377	-	-	14,7	11	7,3	-	21	455,8	0,44	52,5	14	1,7	0,2
12	**Sakarya**	56504	14,5	13,9	13,2	11	7,3	-	117	524,7	5,95	105,3	188,7	3,3	3,2
13	**West Blacksea**	29682	14,6	14	12,1	9,8	7,2	-	57	811	10,83	337,9	317,9	10,7	5,4
14	Yeşilırmak	36129	14,6	14	12,1	9,8	7,2	-	72	496,5	5,76	159,4	182,8	5,1	3,1
15	Kızılırmak	78646	14,6	14	13,1	11,1	7,2	-	138	446,1	6,23	79,2	197,4	2,5	3,3
16	Konya Closed	56554	-	-	-	11,1	7,2	-	95	416,8	4,89	86,5	154,2	2,7	2,6
17	West Mediterranean	22484	19,1	17,9	16,1	13	10	-	30	745	10,09	448,8	345,7	15,4	5,4
18	Seyhan	20731	19,1	17,9	16,1	13	8,7	1,9	29	624	7,24	349,2	229,5	11,1	3,9
19	Asi	10885	19,1	17,9	16,1	13	10	-	22	815,6	1,66	152,5	37	3,4	0,9
20	Ceyhan	21222	19,1	17,9	16,1	13	8,7	1,9	36	731,6	7,07	333,1	224	10,6	3,8
21	Fırat	120917	-	-	17,7	13,8	7,2	1,7	216	540,1	31,61	261,4	992,3	8,2	16,9
22	**East Blacksea**	24022	14,6	14	12,1	9,8	7,2	1,7	64	1198,2	16,44	684,3	521,3	21,7	8,8
23	Çoruh	19894	-	-	14,1	10,8	7,4	0,1	31	629,4	6,57	330,3	208,3	10,5	3,5
24	Aras	27548	-	-	17,9	13,3	8,4	-1,2	47	432,4	4,72	171,3	149,8	5,4	2,5
25	Van Closed	15254	-	-	17,9	13,2	8,4	-1,2	18	474,3	2,62	171,8	82,9	5,4	1,4
26	Dicle	51489	-	-	17,9	13,8	7,2	1,7	72	807,2	22,1	428,3	700,8	13,6	11,8
	TOTAL	766878							1536	17134	187,86	6631,5	6024,3	209,7	100
	AVERAGE									659,02		255,06	231,70	8,07	

NOTES: a- Lake areas are excluded from catchment areas, b- Areas outside the Turkey's borders are excluded, c- River water for irrigation purposes is excluded and discharges are not base discharges, d- Stations which have minimum 5 observations are included for annual ave. precipitations.

(Source: Aksu and others 2006, 54)

Many of the river systems in this region have same geomorphologic characteristic as shown in Figure 3.11. Rivers beginning from the higher slopes on southern skirts of Mountain Ranges end with Black Sea coastal area. Villages are generally located on very close to river edges. Drainage basins of the rivers have very steep slopes. Flood events, like this case are mostly generated due to soil type, steep slope of basin, irregular and unstable riverbeds and the upper basin problem that can not store rainfall water by soil due to change in land-use; such as converting forest area into agricultural land. Excessive rainfalls within the short period of time in that kind of topography cause landslides and debris from upper basins to lower parts. Deforestation or shifts to agricultural activity on that kind of soil and slopes intensify the runoff and the devastating effect of rainfall (FR-Volume Six 1998, 120-128).

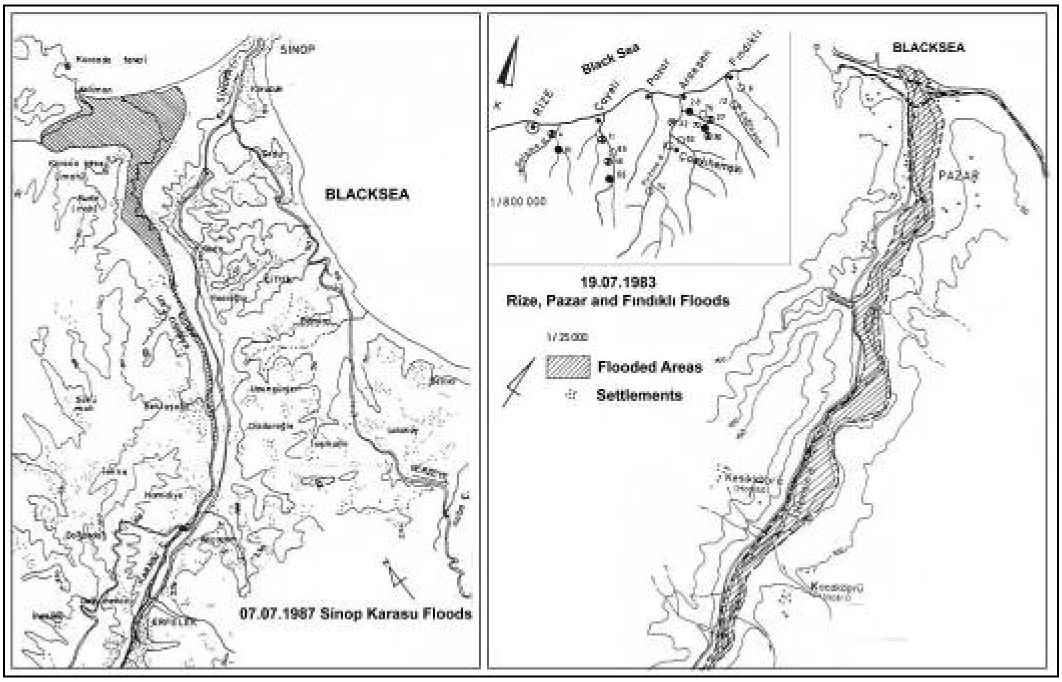

Figure 3.11: Rize and Sinop Floods and Impact Area
(FR-Volume Five and Six 1998)

3.3.3 Flood Events and Losses by Provinces

As shown in Figure 3.12, 80 provinces in Turkey have been exposed to flood events since 1955. Kırklareli is the only exception. Erzurum, Sivas and Kahramanmaraş are the most effected provinces according to GDDA.

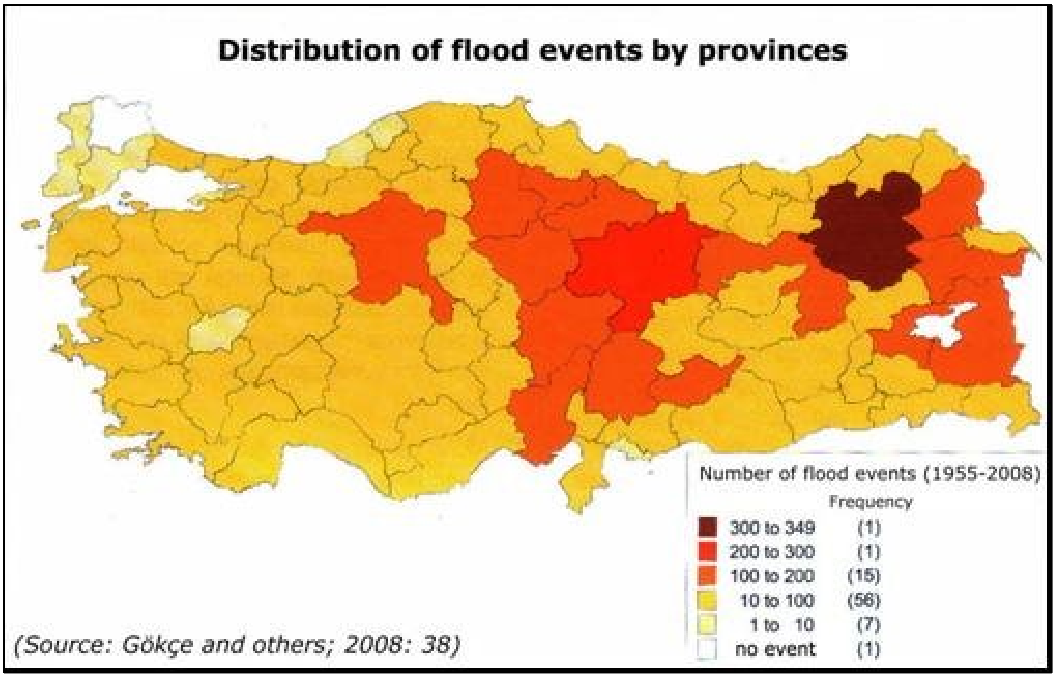

Figure 3.12: Distribution of Flood Events by Provinces (1955-2008)

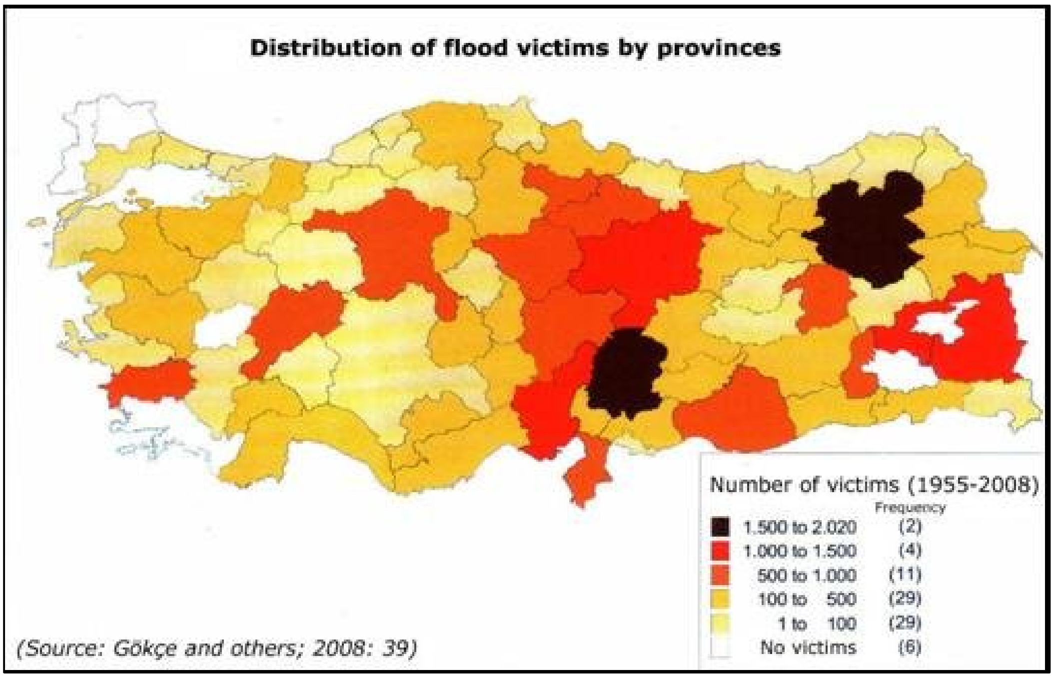

Figure 3.13: Distribution of Flood Victims and Survivors by Provinces

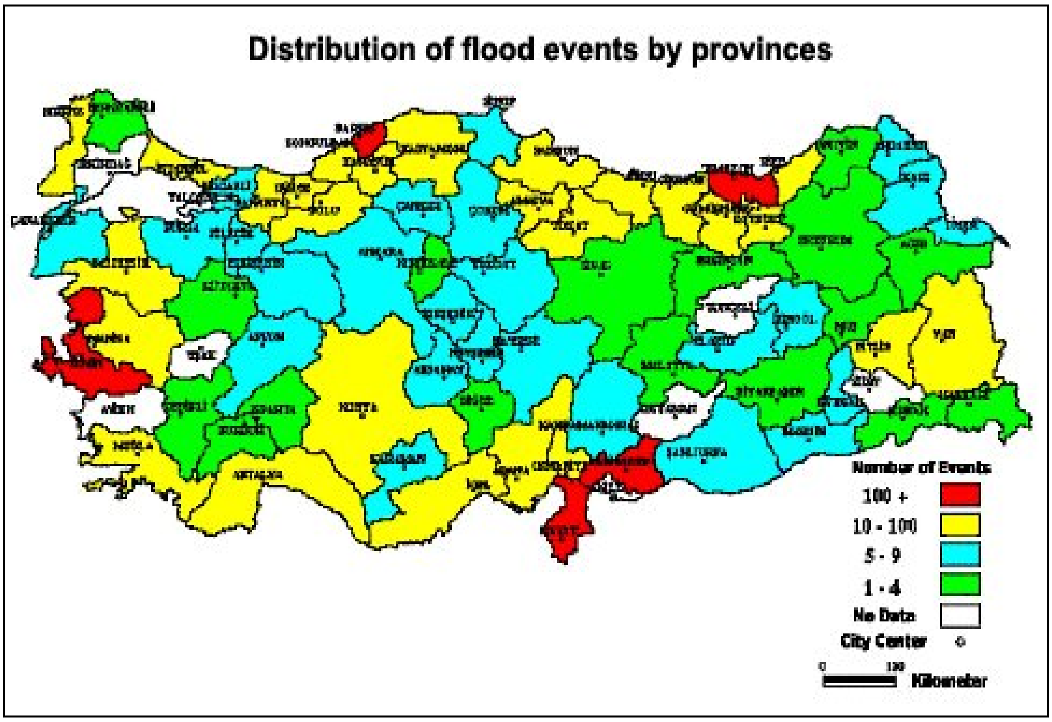

Figure 3.14: Number of Recent Flood Events Resulted in Losses by Provinces *(Taymaz 2008)*

Flood damage records of AİGM, on the other hand, indicate that **Bartın, İzmir, Trabzon, Hatay and Gaziantep** provinces have experienced the highest number of flood events as shown on Figure 3.14.

3.4. FLOOD EVENT AND LOSS POTENTIAL IN TURKEY

As discussed in the previous chapter, although there is a direct impact of high rainfall quantities on flood events, floods may not cause losses only due to rainfall quantities. There are other interacting variables regarding physical features of river basin area.

- the inundation depth (by the discharges from a flood frequency curve)
- flow velocity (geomorphology)
- the duration of the flood situation (rate of soil infiltration, drainage capacity based on land-use)
- the rate of the water rise (rainfall intensity)

In river basins that are surveyed and analyzed spatially regarding such variables it is possible and necessary to make estimations about probable impacts of rainfalls based on actual data collected. Although, rainfall extremes are partially updated in some of major river basins in Turkey, there is a lack of spatial data prepared by SHW; such as river profiles/elevations, impermeabilities, shares of sub-basins, etc. for each river basin. For this reason, overall interpretations can be made for particular regions or basins of Turkey based on annual precipitation data, general topographic structure and climatic features, as well as flood loss statistics of regions/river basins collected from several data-bases in this part of the study.

The most common types of floods in Turkey are flash floods and river floods resulting from intensive rainfall within a short period of time.

For instance; compared to other regions Black Sea Region is always exposed to frequent and heavy rainfalls. At the same time rainfall constantly turns into rapid runoffs in this region due to the geomorphologic structure and soil features on steep terrain of this region. On the other hand, in settlements in South-eastern Anatolian regions where arid mountainous and flat steppes exist with dry climate conditions disastrous floods are observed (figure 3.18).

Among other regions intense and long duration seasonal rainfalls trigger river floods particularly in Aegean and Southern Regions. In Eastern Regions at the beginning of spring season sudden increase in temperatures mostly creates rapid ice-melt of mountainous parts. River floods are usually observed due to the sudden surge of water from such ice-melting process in these areas. Hence, it can be possible to come across less flood losses even the area gets poor precipitation.

In the last two decades, particularly populated urban areas have been continually exposed to river floods and inundations in Turkey due to inefficient drainage systems, building densities and unauthorized establishments after sudden rainfalls (See Appendix 3, Table A3.1). Some of the examples of such distructive flood events that are displayed below have affected a group of settlements in one flood event due to extreme amount of continuous rainfall during hours, even days.

The main reasons that cause continual losses that are triggered by extreme weather conditions or not are examined in riverine cities of Turkey in detail in the next Chapter.

Figure 3.15: 3rd-4th November 1995, İzmir

After heavy rainfall occurred in between 02:00 pm at 03.11.1995 and 05:00 am at 04.11.1995 a flood, which corresponds a 100-year floods, took place in 6 hours. Water level identified from traces on the walls is max. 410m. high. Such water volume is defined as 'catastrophic' for discharge capacities of 27 rivers that were flooded in urban areas. According to official records, 61 persons were killed some of which were due to fully damaged 326 dwelling units that are unauthorized buildings on riverbeds and some of which due to electrical shock from city lines. Total number of buildings affected is 2371.

Figure 3.16: 21st May 1998, West Black Sea Region

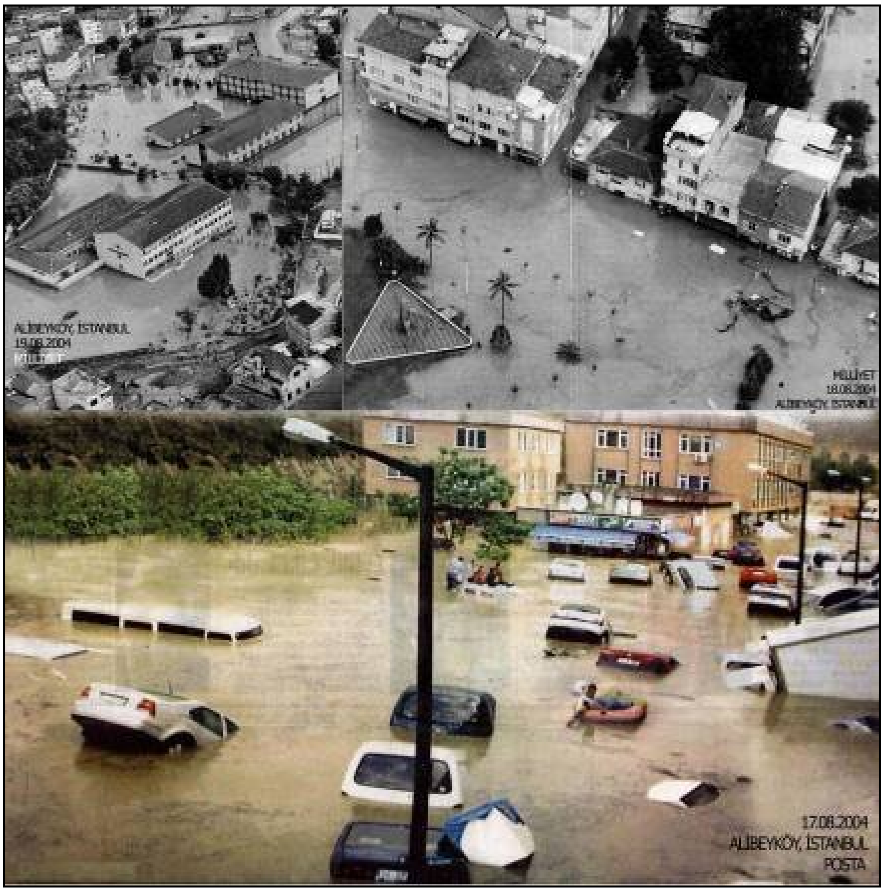

Figure 3.17: 17-18-19th August 2004, Alibeyköy-İstanbul

Figure 3.18: 1-2nd November.2006, Southeastern Anatolia

Figure 3.19: 16th - 17th November 2007, Thracian Region

3.5. DETERMINATION OF CASE STUDY AREAS FOR EMPIRICAL STUDY

Before proceeding through the empirical research in a sample of riverine cities, the criteria for selecting the cases should be identified and discussed. For this purpose, first of all, statistical figures concerning flood events, and losses with respect to major river basins and provinces were used. In this process, following issues have been influential:

- heavy flood losses occurred
- being located on climatically and geomorphologically different river basins
- being continually exposed to flood hazards

Apart from the data on flood events and losses, demographic figures and discharge rates of the major rivers in each basin are also used as criteria for the selection.

As mentioned in the 2nd Chapter, floods are triggered by climatic conditions which vary in different geomorphologic terrains due to shape of the basin and the river network. The extent of the flood events, on the other hand, depend on land use decisions, which affect directly the capacity and velocity of river flow, soil infiltration and retention on basin. The examination of riverine cities therefore should focus on the causes of flood events originated from human interventions rather than solely extreme rainfall volumes.

Four provinces constitute the case study areas of this research. These provinces are Bartın, Batman, Aydın and Hatay. Case study areas are determined on the basis of several criteria.

First of all, each case is selected from a different geographical region in order to avoid the impacts of similar climatic and geographical conditions. Among these impacts, precipitation patterns are essential. In most cases they are the main causes of floods occurred in different parts of the same region. By selecting each case from a different region, impacts of similar natural and climatic factors are eliminated or at least minimized.

As the second criterion, flood damage statistics recorded on major basin levels over a long time period were used. Number of flood events, number of casualties and the area of flooded lands are officially recorded for each basin by DSİ since 1954. According to statistical data[14] of DSİ (Aksu and others 2006, 52) **Sakarya Basin** was exposed to the most frequent flood events between 1970 and 2005, although it has 524.7 mm annual mean precipitation, which is lower than many other basins (Table 3.7). On the other hand, **West Black Sea Basin** has the first place having the largest area that was flooded in that period. However the highest number of casualties occurred in **East Black Sea Basin,** where the annual mean precipitation is the highest (1198.2 mm).

Among these three basins, only West Black Sea Basin is selected as one of the case study areas. The other two basins, which were seriously affected from flood events, were excluded due to several reasons. East Black Sea Basin, which has the highest damage statistics, was excluded in the selection process. The extreme precipitation pattern and high amount of annual precipitation are known as the major causes of floods in this basin. For this reason, East Black Sea Basin with the highest damage statistics is excluded. Secondly, Sakarya Basin, which faced the most frequent flood events between 1970 and 2005, was excluded. The reason of exclusion is that lower levels of flood losses were experienced in this basin due to the major improvements such as dam investments along streams.

Provincial statistics on river flood events were considered as the third criterion for selection. According to GDDA provincial flood damage records indicate that **Bartın, İzmir, Trabzon, Hatay and Gaziantep** provinces have experienced the highest number of flood events as shown in Figure 3.14. In this respect Bartın from West Black Sea Basin and Hatay from Asi Basin are selected. As it is located in East Black Sea Region Trabzon is excluded. Instead of focusing on Gaziantep and Izmir, Aydın is selected from Aegean region and Batman is selected from Southeastern Anatolia due to concerns regarding population sizes and discharges rates, mentioned below.

[14] The records about flood damages between 1955 and 1970 were collected and then categorized according to river basins by SHW, so 1170 flood events during that time period which may change the total dispersion among basins were not included in SHW statistical analysis.

Another criterion for selection was to choose provinces with different sizes in terms of population. Instead of focusing on same-sized provinces it was decided to select provinces with different sizes. Table 3.8 indicates the population figures of the case study areas together with the all other provinces in Turkey. As shown in the table one of our case study areas, namely Hatay has a population of 1.5 million people. Hatay is followed by Aydın, which has a population of 965.500 people. Populations of the other two case study areas, namely Batman and Bartın are 485.616 and 185.368 respectively. This shows that the case study areas chosen for the purposes of this research range from small size towns to big cities and are sufficiently representative.

Table 3.8: Population Figures of Provinces in Turkey

Rank	Province	Population	Rank	Province	Population	Rank	Province	Population
1	İstanbul	12.697.164	28	Eskişehir	741.739	55	Bitlis	326.897
2	Ankara	4.548.939	29	Malatya	733.789	56	Amasya	323.675
3	İzmir	3.795.978	30	Ordu	719.278	57	Rize	319.410
4	Bursa	2.507.963	31	Afyon	697.365	58	Kars	312.128
5	Adana	2.026.319	32	Sivas	631.112	59	Siirt	299.819
6	Konya	1.969.868	33	Zonguldak	619.151	60	Nevşehir	281.699
7	Antalya	1.859.275	34	Tokat	617.158	61	Kırıkkale	279.325
8	Gaziantep	1.612.223	35	Adıyaman	585.067	62	Bolu	268.882
9	Mersin	1.602.908	36	Kütahya	565.884	63	Hakkari	258.590
10	Şanlıurfa	1.574.224	37	Elazığ	547.562	64	Bingöl	256.091
11	Diyarbakır	1.492.828	38	Çorum	545.444	65	Burdur	247.437
12	Kocaeli	1.490.358	39	Ağrı	532.180	66	Karaman	230.145
13	Hatay	1.413.287	40	Batman	485.616	67	Kırşehir	222.735
14	Manisa	1.316.750	41	Yozgat	484.206	68	Karabük	216.248
15	Samsun	1.233.677	42	Çanakkale	474.791	69	Erzincan	210.645
16	Kayseri	1.184.386	43	Osmaniye	464.704	70	Sinop	200.791
17	Balıkesir	1.130.276	44	Şırnak	429.287	71	Yalova	197.412
18	K.Maraş	1.029.298	45	Giresun	421.766	72	Bilecik	193.169
19	Van	1.004.369	46	Isparta	407.463	73	Bartın	185.368
20	Aydın	965.500	47	Muş	404.309	74	Iğdır	184.025
21	Denizli	917.836	48	Edirne	394.644	75	Çankırı	176.093
22	Sakarya	851.292	49	Aksaray	370.598	76	Artvin	166.584
23	Muğla	791.424	50	Kastamonu	360.424	77	Gümüşhane	131.367
24	Erzurum	774.967	51	Niğde	338.447	78	Kilis	120.991
25	Tekirdağ	770.772	52	Kırklareli	336.942	79	Ardahan	112.242
26	Mardin	750.697	53	Uşak	334.111	80	Tunceli	86.449
27	Trabzon	748.982	54	Düzce	328.611	81	Bayburt	75.675

Source: TUIK

Table 3.9 displays a more or less equal grouping of the provinces in Turkey according to their populations. As shown on the table, there are 19 provinces with population more than one million in Turkey. Hatay as one of our case study areas is in this group, and hence represents these cities. 20 of 81 provinces in Turkey have a population between 500.000 and 1.000.000 people. Aydın is selected from this group. Our third case study area, Batman is one of the provinces in the third group. This group involves provinces with a population between 250.000 and 500.000 people. Finally the last group of provinces is the one including provinces with a population less than 250.000 people. Bartın represents the provinces in this group.

Table 3.9: Grouping of Provinces With Respect to Population

Population Size	Number of Provinces	Case Study Areas
1.000.000 and over	19	Hatay
500.000 - 999.999	20	Aydın
250.000 - 499.999	25	Batman
250.000 and less	17	Bartın

To select the case study areas it was also decided to focus on the discharge rates of the major rivers of 26 river basins in Turkey. As basins reveal a great diversity with respect to their discharge rates, the selection in this research aimed an unbiased distribution in reflecting this variety. Table 3.10 indicates the major river basins together with the figures on discharge rates and annual flows. Two of our case study areas were selected from basins with high discharge rates. These are Batman and Bartın located in Dicle and West Black Sea Basins respectively. Annual mean discharge in Dicle Basin is 700.8 m^3/sec, while that of West Black Sea Basin is 317.9 m^3/sec. The other two case study areas are selected from basins which have rivers with low discharge rates. Aydın is located in Büyük Menderes Basin and Hatay is in Asi Basin. Discharge rates in these two basins are 97.1 m^3/sec and 37 m^3/sec respectively.

Table 3.10: Flows and Discharge Rates in Major Basins

Name of the Basin	Catchment Area (km2)	Annual Mean Flow (1.000.000 m³)	Annual Mean Discharge m³/sec.	Case Province
Fırat	120.917	31,61	992,3	
Dicle	51.489	22,1	700,8	Batman
East Black Sea	24.022	16,44	521,3	
East Mediterrenean	22.484	10,09	345,7	
Middle Mediterrenean	14.518	10,57	335,1	
West Mediterrenean	22.615	10,15	321,1	
West Black Sea	29.682	10,83	317,9	Bartın
Marmara	24.100	8,05	255,2	
Seyhan	20.731	7,24	229,5	
Ceyhan	21.222	7,07	224	
Çoruh	19.894	6,57	208,3	
Kızılırmak	78.646	6,23	197,4	
Sakarya	56.504	5,95	188,7	
Yeşilırmak	35.129	5,76	182,8	
Susurluk	23.765	5,08	161	
North Aeagen	9.032	2,09	161	
Konya Closed	56.554	4,89	154,2	
Aras	27.548	4,72	149,8	
Büyük Menderes	24.903	3,06	97,1	Aydın
Van Closed	15.254	2,62	82,9	
Gediz	17.118	1,84	58,6	
Meriç-Ergene	14.560	1,22	38,5	
Asi	10.885	1,66	37	Hatay
Küçük Menderes	7.165	1,13	35,8	
Burdur Göller	8.764	0,45	14,3	
Akarçay	8.377	0,44	14	
TOTAL	**765.878**	**187,86**	**6024,3**	

Source: Aksu and others 2006, 54.

Therefore both in terms of urban size and river capacities, the selected cases represent a sufficient variety for an unbiased method of analysis. Thus with the criteria mentioned above the four case areas selected have been subject for further empirical studies in the analysis of impacts of human interventions, either planned or not, on the occurrence of floods and flood losses in urban areas.

Hence, West Black Sea Basin and **Bartın** from the north, Asi Basin and **Hatay** from the south, Büyük Menderes Basin and **Aydın** from the west and Dicle

Basin and Batman from the southeast are accepted as significant regions, and selected as case study areas.

SELECTION PROCESS OF CASE STUDY AREAS

As indicated in Flood Events and Damage Statistics
Heavily Affected Areas

Basin Level (3 basins among 26 basins)	Provincial Level (5 cities)
~~Sakarya Basin~~ W. Black Sea B. (selected) ~~*E. Black Sea B.*~~	Bartın (selected) Hatay (selected) Trabzon İzmir Gaziantep

- Exclusion of a basin that has extreme precipitation patterns and water potentials
- Inclusion of some of these provinces that have continual flood damage history according to their geographical locations that indicate different climatic features

Further Research on
- **BARTIN** from West Black Sea Basin
- **AYDIN** from B. Menderes Basin
- **BATMAN** from Dicle Basin
- **HATAY** from Asi Basin

To find out main causes of flood damages mainly resulting from human actions

Figure 3.20: Selection Process of Case Study Areas

CHAPTER 4

REVIEW ON PLANNING EXPERIENCE OF FLOOD-PRONE CITIES: BARTIN, BATMAN, AYDIN, HATAY

In this chapter an analysis of selected riverine cities in Turkey is presented, exploring main factors in repeated flood losses. This research employs the flood event and loss histories of each case, based on official archive files of the General Directorate of State Hydraulic Works (DSİ). This organization has recorded information about flood events both at the provincial and basin levels since 1954. On the other hand, an investigation of city growth and development plan histories of these selected cases is undertaken to investigate responses to perceived risks. Such an analysis intends to reveal that human interventions, either planned or unplanned, are the major factors behind the repeated flood losses.

Floods are triggered by climatic conditions which may vary in different geomorphologic terrains due to the shape of basin and the river network. The extent of the flood events, at the same time, could depend on some land use decisions which may directly affect capacity and velocity of river flow, soil infiltration and retention in the basin. The exploration of riverine cities therefore focuses on damages caused by flood events, and the nature of human interventions that cause the conditions rather than solely extreme rainfall volume.

With the examination of the case settlements with different climatic features and physical settings, the aim is to categorize the “common causes” that leads to disastrous and perpetual flood damages. The main question of this examination is whether the land-use or planning decisions and structural interventions before and/or after flood events have contributions to reduce flood damages or have adverse effects in the long run.

4.1. EXAMINATION OF CASES

Selected case areas are examined first according to the official archive files of DSİ. Contents of the archive files examined for each case are summarized, and presented as a process table in the Appendix B.

The official records in the archive files of provinces usually include:

- Official correspondence between local authorities and regional directorates of DSİ, between regional directorates and central departments of DSİ (an example of an official correspondence is given in Appendix C),
- Base maps and development plans from municipalities requiring consultancy about flood protection facilities, irrigation sites/facilities and two-dimensional data about the actual flood prone areas on the map (no data about depth of flood water),
- Survey reports and flood protection plans of Department of Investigation and Planning of DSİ to decide the feasibility of a flood protection facility (an example of a survey report is presented in Appendix D),
- Damage reports, flood extension area sketches and visual data about a particular flood event by Regional Directorates of DSİ,
- Legal documents such as Decrees, Acts and Protocols etc (some of the legal documents are given in the Appendices E, F, G and H).

Secondly these case cities are also examined by means of planning and development histories from written documents such as official survey and development plan reports. Moreover, they are examined through the analyses based on the interviews and semi-structured questionnaires (an example of the questionnaire is given in Appendix I). The interviews and the questionnaires were made with the officials working for planning and infrastructure departments of selected Municipalities, Bank of Provinces, and Private Planning Offices participated in the preparation of Territorial Plans and/or Development Plans for these cities. The aim of the analyses was to establish the impacts of land-use decisions and to explore the explicitly stated strategies concerning potential flood disasters.

Table 4.1: General Information on Each Case

	SELECTED CASES			
	Bartın	**Batman**	**Aydın**	**Hatay**
Provincial Population (2008 Results of Address Based Population Registration System)	185.368	485.616	965.500	1.413.287
Provincial Population (2000 Population Census)	184.178	456.734	957.757	1.253.726
Mayor's Political Party (Before 2009 Elections)	AKP	DTP	AKP	AKP
Mayor's Political Party (After 2009 Elections)	MHP	DTP	CHP	AKP
Total Number of Municipalities in Province	9	12	54	76
Total Number of Villages in Province	265	270	493	362
Total Area of the Province	2140 km^2	4654 km^2	8007 km^2	5403 km^2
Name of the Major Basin	West Black Sea	Dicle	Büyük Menderes	Asi
Catchment Area (km^2)	29'682 km^2	51'489 km^2	24'903 km^2	10'685 km^2
Share of the Province in Total Catchment Area	38%	67%	32%	13%
Location of City	Downstream	Downstream	Downstrea m	Downstream
Annual Mean Precipitation (1971-2000)	1025,7 mm	473,2 mm	601,7 mm	1084,1 mm
Major Rivers that Regularly Flood	Bartın river and its tributaries; Arıt, Ova, Ulus, Kozcağız Creeks	İluh river and its tributaries; Çay, Savara, Aşağıkonaka, Şakuli	Büyük Menderes and it tributaries; Dandalas, Akçay, Çine	Asi, Afrin, Karasu
Sub-Provincial Municipalities Exposed to Floods / Total Number of Sub-Provincial Municipalities	2/3	3/5	14/16	8/11
Local Auxiliary Municipality Exposed to Floods / Total Number of Auxiliary Municipalities	3/5	2/6	10/37	7/64
Percentage of Municipalities Exposed to Floods	66%	41%	44%	19%

(Source: http://www.yerelnet.org.tr, DSİ Archive Files of Each City)

Figure 4.1: Major River Basins in Turkey and the Case Study Areas
(*Source: EIE Official Web Site*)

Each case is investigated in a chronological manner to answer the following questions:

- What are the main stated causes and results of flood events, imposing damages in life and property?
- What are the measures before and after disastrous flood events?
- What are their success and failures? What is the effect of urban growth?
- Although many measures are taken, why flood events still threathen life and property?

4.1.1 West Black Sea Basin, Bartın River Basin Floods and Bartın City

Bartın River Basin is surrounded by Amasra basin on the north, Eflani and Safranbolu basins on the south-east, Filyos basin on the south and west. Bartın River and its tributaries; namely Bartın, Arıt, Gökırmak (Ulus) and Kozcağız Creeks, Güney Brook are main streams of Bartın basin which is a part of West Black Sea Region as shown on Figures 4.1 and 4.2.

The basin, which is divided by Bartın River and its tributaries[15], are located on deep and narrow valleys originating from south and south-east mountains with an altitude of 2000m at maximum. On these mountains very steep cliffs exist. Towards the center of Bartın city, the slope gets smoother. The area, where Bartın city is located, is flat. The city center was established on the intersection of Kozcağız and Bartın Creek, which compose then Bartın River that reaches the Black Sea (Figure 4.2).

[15] These tributaries are Bartın, Arıt, Ulus, Kozcağız, Gökırmak, Kocanaz, Kocaçay, Günye and Ova Creeks; and Bedesten, Güney, Kapısuyu, Tekkeköyü Brooks (ZBK 2006)

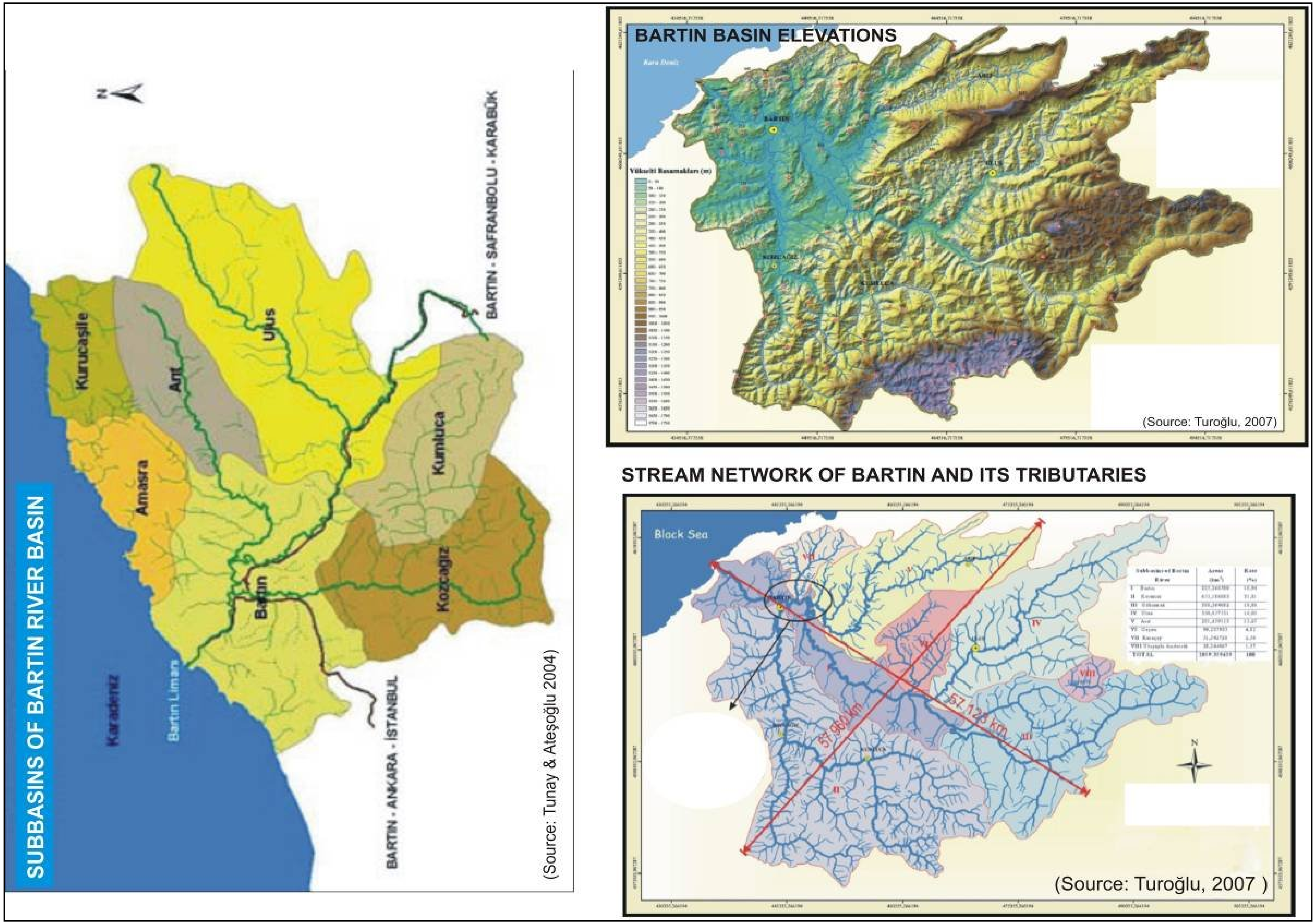

Figure 4.2: Main River Basins of West Black Sea Basin and Bartın

Precipitation regime and runoff followed by meteorological and geomorphologic settings frequently expose Black Sea basin to floods. In the Western Black Sea region, an intense rainfall is usually followed by large water volumes and debris dragged down from upper basin which has semi-impermeable soil and steep slopes (Figure 4.3).

Figure 4.3: Bartın and Surrounding Mountains
(Source: ZBK 2006, 220)

The built-up area of Bartın city is mainly located at the delta of three valleys and partly on their slopes, which is 15 km. away from the Bartın Sea port. Geomorphologically, valleys feeding the upper basin are extensive and large; however, the emptying valley on the lower basin; that is Bartın Strait, is narrow, deep and almost flat. This strong funneling usually causes outlet problems on the coast of Black Sea as experienced in several floods (Turoğlu 2004; Ege Plan 2005).

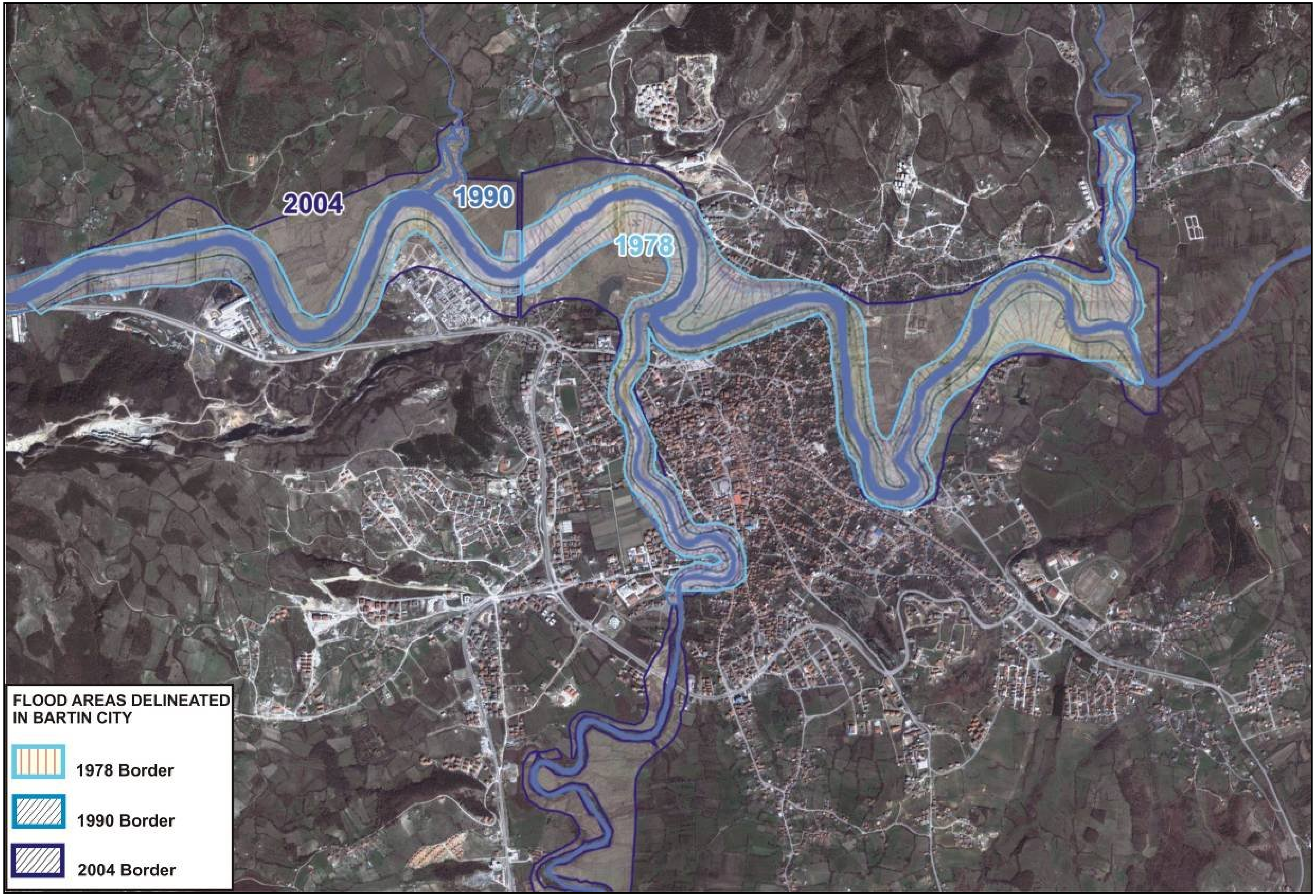

Figure 4.4: Flood Areas Delineated in Bartın City *(Sources: DSİ Archive Files)*

Bartın has typical Black Sea climate which is cool in summers; mild and rainy in winters. It usually receives greater rainfall in autumn and winter seasons mainly from October to December. According to monthly precipitation values (1971-2000) annual mean precipitation of Bartın is 1025,7 mm (Website of Turkish State Meteorological Service). Most of the flood events occurred in spring and summer seasons, mainly due to the combination of continuous rainfall and rapid snow-melt of mountains on the upper basin area (Table 4.2. based on Table B1 in Appendix B).

Bartın province has been exposed to continual flood losses such as, in 1973, 1975, 1983, 1991, 1998, 2000, 2004, and recently in 2006 (Table B1 in Appendix B). Bartın and its tributaries still cause flood losses today in spite of a number of protective measures. The exact dates of the previous flood events in Bartın are shown on Table 4.2.

Table 4.2: Exact Dates of Major Floods in Bartın Province

SEASON	MONTHS	WEEKS	MAJOR FLOOD EVENTS
WINTER	December/January	Week 1	
	January	Week 2	
	January	Week 3	
	January	Week 4	
	January/February	Week 5	
	February	Week 6	
	February	Week 7	
	February	Week 8	**1998** (25 buildings, 17 stores damaged)
	February	Week 9	
SPRING	March	Week 10	
	March	Week 11	
	March	Week 12	
	March	Week 13	
	March/April	Week 14	
	April	Week 15	
	April	Week 16	
	April	Week 17	
	April/May	Week 18	**1975** (17 buildings damaged)
	May	Week 19	
	May	Week 20	
	May	Week 21	**1998** (1555 buildings, 1302 stores inundated)
	May	Week 22	
	May/June	Week 23	
SUMMER	June	Week 24	**2000**
	June	Week 25	**1973**
	June	Week 26	
	June/July	Week 27	
	July	Week 28	**1991**
	July	Week 29	
	July	Week 30	**1995**
	July/August	Week 31	
	August	Week 32	
	August	Week 33	
	August	Week 34	
	August	Week 35	**1983**
	August/September	Week 36	
AUTUMN	September	Week 37	
	September	Week 38	
	September	Week 39	
	September/October	Week 40	
	October	Week 41	
	October	Week 42	
	October	Week 43	
	October	Week 44	
	November	Week 45	
	November	Week 46	
	November	Week 47	
	November	Week 48	
WINTER	November/December	Week 49	
	December	Week 50	
	December	Week 51	
	December	Week 52	

Bartın river basin is strongly affected by precipitation patterns, and flow characteristics of the main streams due to its geomorphologic structure, soil characteristic and climatic features. Bartın city center is located on the intersection of two tributaries that make Bartın River on the downstream. These physical and climatic features are the major reasons that cause continual flood losses. According to the documents and reports on previous flood losses in DSİ Archive files (Official Documents dated 06.06.1975, 30.12.1991, 08.02.1995, 17-18.02.1998, 21-22.05.1998) for Bartın Province, the following issues emerge as the main causes of flood losses in this province. Contents of the archive files for Bartın are summarized, and presented in Table B.1 in the Appendix B.

- Due to considerable decrease in the upper basin forests, rainfall cannot be retained upstream anymore. This change also leads sediment and debris to move rapidly and accumulate in the lower riverbed of Bartın river basin area.
- During the dry seasons, the river channel and tributaries are used as a free public dumping area for debris and solid waste. In addition to this, the maintenance and clearance works, which are expensive and time-consuming activities, are not performed regularly. In turn, riverbed capacity is gradually diminished to an unexpected degree.
- Bridges become bottlenecks in river flows, as they are neither designed in terms of hydraulic calculations of river flows, nor reconstructed by local governments regarding the changing hydraulic conditions.
- The estuary of Bartın River lost its natural form of the river channel and its connection to Black Sea due to the construction of military port facilities. This affects the discharge of the river particularly in peak periods.

Table 4.3: Documents Related to Bartın Flood Events

Date	Type of The Event/Activity/Project/Development Plan/Aerial Photos
1944	Aerial Photo of Bartın (Harita Genel Komutanlığı 2008)
1969	Aerial Photo of Bartın (Harita Genel Komutanlığı 2008)
1970	Development Plan (İlbank)
15.06.1973	Flood Event
	Transfer of properties on safer locations
30.04 and 01.05.1975	Flood Event
	Water storage facilities at upper basins (Kozcağız Dam)
17.07.1978	Survey for flood defense structures (DSİ)
1978	İlbank Survey Report for Development Plan Study
06.08.1979	Survey on Kozcağız River
1980	Development Plan
1982	Implementation Plan
1982	Aerial Photo of Bartın (Harita Genel Komutanlığı 2008)
27-28.08.1983	Flood Event
18.10.1990	Survey (DSİ)
06-07.07.1991	Flood Event
24-25.07.1995	Flood Event
	DSİ Proposals: Kirazlıköprü Dam construction on Gökırmak (Ulus) Creek began (2002 partially completed, 2012 expected)
17-18.02.1998	Flood Event
21-22.05.1998	Flood Event
1998	Aerial Photo of Bartın (Harita Genel Komutanlığı 2008)
04.09.1998	TEFER Project
03-04.06.2000	Flood Event
11.11.2004	Survey (DSİ)
2006	Territorial Plan of Zonguldak-Bartın-Karabük (1.100000) by UTTA and GeoTECH Firms on behalf of Ministry of Forest and Environment
2006	Development Plan (EgePLAN on behalf of Municipality)
2006-2007	Upper Basin Measures: Kozcağız Dam Project, Arıt Dam & HES, Kışla Flood Detention Dam on Güney Brook

After the wide-ranging and disastrous floods in 1998 Bartın Provincial Directorate of DSİ was founded by the Decree of the Ministerial Board. Some of the projects in progress based on the TEFER project are Kirazlıköprü dam project (under construction), Kozcağız dam project (but not constructed due to financial constraints) redesigning of the Black Sea estuary, and reconstructing some of the transport bridges that are hydraulically deficient etc. (Akar, 2008). According to project summary report 57 million $ credit was already used for a number of projects based on TEFER.

4.1.1.1. Population Status, City Growth and Planning Decisions

Bartın was a settlement with an occupational structure based on agriculture, manufacture, commerce sectors that depend on foreign trade since the 19th Century. The city was a district of Zonguldak for sixty-seven years before it was declared as a 'province' in 1991[16]. Since 1964, a few macro-scale plans[17] and development plans[18] were prepared for Zonguldak and its region. According to the Zonguldak Metropolitan Plan (ZMA) report prepared in 1975, Bartın was evaluated as a 4th level center developed in agriculture and manufacture sectors, and supported with commerce, service and transportation facilities. Since it was the only district that has economic relationships with Zonguldak, the regional center, agriculture and manufacture products of Bartın were consumed in Zonguldak.

In its hinterland, where favorable natural conditions and land resources exist, there is a kind of integration which seldom prevails in other regions of Turkey. There is high level of daily commuting between Bartın and its villages either due to its labor demand or its location as a market place. Since the settlement center has a connection to Black Sea Port via Bartın River, Bartın has developed as an important commercial center of the region before Amasra, which offers a more preferable seaport.

Today, central district of Bartın still preserves its function as a market place, at which 4 district centers[19], 5 municipalities and 266 villages meet for commercial activities. Although level of areas favorable for agriculture is limited, it is the dominant sector in labor structure of Bartın province in 21st century. On the other hand, mining industry, manufacturing and service sector are the more intensively demanded sectors in Bartın. Agricultural production was made for self consumption, not for economic purposes.

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[16] Act No: 3760 dated 28th August 1991 was published in Official Gazette No: 20984 dated 7th September 1991.

[17] Zonguldak Sub-Region Plan – 1964, Zonguldak Territorial Plan – 1968, West Black Sea Regional Development Plan – 1970, Zonguldak Metropolitan Area Plan – 1975, Zonguldak-Bartın-Karabük Planning Region 1/100000 Scale Territorial Plan – 2006 (İlbank 1978, 29)

[18] 1/1000 Scale Implementation Plan – 1970, 1/5000 Scale Development Plan – 1980, 1/1000 Scale Implementation Plan – 1982 (ZBK 2006, 754)

[19] Bartın central district, Amasra, Kurucaşile and Ulus are the district centers of Bartın Province

Population growth of Bartın province experienced a gradual increase until 1990. In spite of becoming a province in 1991, it lost population between 1990 and 2000 due to the investment recession in mines and/or new labour intensive sectors (ZBK 2006, 704). According to the population census of 2000, 25% of the population lives in urban areas, while 75% lives in the rural areas. Spatial organization based on agricultural production and forestry has created relatively higher ratios of rural population as shown in Table 4.4.

Table 4.4: Population Growth of Bartın (1970 – 2000)

POPULATION (person)	YEARS[20]					
	1970	**1975**	**1980**	**1985**	**1990**	**2000**
Total	100465	112728	128132	147212	205834	184178
Urban	15926	18409	20786	25117	43662	48002
Rural	84539	94319	107346	122095	162172	136176

Source: TÜİK, 2000

Structural elements of the current macro-form of Bartın were established by major land-use decisions in 1950's. Before that, as in 1944 (Figure 4.5) Bartın city was a compact settlement being as a sub-province of Zonguldak. With the relocation of public areas, city began to grow at the periphery of the historical center by the beginning of 50's. One of the relocation decisions is the transformation of 'Dock Square' to 'Timber Industry Square' (İlbank 1978, 5).

Decentralization of industrial facilities began in 1965 and created a spatial expansion of the commerce and service sectors. According to the 1978 analysis report of Bank of Provinces, the pattern of Bartın city center began to change and decompose during 70's. While residential areas approached the Bartın Creek, crafts industry units were replaced by commercial activities. Industrial facilities, on the other hand, first occupied ship workshops, then expanded to the river-dock area, and later expanded towards the Bartın Strait (İlbank 1978, 6).

[20] Populations in 1970, 1975, 1980 and 1985 are of Bartın as a district of Zonguldak.

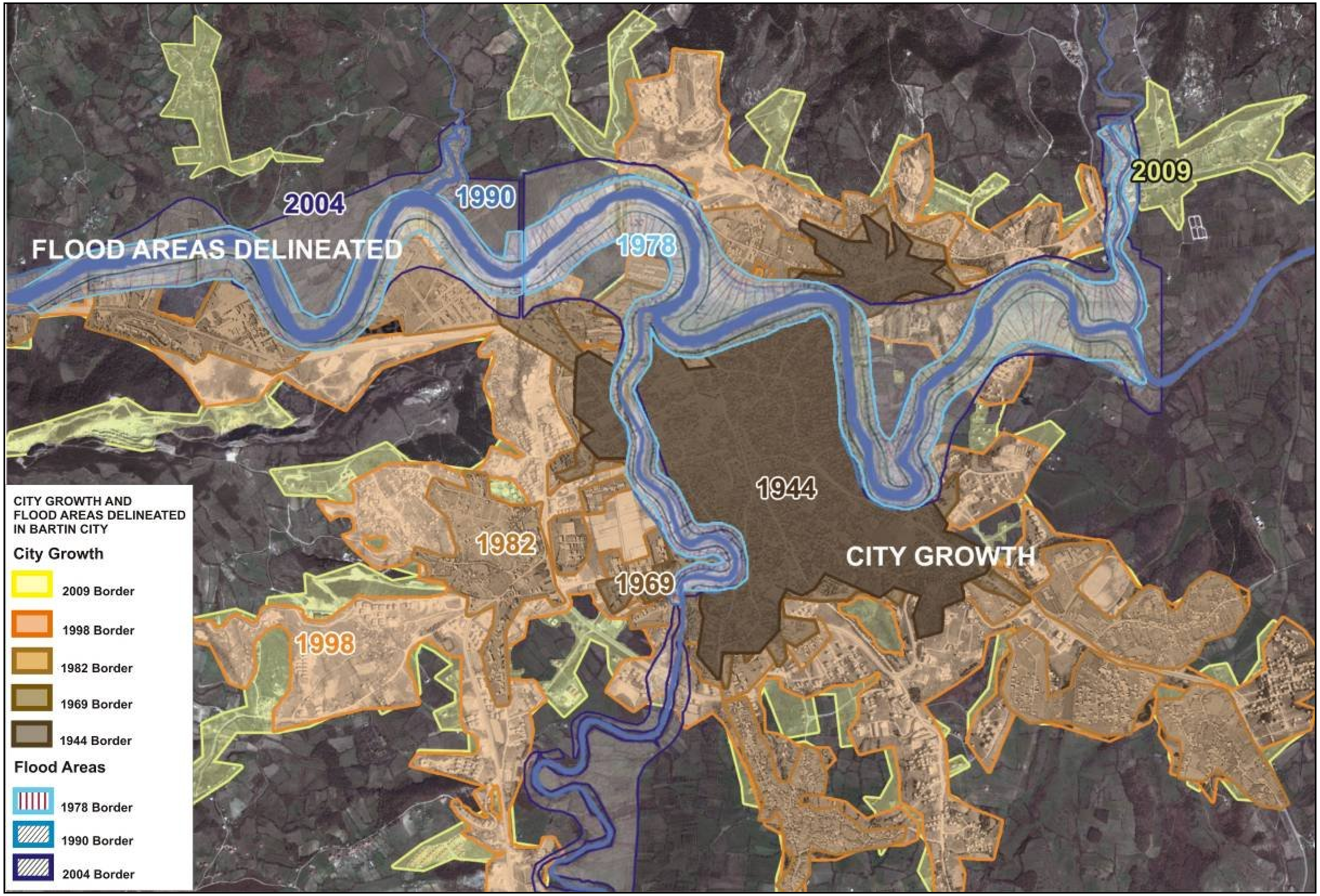

Figure 4.5: Bartın City Growth and Flood Hazard Areas Delineated
(Sources: Harita Genel Komutanlığı, Flood Extension Maps by DSI in 1978, 1991, 2004; see Appendix Table B.1)

In 1950's residential areas were not permitted to locate at the lower elevations of 9-10 m. to avoid settlements at agricultural areas, plains that have inadequate drainage, high groundwater level and flood hazard. Therefore, residences were allowed to settle around elevations between 10-20 m. until 70's. Spreading on these plains began just after the development decisions in 1970 which encouraged the transformation of agricultural fields into residential areas. Nevertheless, the formation of the plain where Bartın Creek and its tributaries compose is alluvium, mainly of 40-50 m. deep silt and sand layers, which are absolutely unsuitable for construction (İlbank 1978, 7).

According to the 1978 İlbank survey report reviewing the 1970 Development Plan of Bartın, flood-prone areas, low drainage sites and agricultural lands were allowed for new developments. Some parts of such areas were already settled. Although by settling at locations above +10m elevations, minimum capacity increase in the old settlement area could provide additional space for population increase projected for the next 20 years; such areas were preferred by residents and approved by the Bartın municipality.

Bartın municipality has also decided to use the whole of municipal lands, even though dispersed on unsuitable locations of Bartın and declared such districts as residential areas. High demand by land owners and construction enterprise for greater development rights in terms of increased number of storeys in built-up areas were welcomed by the municipality.

A number of plan decisions (in 1970, 1980 Development Plans and 1982 Implementation Plan) that mainly considers high demands of residents and interest groups have created vulnerable areas. The growth of the Bartın city is depicted in Figure 4.5.

Valuable agricultural lands have been transformed mostly to other land-uses such as industrial and residential purposes. River banks and flood plains have also been preferred by such developments. While the Bartın city grew, the natural landscape of streams and estuary of Black Sea were also disrupted. The deforestation of the upper-basin where tributaries of Bartın River are born created rapid accumulation of debris in the river bed. This led to decrease river discharge capacities. Another reason that lowered river capacities was the direct discharge of sewerage and solid wastes from several locations into the river bed. This action also caused water and environmental pollution. In 1995 Bartın Municipality has launched a construction project for the sewerage system with a sewage treatment facility to process the waste water before discharging it into Bartın River. However, the project is not been realized since then.

4.1.1.2. Vulnerability Analysis In Bartın City

In this section, an analysis aimed at defining the inventory of vulnerabilities in Bartın city is presented. This vulnerability analysis is necessary to determine, and to assess the probable volumes of losses together with their values within the flood-prone area in case cities. Furthermore, this analysis would enable us to compare the likely losses with the costs of measures to reduce risks, and to derive opinions about the viability of such measures. To start with, major decisions concerning the spatial development of Bartın City are discussed in relation to the flood issues. Following this discussion, the analysis on the inventory of vulnerabilities in Bartın is presented.

4.1.1.2.1. Bartın City Growth and Persisting Floods and Vulnerabilities

The spatial decisions implemented in 1970s have changed the spatial structure of the Bartın City prevailed from 1950s. The pressures due to the increase in population triggered the implementation of these decisions. Thus, the bases of the current urban macroform of Bartın city have been determined by the early 1970s. While the entire city was settled between the elevations 10 meters and 20 meters until 1970s, after this date the agricultural lands exposed to floods below this elevation (below 10 meters) was designated for development by 1970 development plans (İlbank 1978).

As shown in Figure 4.6, development plan of 1980 proposed new residential developments on flood-prone areas designated by the flood hazard map of 1978. Some of these residential development proposals were realized. as indicated in the map of 2004.

Flood hazard map of Bartın was renewed in 2004 with respect to the changes in impact areas due to 1998, 2000 and 2004 floods. A development plan was prepared and put into effect after the renewal of flood hazard map. In the development plan of 2006, flood-prone areas seem to be considered, and designated as ‘special project areas’ in order to avoid residential developments on them (Figure 4.6). However, it is not clear in the plan that how the special project areas would be defined in detail and implemented.

According to the interviews and the results of semi-structured questionnaires despite the engineering measures taken in Bartın especially after the 1998 floods, the potential loss of life and assets are still significant. Although municipalities claim that they follow the opinions and suggestions of DSİ, they are complaining about existing settlements within the flood-prone areas and river beds. It is clear that municipalities cannot manage to avoid urban developments in such areas. However, they prefer that river flood-prone lands and river beds in urban areas are designed as public areas like parks and open spaces. Preparation of updated flood emergency plans, warnings and SAR activities are defined as the main flood protection measures by municipalities and Governorate. They expect that DSİ should prepare and implement all flood protection projects.

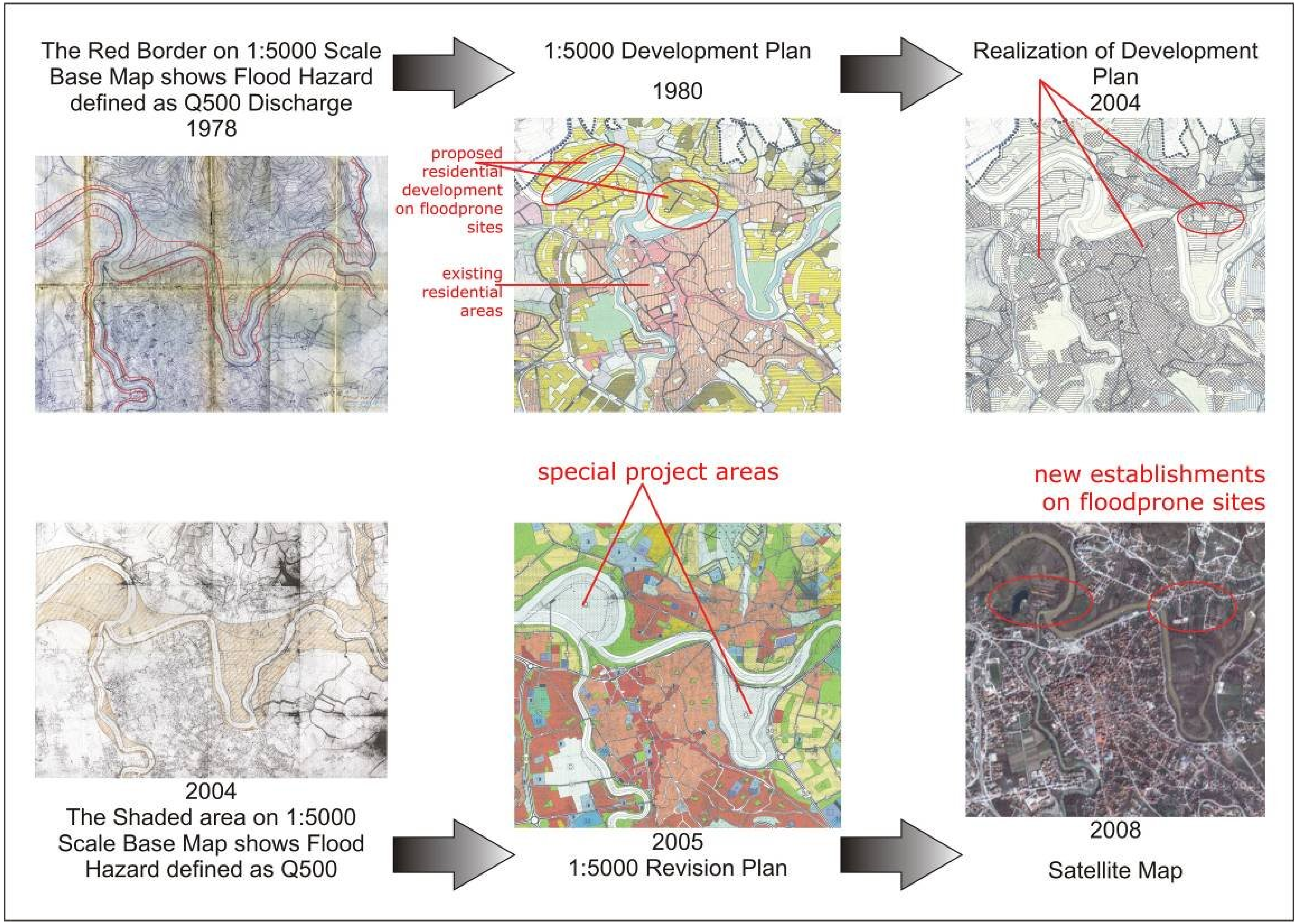

Figure 4.6: Changes in the Locations of Flood-Prone Areas and City Growth
(Sources: Flood Extension Maps of 1978, 2004 by DSI, EgePLAN, Google Maps)

4.1.1.2.2. Inventory of the Vulnerabilities in Bartın City

Vulnerability analysis in Bartın city is based on the flood-prone area designated by DSİ in 2004, and on the current maps and satellite images of the city. In some certain parts along the river the border of flood-prone area is delineated by DSİ in such a way to include only a part of an existing building or a current urban development. In those parts, the border is extended outwards by the author to include that building or urban development entirely within the vulnerable area in order to conduct a true analysis. The borders of the flood-prone area in Bartın are shown in Figure 4.7 and Figure 4.8. In the first figure the border is delineated on the satellite image, while it is delineated on the current map of the city in the second one.

The inventory of vulnerabilities covers the information about the buildings and urban developments located within the flood-prone area. The information is mainly derived from the current maps and satellite images of the area. Besides, some of the information is derived from the existing information on the basis of some assumptions.

Vulnerability analysis in Bartın is made on three different sections of the city. These sections are the areas along Bartın River and the areas along its tributaries namely Kozcağız and Karaçay Creeks. Bartın River and Karaçay Creek exist on the northern part of Bartın City, whereas Kozcağız Creek is passing through the built-up area of Bartın City towards southern direction. However it could be stated that majority of the vulnerabilities exist on the northern parts, particularly along Bartın River.

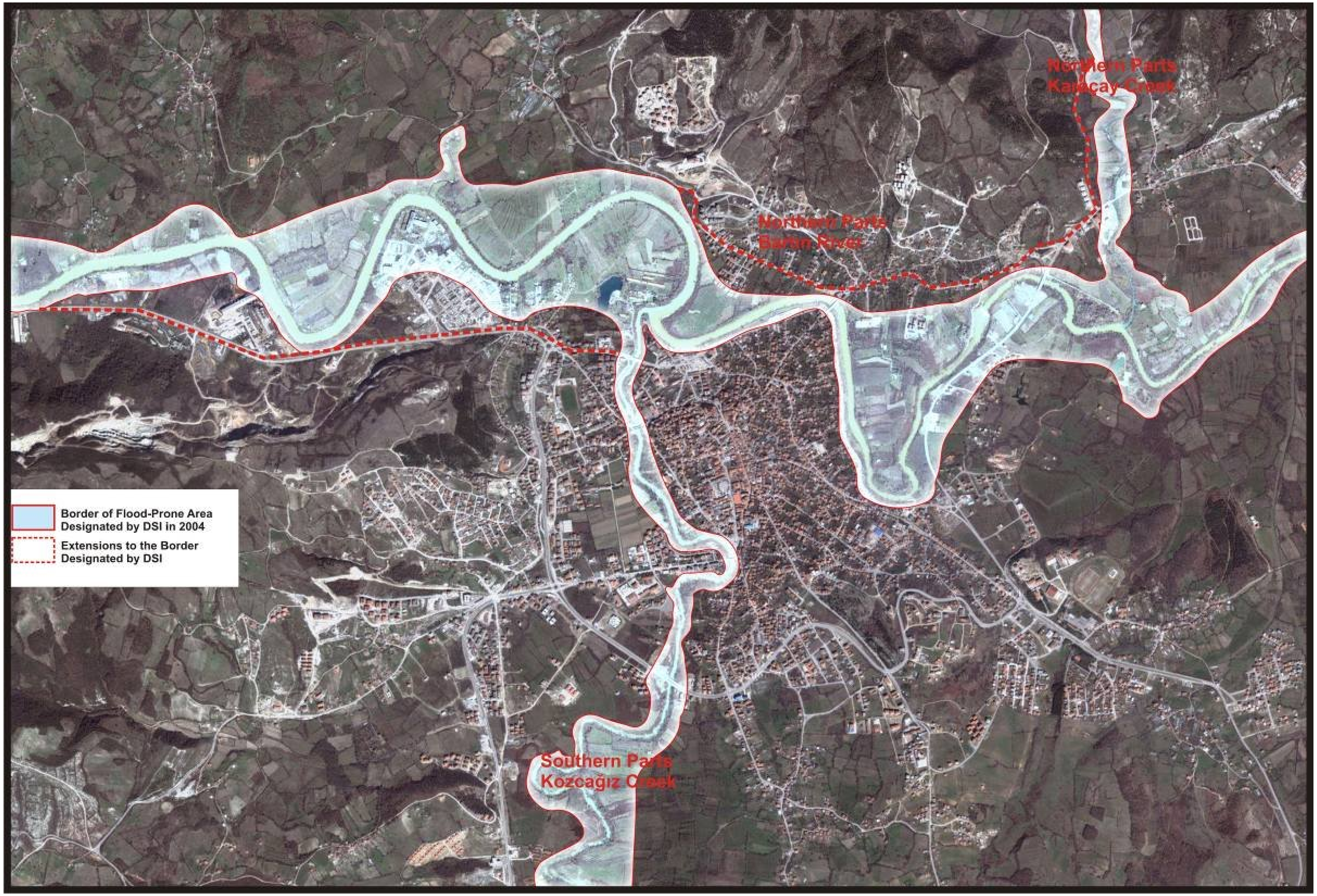

Figure 4.7: 2004 Flood-Prone Areas on the Satellite Image of Bartın (based on Q-500 Discharge)
(Sources: Flood Extension Map of 2004 by DSI & Google Maps)

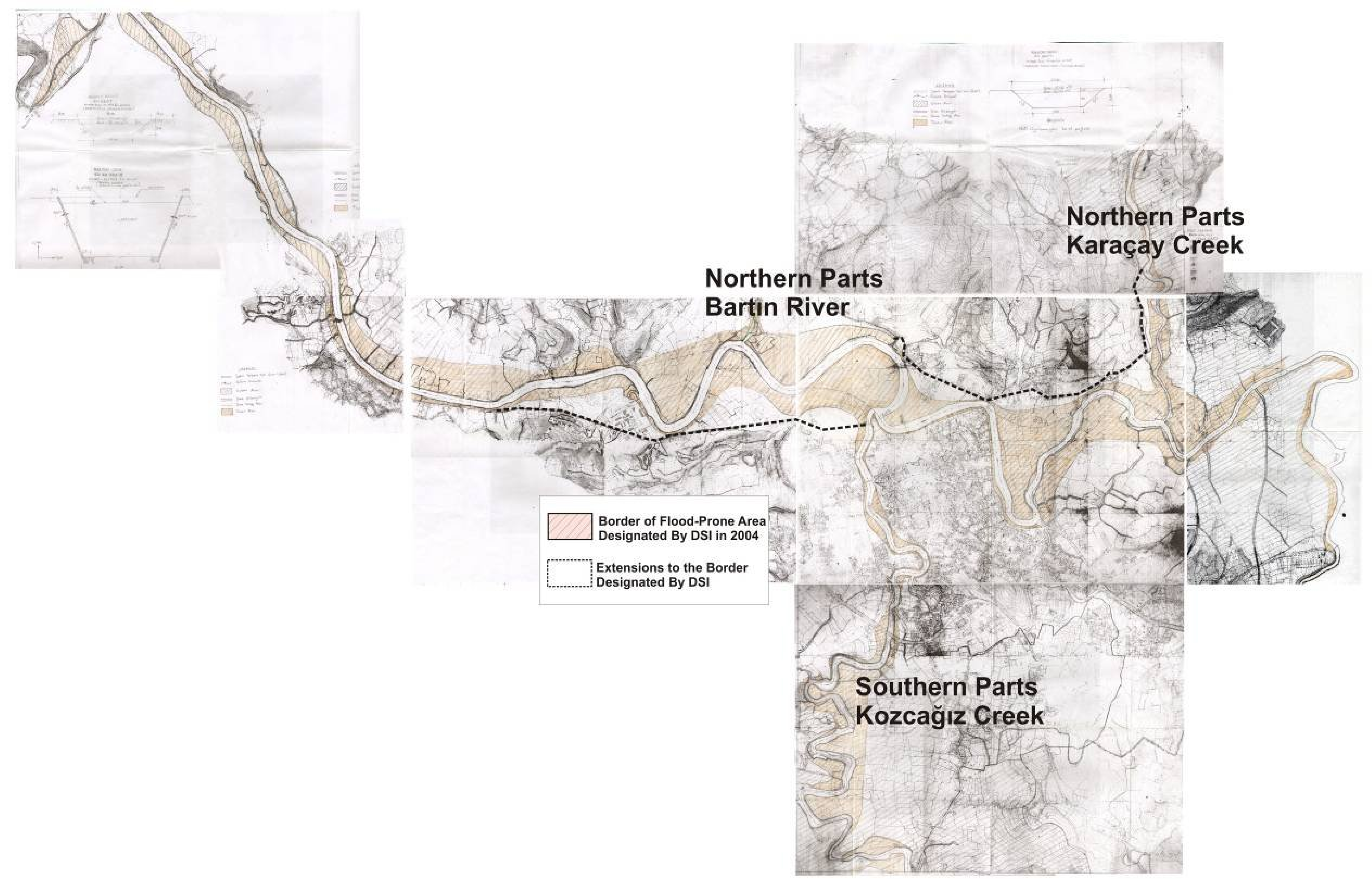

Figure 4.8: 2004 Flood-Prone Areas on the Current Map of Bartın (based on Q-500 Discharge)
(Sources: Flood Extension Map of 2004 by DSI & EgePLAN)

Vulnerabilities along Kozcağız Creek

Urban developments over the flood-prone area along Kozcağız Creek are limited. In other words, a few vulnerabilities are observed on the southern part of the city. 12 apartment blocks are detected on flooding area, where 1st Çevre Yolu Street and Kozcağız creek meet. Each block is observed to have 6 floors, and covers a site size square footage (floor area) of 300 m². Therefore, the total number of vulnerable dwellings in this part of the city is calculated as 150 and the total building square footage as 2.16 hectares.

Vulnerabilities along Karaçay Creek

The situation in terms of existing vulnerabilities on the northern parts of Bartın River is similar to the situation on the southern parts of the city. It is observed that vulnerabilities over the flood-prone area along Karaçay Creek are also limited.

A primary school is detected on the flooding area, where Orduyeri Street and Karaçay Creek meet. The total building square footage of the primary school, which is located on the east bank of Karaçay, is calculated as 0.3 hectare.

A residential estate namely Martı Sitesi is also detected in the same area. There are 5 apartment blocks located on the west bank of Karaçay, over the flood-prone area. Each block is observed to have 5 floors, and covers a site size square footage (floor area) of 850 m². The total number of vulnerable dwellings here is calculated as 100 and the total building square footage as 2.15 hectares.

In the vicinity of the residential estate there are 6 residential buildings, four of which are higher and larger than the other two. The total number of vulnerable dwellings in this area is calculated as 60 and the total building square footage of the 6 buildings as 1 hectare.

Finally, a five-storey building including 20 dwellings and 10 ground-floor shops is detected over the flooding area of Karaçay. This building, which is adjacent to the road junction, covers a site size square footage (floor area) of 500 m². The total building square footage of this building is calculated as 0.25 hectare.

Vulnerabilities along Bartın River

Majority of the vulnerabilities over the flood-prone area in Bartın City are located along Bartın River, which passes through the northern parts of the built-up area of the city. In the vulnerability analysis, this area is investigated in two different sections, namely the north and the south banks of Bartın River.

Vulnerabilities on the North Banks of Bartın River

Vulnerabilities observed on the north banks of the river are less when compared to the vulnerabilities on the south banks. Agricultural lands and vacant lands are the dominant land uses on north of Bartın River. Vulnerabilities in this section are largely concentrated in between Bartın River and Kaynarca and Orduyeri streets.

64 buildings, most of which are under residential use, are detected on the flooding area in between Kaynarca Street and Bartın River. 52 of these buildings are 5-storey apartment blocks, each of which covers a site size square footage (floor area) of 300 m². The rest of the buildings in this area are either low-storey multi-unit residential blocks or detached houses. These buildings occupy a floor area of 150 m² at an average. Consequently, the total number of vulnerable dwellings between Kaynarca Street and Bartın River is calculated as 550, and the total building square footage of the 64 buildings in this area are calculated as 0.83 hectare.

There is a primary school over the flooding area between Orduyeri Street and Bartın River. The total building square footage of this primary school is 0.65 hectare. There are two buildings under residential and agricultural uses in the vicinity of the primary school. These buildings have 0.1 hectare building square footage in total.

Moreover, 35 buildings, some of which are the examples of traditional Bartın houses, on the flood-prone area along Orduyeri Street are observed. 10 out of these 35 buildings are 5-storey apartment blocks. Each block covers a floor area of 250 m² at an average. The total number of dwellings on these blocks is calculated as 100 and the total building square footage as 1.25 hectares. 20 of the 35 buildings along Orduyeri Street are observed as traditional Bartın houses with one or two storey, each of which covers a floor area 100 m². Based on the calculations made by using the satellite images, the total number of independent housing units on these traditional buildings is 50. The total building square footage of the 20 traditional houses in this area are calculated as 0.50 hectare. The rest of the buildings (5 in quantity) detected along Orduyeri Street are small-size and detached houses. The site size (floor area) of these detached houses is 50 m². Therefore the total number of vulnerable dwellings on these buildings is accepted as 5, and the total building square footage as 0.03 hectare.

There is also a residential estate composed of 6 residential blocks over the flooding area between Orduyeri Street and Bartın River. Each block is observed to have 5 floors and covers a floor area of 400 m². It is assumed that the total number of dwellings in this residential estate is 120. The total building square footage is calculated as 1.2 hectares. In the vicinity of this residential estate, 28 buildings with different sizes are detected. 15 of these 28 buildings are 5-storey apartment blocks, each of which covers a site size square footage (floor area) of 200 square meters. There are 150 dwelling units in these apartments, and the total building square footage of them is calculated as 1.5 hectares. The other 13 buildings are observed as detached houses constructed on a floor area of approximately 100 square meters. Therefore the total number of dwellings in these buildings is accepted as 13 and total building square footage as 0.13 hectare.

Vulnerabilities on Southern Banks of Bartın River

Majority of the vulnerabilities in Bartın are concentrated on the south banks of Bartın River. Especially the flood-prone area in between Bartın River and 4th Çevre Yolu Street and Boğaz Street is occupied by various urban developments such as residential buildings, industrial premises and public facilities.

On the western part of the area in between Bartın River and Boğaz Street, 6 residential buildings are observed. 4 of these buildings are high-rise apartment blocks, whereas the rest two are detached houses. The total number of dwellings in these residential buildings is calculated as 42, and the total building square footage is calculated as 0.5 hectare. In the vicinity of these residential buildings, there are 6 buildings observed to be under industrial use. The total area occupied by these industrial buildings is 2 hectares. Another industrial establishment is observed in this area. This establishment is composed of three separate buildings located over an area of 0.3 hectare. Finally the cement factory of Bartın, which is formed by 10 separate buildings, exists over the flooding area in between Bartın River and Boğaz Street. The total area of the land occupied by the cement factory is 4 hectares.

On the eastern part of the area in between Bartın River and Boğaz Street, there is an organized industrial estate, which is named as “Yeni Sanayi Sitesi”. There are plenty of buildings, premises and warehouses with different sizes located in this industrial estate. Majority of the buildings in the estate are industrial workshops, each of which covers a floor area of 250 m². According to the calculations made by using the satellite images the total number of these workshops is about 400. Furthermore, the total area occupied by the organized industrial estate is calculated as 25 hectares. Thus, it is appropriate to conclude that 27.5 hectares land occupied by industrial establishments along Bartın River is vulnerable to flood events.

There are 70 buildings over the flood-prone area in between Bartın River and 4th Çevre Yolu Street. These buildings are located on the eastern part of “Yeni Sanayi Sitesi. 20 of these buildings are 5-storey apartment blocks, each of which includes 10 separate dwelling units. While the total number of dwellings in these blocks is 200, the total building square footage in these buildings is 2.5 hectares. The rest of the buildings in this area (50 in quantity) are low-storey and small residential buildings, each covers a floor area of 100 m² at an average. It is calculated that the total number of dwellings in these buildings is 150, and the total building square footage is 1 hectare.

Besides, Bartın Provincial Directorate of Ministry of National Education, which covers an area of 0.5 hectare, is located on the flooding area in between Bartın River and 4th Çevre Yolu Street. In the vicinity of the Directorate, 20 industrial buildings occupying an area of 1 hectare are observed.

5 buildings used by agricultural purposed are detected on the flooding area in between Bartın River and Tersane Street. The total building square footage of these buildings is calculated as 0.35 hectare.

There are 5 buildings observed to be under residential use on the flooding area in between Bartın River and Kanlıırmak Street. Each of these 4-storey buildings occupies a floor area of 150 m² at an average. The total number of dwellings and the total building square footage in these buildings are calculated as 40 and 0.3 hectare respectively.

On the flood-prone area where Bartın River and 3rd Çevre Yolu Street become parallel to each other there are 2 petrol and gas stations, located an area of 0.4 hectare. Moreover, there are 16 high-rise residential blocks (Lalekent and Menekşe Siteleri), each of which occupies a floor area of 350 m² at an average. There are 6 floors and 24 dwellings in each block. Therefore, the total number of dwellings in these buildings is 384, and the total building square footage of them is 3.4 hectares.

Up to now the detailed inventory of vulnerabilities located on the flood-prone area designated by DSİ in 2004 is presented. A summary of this inventory are displayed in the following table. As shown in Table 4.5 the total number of vulnerable buildings in Bartın is 705. Most of these buildings are under residential and industrial uses. The total number of residential dwellings constructed over flooding area is calculated as 2141. There are also plenty of vulnerabilities in terms of industrial establishments located over the flood-prone areas in Bartın.

Table 4.5: Numbers of Buildings and Dwellings on Flooding Area in Bartın

Type of Use	Number of Buildings	Number of Dwellings	Total Building Square Footage or Floor Area
Residential	256	2136	18,82
Education	2		0,95
Petrol Station	2		0,4
Public Facilities	1		0,5
Industry	439		32,3
Agriculture	5	5	0,35
TOTAL	**705**	**2141**	**53.32**

Table 4.6 presents a more detailed analysis of the vulnerabilities in Bartın. In addition to the number of existing stock on vulnerable areas, values of the current

stock as well as the population using that stock is also provided. Figures in the table enable us to state that vulnerabilities in Bartın are essential in quantity terms. 8.566 people are living in residences vulnerable to flood hazards in the city. When the population engaged to educational, administrative, commercial and industrial functions are considered the number of population under flood risk rises to 13.226 people. According to the results of 2000 population census, 47.082 people are living in the central district of Bartın Province. This indicates that approximately 30% of population in the city is either working or living in a property prone to flood hazard.

Table 4.6: Inventory of Vulnerabilities in Bartın City

	TYPES OF INVENTORY	TYPES OF URBAN LAND USE					
		Residential (1)	Education (2)	Adminis-trative (3)	Commer-cial	Industrial (4)	TOTAL
Vulnerabilities Along Bartın River and Kozcağız and Karaçay Creeks	Number of Buildings	**261**	**2**	**1**	**2**	**439**	**705**
	Number of Dwellings	**2.141**	**-**	**-**	**-**	**-**	**2.141**
	Total Building Square (m²) Footage (5)	**191.500**	**9.500**	**5.000**	**4.000**	**323.000**	**533.000**
	Value of Stock (TL) (6)	**1.890.850**	**103.000**	**42.500**	**34.000**	**2.745.500**	**4.815.850**
	Value of Stock ($) (7)	**978.250**	**73.500**	**30.500**	**24.250**	**1.950.000**	**3.056.500**
	Approximate Population (person) (8)	**8.566**	**2.000**	**150**	**10**	**2.500**	**13.226**

(1) Includes all residential buildings and agricultural buildings such as farms, etc.
(2) Includes all kinds of schools, colleges, etc.
(3) Includes all kinds of public institutions and facilities.
(4) Includes factory sites, small and medium scale industrial premises, and industrial sites/estates.
(5) Total area of all floors of residential buildings and total area occupied by industrial, administrative, educational and commercial uses.
(6) Is calculated by using the property values per m², officially declared by Revenue Administration of Turkey to assess the taxable values of properties (2006 values). It should be noted that the values in the table are probably lower than the actual values.
(7) Is calculated by using the exchange rates for US Dollars in December 2006
(8) For residential buildings, the average household size is taken as 4 persons,
For education, Bartın Fatih İlköğretim Okulu, in which 950 students are being educated by 50 staff, is taken as an example.
For industry, number of working population is calculated by using 75 people per hectare as a standard.
The only administrative facility is Bartın Provincial Directorate of Ministry of National Education, which has 150 staff.
The only commercial use is a petrol station. Total number of staffs in the station is accepted as 10.

Value of the existing stock on flood-prone areas is calculated as about 5 Million TL in 2006 prices, which corresponds to 3 Million Dollars. However these figures cover only the value of the properties on flood-prone areas. When the total value of the industrial and commercial establishments including the technology, machinery, etc. is considered the value of the vulnerabilities would increase. The annual budget of Bartın Municipality for fiscal year of 2009 has been approved by the Municipal Council as 30 Million TL[21]. This figure covers all types of incomes and expenditures of the municipality in a year. Therefore, value of vulnerabilities in Bartın corresponds to 15% of the annual budget of the municipality. On the other hand, according to the information given by DSİ Officials total cost of flood protection measures implemented in central district of Bartın Province stands at 650.000 TL with 2006 prices. Current value of vulnerabilities is 5 times more than the total amount of previous structural investments, which have been insufficient to mitigate the flood risks.

These figures show that the rational decision is to avoid urban developments on flood-prone areas. Once development is not controlled or permitted over flooding areas the potential volumes of losses in terms of human life and properties increase. Besides, structural measures remain insufficient to reduce the risks and to prevent the losses. Therefore, in case of a flood event that brings serious damages substantial amount of resources including the money spent on both existing urban developments and structural measures are lost. As a final remark, it should be emphasized that in order to mitigate flood risks in riverine urban environments urban developments including essential numbers of properties should be avoided on flood-prone areas. These areas should be used for urban functions requiring large open areas such as urban parks, sports and recreation areas, etc.

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21 http://www.bartinbelediyesi.com/bld/index.php?option=com_frontpage&Itemid=1&limit=7&limitstart=77 (last access 30.04.2009)

4.1.2 Dicle Basin, Batman-İluh River Basin Floods and Batman City

Batman River that flows near the city of Batman originates in Sason and Genç Mountains in a channel oriented in the north to south direction, until it joins the Dicle River (Tigris) in the southeast of Turkey. It defines the provincial border between Diyarbakır and Batman. Due to its irregular river bed it floods the Batman plain usually in the winter and spring seasons.

One of the tributaries of Batman River, called İluh River, passes through the Batman provincial center. Rising from Raman Mountains in the southeast Eliheyolu Creek, merges with the Çay Creek and Savaro Creeks and create İluh River in the Bartın city center. İluh River is discharged into Batman River in the northwestern parts of the province. Figure 4.9 shows the sub-basins in Batman-Iluh River Basin.

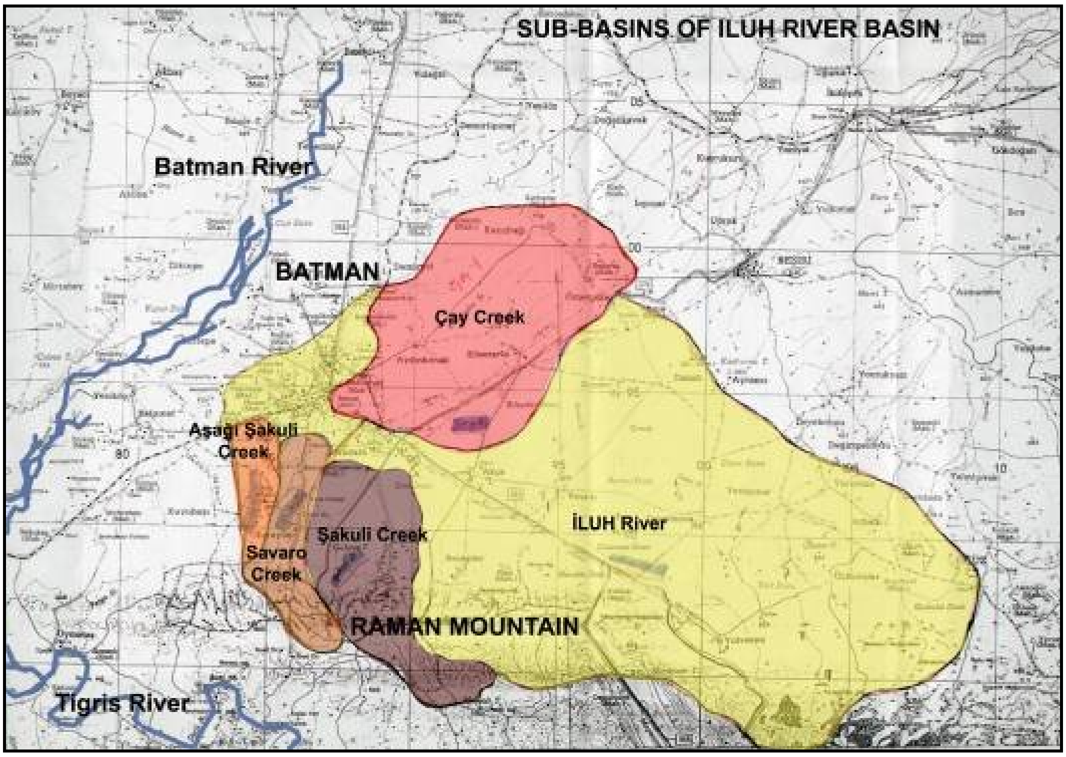

Figure 4.9: Sub-Basins of Batman–İluh River Basin
(Sources: Official Document dated 27.12.1991 in DSİ Archive File of Batman)

Hence, Dicle River Basin contains Batman and İluh River Basins. Batman city center is located on eastern plains of Bartın River and downstream lands of İluh River basin that is fed by Çay, Aşağıkonaka, Savaro Creeks. In the east part the Raman Mountain, in the north Kıra Mountain and Southeastern Taurus Mountains are located. Although northern and southern parts of the province have high, rocky and mountainous lands, the city is built up on almost flat lands at 540 m. altitude above sea level.

Batman is located on the transition zone of continental and desert climate. The precipitation in winter season (December to April) is twice of Ankara's precipitation. However at summer season it is usually very dry in Batman (DMİ Official Website). Dry-farming is observed at the edges of Batman plain, whereas irrigated farming along the Batman River prevails. There is almost no forest land in Batman. Soil type in Batman and its environs is unstable and can easily be eroded with water flows. It consists of clay and clay stone which are soft and have low permeability capacities. At the same time, rivers in Batman province are generally dry in summer seasons. However rainfalls in spring and autumn seasons generally create high discharges, and usually cause floods (Table 4.7). These floods are mainly observed along İluh River, which passes through the town center, and along its tributaries; namely Çay, Savara, Aşağıkonaka, Şakuli.

Although the city of Batman experiences usually long dry months and usually droughts, flood events in 1969, 1972, 1991, 1995 and 2006 have resulted in gradually increasing damages (Table B.1 in Appendix B). Table 4.7 displays the exact dates of the flood events that have taken place in Batman. According to the table it is understood that floods generally occur in spring and autumn seasons in Batman.

Table 4.7: Exact Dates of Major Floods in Batman Province

SEASON	MONTHS	WEEKS	MAJOR FLOOD EVENTS
WINTER	December/January	Week 1	
	January	Week 2	
	January	Week 3	
	January	Week 4	
	January/February	Week 5	
	February	Week 6	
	February	Week 7	
	February	Week 8	
	February	Week 9	
SPRING	March	Week 10	
	March	Week 11	
	March	Week 12	**1995** (950 buildings inundated, 450 damaged, 3 collapsed)
	March	Week 13	
	March/April	Week 14	
	April	Week 15	
	April	Week 16	**1969** (60 buildings totally damaged)
	April	Week 17	
	April/May	Week 18	**1972** (110 buildings damaged)
	May	Week 19	
	May	Week 20	
	May	Week 21	**1972** (100 buildings damaged, 83 totally damaged)
	May	Week 22	
	May/June	Week 23	
SUMMER	June	Week 24	
	June	Week 25	
	June	Week 26	
	June/July	Week 27	
	July	Week 28	
	July	Week 29	
	July	Week 30	
	July/August	Week 31	
	August	Week 32	
	August	Week 33	
	August	Week 34	
	August	Week 35	
	August/September	Week 36	
AUTUMN	September	Week 37	
	September	Week 38	
	September	Week 39	
	September/October	Week 40	
	October	Week 41	
	October	Week 42	
	October	Week 43	
	October	Week 44	**2006** (100 people died and 20 people injured)
	November	Week 45	**1991** (500 buildings inundated, 3 buildings collapsed)
	November	Week 46	
	November	Week 47	
	November	Week 48	
WINTER	November/December	Week 49	
	December	Week 50	
	December	Week 51	
	December	Week 52	

Documents and survey reports in DSİ archive files of Batman, contents of which are given in the Appendix B.2, indicate the main reasons of losses of such major floods in Batman as follows:

- Inefficiency of the riverbed due to direct discharge of sewerage,
- Blockage of the natural link between Çay and İluh River by residential developments and urban facilities,
- Construction of buildings on floodway and floodplains of İluh River,
- Decrease in the riverbed flow capacity due to the construction of bridges by municipal government over İluh River, to the direct discharge of sewerage and solid waste and to the construction of sewage water collectors,
- Lack of effective and regular clearance of the debris agglomerated on İluh riverbed
- Blocking effect of Batman-Midyat Road and TPAO Facilities on Çay Creek,
- Closed channel use of the tributaries namely Savara, Aşağıkonaka, Şakuli as streets, public services and residential developments
- Inefficiency of the existing infrastructure systems such as rain-water and sewage systems.

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Table 4.8: Documents Related to Batman Flood Events

Date	Type of the Event/Activity/Project/Development Plan/Aerial Photos Available
1926	Batman River Flood Event (Elmedin District was affected)
1952	Aerial Photo of Batman (Harita Genel Komutanlığı 2008)
1959	Development Plan Prepared by Raşit Durak on behalf of Municipality
1968	Survey Report (DSİ)
10-11.4.1969	İluh Flood Event
1969	Flood Protection Survey Report (not feasible to transfer 60 dwelling units to safer locations) (DSİ)
1971	Flood Protection Survey Report (Rehabilitation projects of İluh and Çay Creeks in 8 years developments cannot be prohibited on flood-prone areas) (DSİ)
30.04.1972	İluh Flood Event
14-15.5.1972	İluh Flood Event
1976	Development Plan Prepared by Yavuz Taşçı on behalf of Municipality
1984	Aerial Photo of Batman (Harita Genel Komutanlığı 2008)
1990	Debris/Erosion Survey (DSİ)
1991	Development Plan Prepared by Barlas & Barlas on behalf of Municipality
1991	İluh Flood Event
1992	Survey Report (DSİ)
17.03.1995	İluh Flood Event
July 1995	Survey Report (DSİ)
August 1996	Iluh Reclamation Project Meeting
2000	Revision Plan Prepared by Nevzat Uğurel on behalf of Municipality
2003	Reclamation Facility for inner city segment of Iluh River Construction Started
2004	Construction Completed (DSİ)
31.10-2.11.2006	İluh Flood Event
2007	Survey Report (DSİ)
2007	Revision Plan Prepared by Nevzat Uğurel on behalf of Municipality

For such causes DSİ has proposed a number of protective solutions after any flood event. However, such proposals were not implemented in time and properly. According to DSİ Survey reports (in 1968, 1969, 1971, 1992, 1995 and 2007) the following proposals are made:

- transfer of dwellings on floodplains to safer locations,
- rehabilitation of İluh and Çay Rivers,
- clearance of solid waste and debris,
- avoidance of direct sewage discharge,
- reconstruction of sewage connectors of TPAO outside the riverbed,
- reconstruction of bridges according to hydraulic standards,
- revitalization of the riverbeds of tributaries; such as Çay, Savaro, Aşağıkonaka in order to create their natural link with İluh River by opening of closed parts of tributaries and construction of reclamation facilities with service road for maintenance-clearance works,
- extension of the existing flood protection facility 500 m. long to protect newly developed areas,
- provision of earth channel reclamation towards Batman River and creation of 30 m buffer zone behind both banks,
- revision of development plan for the adaptation of İluh reclamation project,
- expropriation of certain areas to implement the reclamation project,

However, most of the DSİ recommendations could not be implemented mainly due to uncontrolled developments on dry riverbeds. The city growth and development plans provided legal status to such establishments. These experiences reviewed in the following pages have also created vulnerable areas regarding river floods.

4.1.2.1. Population Status, City Growth and Planning Decisions

İluh was first settled as a village of Elmedin district of Siirt. After Batman River flood in spring of 1926 Elmedin district disappeared. Then İluh was a village of Beşiri sub-province. After becoming a district in 1937, it was annexed to Siirt province in 1957. In 1990, İluh village gained status of a central sub-province of the Batman province (Uğurel 2007, 21-22).

The settlement was first established on the İluh hill called İluh precinct (mahalle) today. Then it expanded in rings towards the direction of north and northeast until 50's (Figure 4.10). This growth continued along the Diyarbakır road after the requisition of provincial status, because administrative facilities and commercial activities were located along this road (Uğurel 2007).

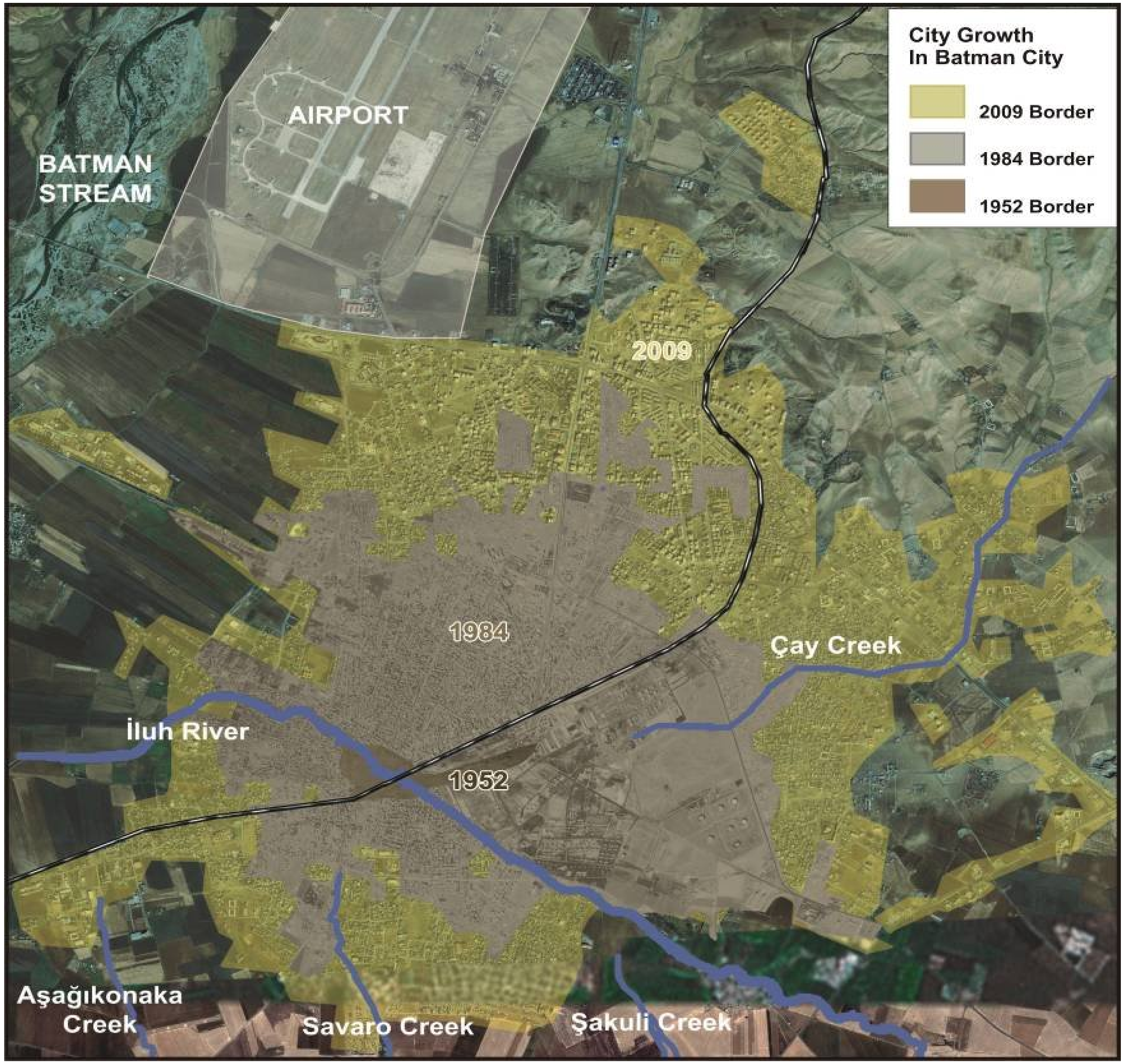

Figure 4.10: Growth of Batman City (Years 1952, 1984, 2009)
Based on Sources of Harita Genel Komutanlığı & Google Maps)

After oil reserves were found in the Raman Mountain ranges and were operated by the Turkish Petroleum Corporation (TPAO) in 1954, Batman became a regional growth point. Batman Vocational High School was established in 1975 with an extensive education hinterland in this region. According to the Development Plan Analysis Report by Uğurel (2007) Batman was declared a 'Priority Region for Development' and urban population rapidly increased (Table 4.9). Due to migration from rural settlements of the Southeastern Anatolia, Batman old city center transformed. Limited lands for development and high land prices in the city center caused densely populated development. One-storey buildings were rebuilt as multi-storey buildings on the same urban plots of the old city center. According to the Census of 2000, the population density is 484 person/km^2 in the Batman central sub-province. This process of intensification was also observed in residential neighborhoods adjacent to central area.

Table 4.9: Batman Urban Population Rate

1950	1955	1960	1970	1975	1980	1985	1990	1997
39.63	56.55	69.99	76.83	81.93	83.82	84.99	72.80	90.12

(Source: TÜİK 2007)

Since 1990, Batman has 5 sub-provincial municipalities; Beşiri, Kozluk, Sason, Gercüş and Hasankeyf, 6 local auxiliary municipalities and 270 villages (http://www.yerelnet.org.tr). Main economic sector is petroleum industry. Agricultural activities, husbandry, commerce and particularly administrative service sectors are in secondary position. Due to the advantageous location in terms of transportation Batman is the regional market place that controls the marketing of goods and products of surrounding settlements in the economic and social networks of the national market (Uğurel, 2007).

The 1976 development plan was prepared by Yavuz Taşçı and approved by the Ministry of Public Works and Settlement. According to this plan new developments were allowed on the northern parts of the city. Because of the prevailing wind, the industrial areas and related institutions are more appropriately located in the south and southeastern parts.

In order to create a new urban fabric, development of the commercial center parallel to the railway was discouraged by the 1976-Development Plan. It was extended to the north and northeast along the Diyarbakır highway. This extension was both integrated with wholesale retail and market areas and also with the sports and recreation areas planned as an extension of the city park. Nevertheless, such plan decisions were not preserved by local authorities because low-income migrant population from rural parts of the Southeastern Anatolia created high demands in housing supply. Such population who came to Batman for new job opportunities in the sectors of petroleum refinery and other supportive industries and services invaded lands and established unauthorized residential areas. Subsequent development plan (1991 Plan-Barlas) and revision plans (2000 and 2007 Revisions-Uğurel) were prepared to meet such development dynamics of rapid population increase. Instead of governing such developments, they have legalized such developments.

According to field surveys of the revision plan about the Highway route (Uğurel 2007) the inequalities in the distribution of property ownership in Batman province affect social structure. For example, there is no legal ownership of 1200 houses some of which are built on rental lands of State and some of which are used in agricultural production with respect to partnership system. The migrated population from rural parts of Southeastern Anatolian Region created squatter establishments since 1950 and this population brought their traditional modes of life, customs and feudal relations together. The yearly population increase rate has reached the highest value in the period of 1955-60 while comparing other periods. These social relations have also determined economic structures in the Batman city. Multi-marriages, higher fertility rates are usually observed in empirical surveys of Development Plan Analysis Report by Uğurel (2007). According to the 2000 census family is composed of an average of 5 persons and the average household size is 6 persons. Usually more that one family (extended families) lives in one dwelling unit in Batman.

Squatter establishments on public lands are defined as unauthorized housing. Private lands are lands owned by foundations and associations are not observed in Batman. Rather, such developments exist in the form of ‘shared ownership’. In the case of Batman property owners of a particular land sell informally sub-divided plots (approx. 100-200 m^2) based on private agreements they prepare (Uğurel, 2007). Therefore, it is not possible to implement plan decisions like readjustment in such areas or to put amelioration plans into force.

4.1.2.2. Vulnerability Analysis in Batman City

In this section, the vulnerability analysis aimed at defining the inventory of vulnerabilities in Batman city is presented. This analysis is functional to determine, and to assess the probable volumes and values of losses in a case city. Furthermore, this analysis would enable us to compare the likely losses with the costs of measures to reduce risks, and to derive opinions about the viability of such measures. To start with, major decisions concerning the spatial development of Batman City are discussed in relation to the flood issues. Following this discussion, the analysis on the inventory of vulnerabilities in Batman is presented.

4.1.2.2.1. Batman City Growth and Increasing Risks of Floods

Although a number of protection facilities were constructed; such as İluh River reclamations, Batman dam, flood losses have been gradually increasing in Batman central sub-province. For instance, the 2006 floods affected 35 precincts with 100’000 people, and 20 people were injured, 11 people were killed.

Soil type in Batman and its environs is unstable which can easily be eroded by water. It’s also made up of clay and clay stone which are soft and have low permeability. Due to such properties top soil flows with the rainfall and accumulates on the riverbed, thus causing decreases in its carrying capacity. Another variable is topography which has critical impacts on the intensity of floods. Northeastern and southern parts of Batman are steep. Slope decreases on locations towards Batman River where average slope is % 0.6. However the town center is located on almost zero slope, when flooding occurs it spreads throughout the town center (1971 DSİ Official Survey Report).

It can be observed that apart from such natural circumstances, consequences of human actions result in the increase of flood damages. There are a number of examples about such actions obtained from detailed flood damage surveys done by DSİ in 1968, 1969, 1971, 1992, 1995 and 2007.

- Waste water discharges of the city sewage system, as well as solid and construction waste dumping into rivers are main activities that decrease carrying capacity of rivers.
- Another factor, that is particular for Batman case, is about the placement of waste water collectors of Petroleum Refinery (TPAO) into the river channel lowering the riverbed capacity further.
- Pedestrian and vehicle transport bridges, joining two sides of the rivers are not properly designed or rebuilt in accordance with hydraulic standards of flow. So they usually behave as bottlenecks. Various waste materials, sediments and debris are accumulated causing inundations from such spots.
- Furthermore, a number of interventions like cutting off natural connections of tributaries (Çay, Savaro and Aşağıkonaka) with İluh River in order to use for streets and residential developments are the main factors of flood losses today (figure 4.9). Such interventions are the product of certain processes in the past. As mentioned in survey reports, these areas were mostly preferred by unauthorized settlements. At the same time, dry seasons have given such opportunities even in determining cadastral areas. For example, the location decision of TPAO area in 1954, and surrounding residential developments led to block Çay Brook connection with İluh River. While expanding out and being densely populated inner city, other connections were blocked as well.

Hence, the city has grown into broad agricultural fields, getting densely populated particularly in central neighborhoods (Figure 4.10). However, during such unplanned growth, the provision of public services; particularly open spaces and green areas decreased inevitably. For instance, according to latest revision plan (by Uğurel 2007), total green area per person is calculated as 6.85 hectares. However, to achieve the minimum standard, that is 10 hectares/person, 295 ha green land is required.

Therefore, within such an impermeable soil structure, poor vegetation and nearly flat land, even very weak rainfalls can easily create inner-city inundations (flash floods) as well as river floods. In time these lands are legalized by certain populist interventions of local governments like amelioration plans empowered by related laws.

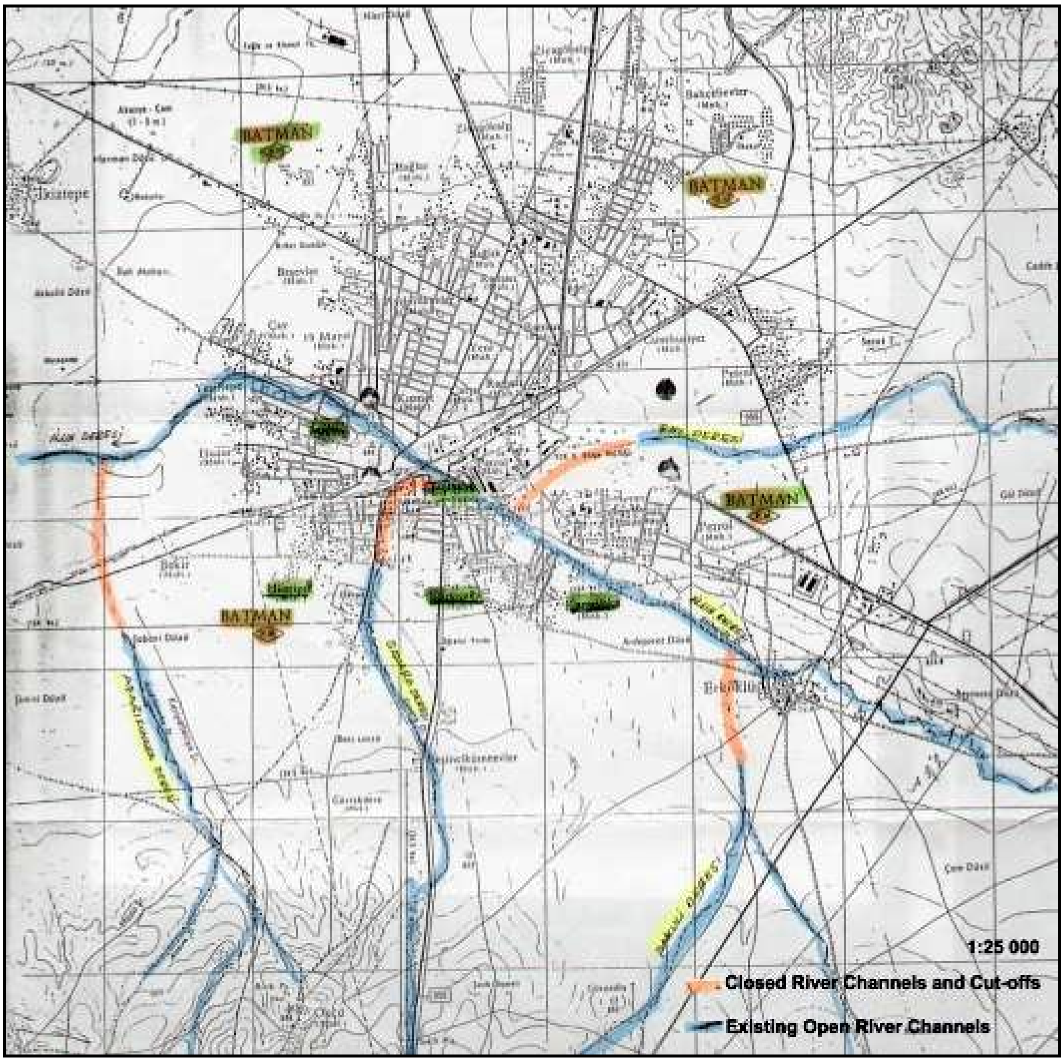

Figure 4.11: Blockage of Tributaries by Streets and Residential Developments *(Source: Official Document of DSİ dated 30.11.2006)*

Following the disastrous losses of 2006 floods in Batman, DSİ and General Directorate of Disaster Affairs have conducted a collaborative study according to the protocol dated 1984 (Appendix H). First of all, the impact area of 2006 floods in Batman city was identified and drawn on digital base maps by the engineers of DSİ. As stated by the Head of Investigation and Planning Division of DSİ (Inal 2007) after that it was compared with the impact areas of 500-year and 1000-year design flood discharges. Then, the team from both institutions determined the properties and property owners that were affected and may probably be most frequently affected by floods. In this way the transfer of these properties to pre-determined mass housing areas to be constructed in relatively safer locations by the Housing Development Administration (HDA) were planned. Nevertheless, it was difficult to realize such transfers as planned due to the complicated status of property ownership in Batman. Households are composed of extended families, and shared ownership pattern is the extensively prevailing status in Batman. For this reason, today buildings in flood-prone areas and new apartment flats are both in use. The expropriation of these flood-prone areas has not been easy and has not be thoroughly implemented.

Even in the 2007 Revision Plan concerning the southern highway route, these areas are not taken into consideration as shown in Figure 4.12. The area, which was delineated as flood area after 2006 floods, is designated as housing area in the plan. No specific decisions and provisions are determined in the plan concerning the area affected seriously by 2006 floods.

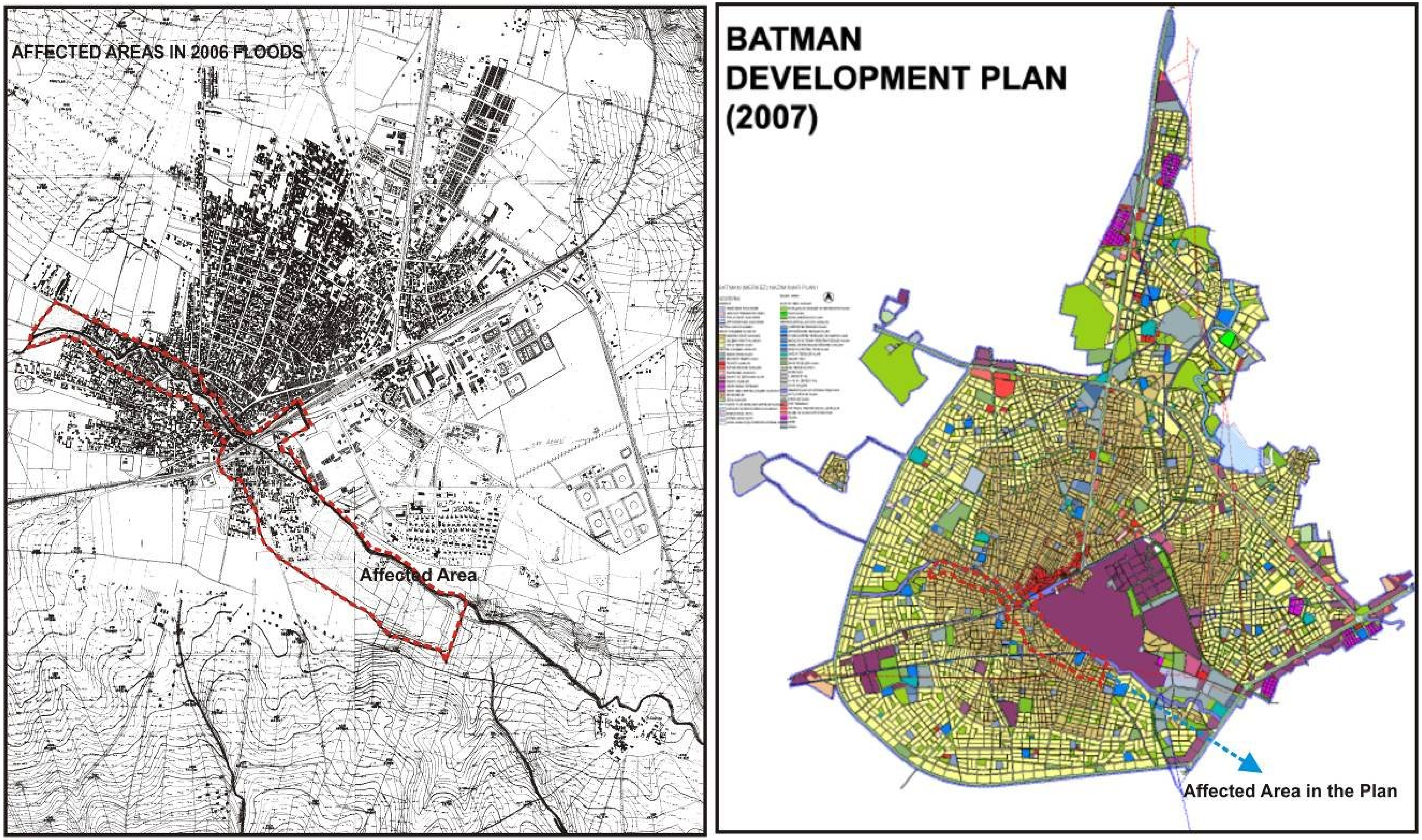

Figure 4.12: Affected Area of 2006 Floods and Revision of Development Plan (2007)
(Sources: left from Official Document of DSİ dated 26.01.2007, right from Uğurel 2007

4.1.2.2.2. Inventory of the Vulnerabilities in Batman City

Vulnerability analysis in Batman city is based on the flood-prone area designated by DSİ in 2006 and on the satellite image of the city. The flood-prone area was designated by DSİ only for a particular part of the city center in Batman. The borders of the flood-prone area in Batman city center are shown in Figure 4.13. In this figure the border is delineated on the satellite image of the city

The inventory of vulnerabilities covers the information about the buildings and urban developments located within the flood-prone area. This information in Batman is mainly derived from the current satellite images. Besides, some of the information is derived from the existing information on the basis of some assumptions.

Vulnerability analysis in Batman is made on two different sections of the city. These sections are mainly along İluh River, which passes through the city center in Batman. The first section subjected to the analysis could be named as the western parts of Selahattin Eyyubi Street, whereas the second section as the eastern parts of Selahattin Eyyubi Street.

Western Parts of Selahattin Eyyubi Street

Vulnerabilities are observed on both banks of Iluh River on the western part of Selahattin Eyyubi Street. The area is largely occupied by unauthorized and low-quality houses. Based on the calculations made by using the satellite images, there are 140 buildings located on the north banks of Iluh River. The total area occupied by these buildings is calculated as 7.5 hectares. According to our observations, the average number of floors of the buildings constructed in this area is 3 and the average floor area of them is 175 m². Therefore, the total number of vulnerable dwellings on the north banks of Iluh River is determined as 850. Besides, the total building square footage of 140 buildings observed in this area is calculated as 7.35 hectares. There is not any substantial urban use located on the flooding area in this part of the city. The only exception of this situation is a mosque serving at neighborhood level.

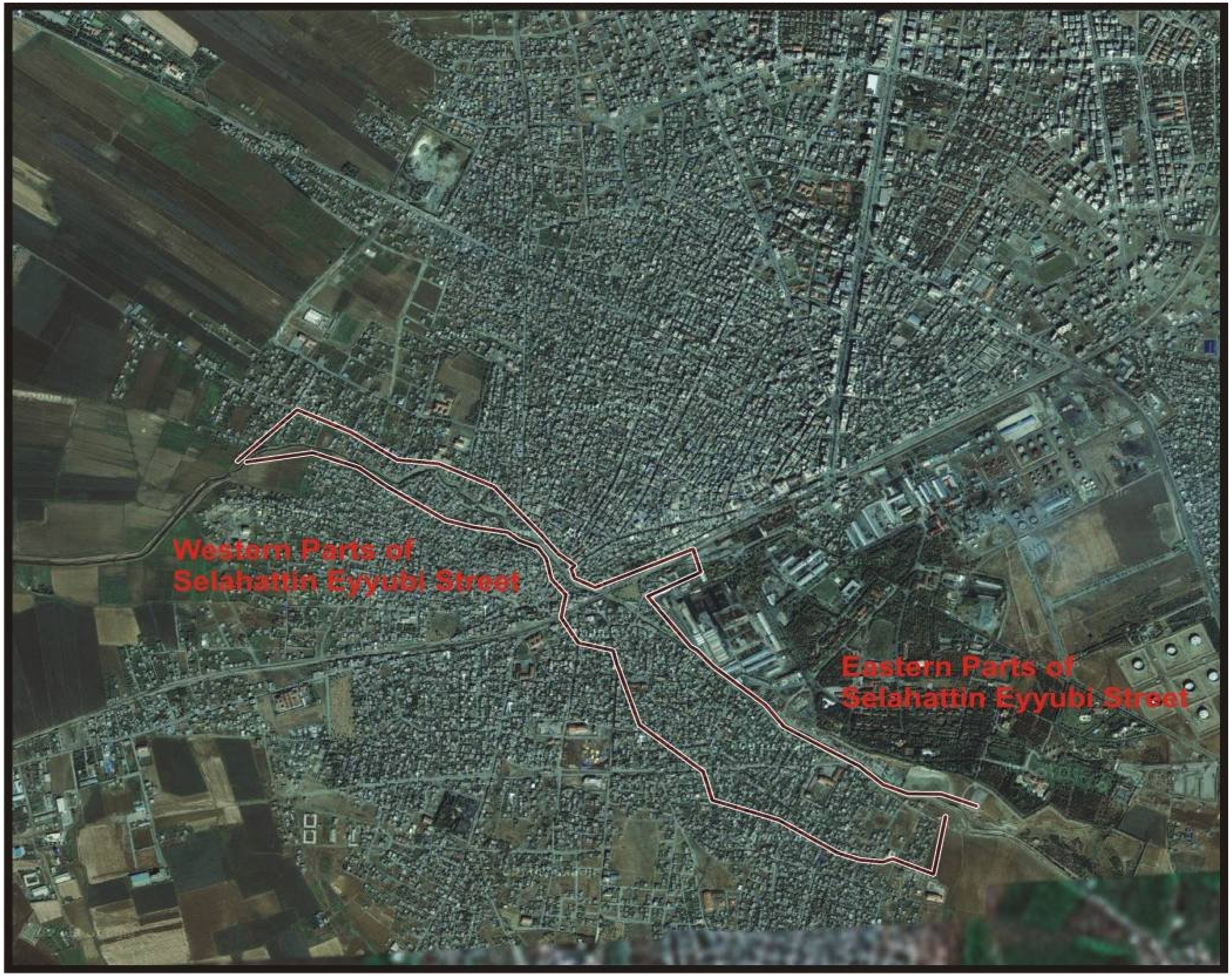

Figure 4.13: 2006 Flood-Prone Area on the Satellite Image of Batman
(Sources: Official Document of DSİ dated 26.01.2007, Google Maps)

There are plenty of vulnerabilities on the south banks of Iluh River. Based on the calculations made by using the satellite images, there are 300 buildings located over the flood-prone area on this bank. The total area of the land occupied by these buildings is 8.85 hectares. The average number of floors and the average floor area of the buildings constructed in this area is 3 and 175 m² respectively. Therefore, the total number of vulnerable dwellings on the south banks of Iluh River is determined as 1800, and the total building square footage of 300 buildings observed in this area is calculated as 17.75 hectares. Yet no substantial urban use is observed on the south banks of Iluh River.

All in all, 440 buildings and 2650 dwellings are determined as vulnerabilities exist on the flooding area on the western part of Selahattin Eyyubi Street. The total building square footage of these buildings is calculated as 25 hectares, which should be accepted as a high amount.

Eastern Parts of Selahattin Eyyubi Street

Several vulnerabilities are detected on the area, where Selahattin Eyyubi Street and Iluh River meet. The vulnerabilities in this area are concentrated along the railway line. The total number of vulnerable buildings, which are generally high-rise and mixed-use buildings, is about 50. Based on the observations made by using the satellite images, the average number of floors and the average floor are of these buildings are assumed as 4 and 250 m² respectively. Thus the total number of dwellings (or separate units in buildings) and the total building square footage of these dwellings located along the railway line are calculated as 600 and 5 hectares respectively. There is also a cemetery and a public institution located on the flood-prone area in this part of the city. The cemetery and the public institution cover an area of 1.1 hectares in total.

There are plenty of vulnerabilities on the south banks of Iluh River. Although it is developed as a residential area there are also non-residential uses vulnerable to floods in this part of the town.

Based on the calculations made by using the satellite images, there are 1245 residential buildings located on the south banks of Iluh River. The total area occupied by these buildings is calculated as 52 hectares. According to our observations, the average number of floors of the buildings constructed in this area is 4 and the average floor area of them is 200 m². Therefore, the total number of vulnerable dwellings on the south banks of Iluh River is determined as 15.000. Besides, the total building square footage of 1245 buildings observed in this area is calculated as 100 hectares.

Moreover there are two schools located on the flooding area in this part of the city. These schools are composed of 5 separate buildings and they cover an area of 2.5 hectares in total.

Up to now the detailed inventory of vulnerabilities located within the flood-prone area designated by DSİ in 2006 is presented. A summary of this inventory are displayed in the following table. As shown in Table 4.10 the total number of vulnerable buildings in Batman is 1741. Most of these buildings are under residential uses. The total number of residential dwellings constructed over flooding area is calculated as 17650. There are also plenty of vulnerabilities in terms of mixed-use buildings located over the flood-prone areas in Batman city center.

Table 4.10: Number of Buildings and Dwellings on Flooding Area in Batman

Type of Use	Number of Buildings	Number of Dwellings	Total Building Square Footage or Floor Area
Residential	1685	17650	125.1
Mixed	50	600	5.0
Education	5		2,5
Public Facilities	1		0,6
Cemetary	0		0,5
TOTAL	**1741**	**18250**	**133,70**

Table 4.11 presents a more detailed analysis of the vulnerabilities in Batman. In addition to the number of existing stock on vulnerable areas, values of the current stock as well as the population using that stock is also provided. Figures in the table enable us to state that vulnerabilities in Batman are essential in quantity terms.

The number of population living in residences vulnerable to flood hazards in the city is calculated as 70.600 people. When population in educational and administrative facilities as well as the population in mixed-use zones are considered the number increase to 76.380 people. According to the results of 2000 population census, 293.024 people are living in the central district of Batman Province. This indicates that approximately 26% of population in the city is either working or living in a property prone to flood hazard.

Table 4.11: Inventory of Vulnerabilities in Batman City

	TYPES OF INVENTORY	**TYPES OF URBAN LAND USE**				
		Residential	Educational (1)	Administrative (2)	Mixed Use (3)	TOTAL
Vulnerabilities Along Iluh River in Central Parts of Batman	Number of Buildings	**1.685**	**5**	**1**	**50**	**1.741**
	Number of Dwellings	**17.650**	**-**	**-**	**600**	**18.250**
	Total Building Square Footage (m²) (4)	**1.251.000**	**25.000**	**6.000**	**50.000**	**1.332.000**
	Average Value of Stock (TL) (5)	**13.730.500**	**275.000**	**900.000**	**7.500.000**	**22.405.500**
	Average Value of Stock ($) (6)	**9.800.500**	**200.000**	**645.000**	**5.350.000**	**15.995.500**
	Approximate Population (person) (7)	**70.600**	**2.000**	**180**	**3.600**	**76.380**

(1) Includes all kinds of schools, colleges, etc.
(2) Includes all kinds of public institutions and facilities.
(3) Includes the buildings in city center used for commercial and residential purposes
(4) Total area of all floors of residential and mixed-use buildings and total area occupied by administrative and educational uses.
(5) Is calculated by using the property values per m², officially declared by Revenue Administration of Turkey to assess the taxable values of properties (2006 values). It should be noted that the values in the table are probably lower than the actual values.
(6) Is calculated by using the exchange rates for US Dollars in December 2006
(7) For residential buildings, the average household size is taken as 4 persons,
For mixed use buildings, the average household size is taken as 6 persons
For education, Bartın Fatih İlköğretim Okulu, in which 950 students are being educated by 50 staff, is taken as an example.
For administration, Bartın Provincial Directorate of Ministry of National Education, which has 150 staff and covers 0.5 ha land is taken as an example.

Value of the existing stock on flood-prone areas is calculated as about 22.5 Million TL in 2006 prices, which corresponds to 16 Million Dollars. Value of current vulnerabilities in Batman is higher than the ones in Bartın. This is because the flood-prone area in central parts of Batman is highly occupied. However the values mentioned cover only the value of the properties on flood-prone areas. When the total value of commercial establishments and some essential infrastructural utilities such as the railway line are considered the value of the vulnerabilities would increase.

The annual budget of Batman Municipality for fiscal year of 2009 has been approved by the Municipal Council as 117.5 Million TL[22]. This figure covers all types of incomes and expenditures of the municipality in a year. Therefore, value of vulnerabilities in Batman corresponds to 20% of the annual budget of the municipality. On the other hand, according to the information given by DSİ Officials total cost of flood protection measures implemented in central district of Batman Province stands at 7.700.000 TL. Current value of vulnerabilities is 3 times more than the total amount of previous structural investments, which have been insufficient to mitigate the flood risks.

The statements that were made after the vulnerability analysis in Bartın could be repeated here. The findings of vulnerability analyses in both cases enable us to state that the rational decision is to avoid urban developments on flood-prone areas. Once development is not controlled or permitted over flooding areas the potential volumes of losses in terms of human life and properties increase. Besides, structural measures remain insufficient to reduce the risks and to prevent the losses. Therefore, in case of a flood event that brings serious damages substantial amount of resources including the money spent on both existing urban developments and structural measures are lost. In the light of these findings, it should be emphasized that in order to mitigate flood risks in riverine urban environments urban developments including essential numbers of properties should be avoided on flood-prone areas. These areas should be used for urban functions requiring large open areas such as urban parks, sports and recreation areas, etc.

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[22] http://www.lpghaber.com/2009-Yili-Batman-Belediyesi-nin-Butcesi-Kabul-Edildi--haberi-143299.html (last access 30.04.2009)

4.1.3 B. Menderes Basin, Inner City River Floods and Aydın City

Büyük Menderes is the 9th largest basin with the basin area of 25'000 km2. When the climatic and topographic structure is taken into consideration it is composed of two sub-basins. The upper basin covers Afyon, Uşak and Denizli provinces, while Muğla and Aydın are in the lower basin of B. Menderes. Mountains are generally located perpendicular to the sea in the basin. In the northern part of the B. Menderes Valley there are Aydın Mountains, and Beşparmak, Madrababa, Gökbel Mountains in the southern parts. As moving to the inner parts elevation increases. Although the amount of snowfall is limited, the water provided by rapid snowmelt is sometimes in crucial volumes. Thorough the valley the annual precipitation is between 500-700 mm. On the higher altitudes this increases to approximately 1000 mm (Flood Survey Report of DSİ dated 04.06.2004).

During the summer season precipitation is quite low. In the eastern part of the valley most of the annual precipitation occurs in autumn and winter months. Thus, B. Menderes River reaches its peak level during January and February. In the upper basin which is a transition zone between Mediterranean and Continental Climate, spring rainfalls are significant. In this section where the snowmelt is drastic, the maximum flows are seen during spring months. On Table 4.8 the exact dates of these flood events are shown. Flood events mostly occurred in spring and winter seasons in Aydın.

The biggest river of Aydın is Büyük Menderes 281 km. which flows through Aydın Province from east to west. From east to west Dandalas, Akçay and Çine Creeks (and Karpuzlu connecting Çine) join Büyük Menderes River. Apart from these, there are a number of small brooks joining to Büyük Menderes which are mostly dry in summer, namely İkizdere, Malgaç, Köşk, Koçak, Emirdoğan, İmamköy,Torluk and Kısır. Tabakhane and Kemer Brooks cause continual flood losses in the Aydın provincial center despite the improvements in protection measures (Figure 4.14).

Aydın has been affected by a number of flood events in 1956, 1958, 1965, 1993, 1996, 1999, 2001, 2003, 2004 and 2007 (Appendix B.3). B. Menderes and its tributaries almost regularly cause flood damages in agricultural fields.

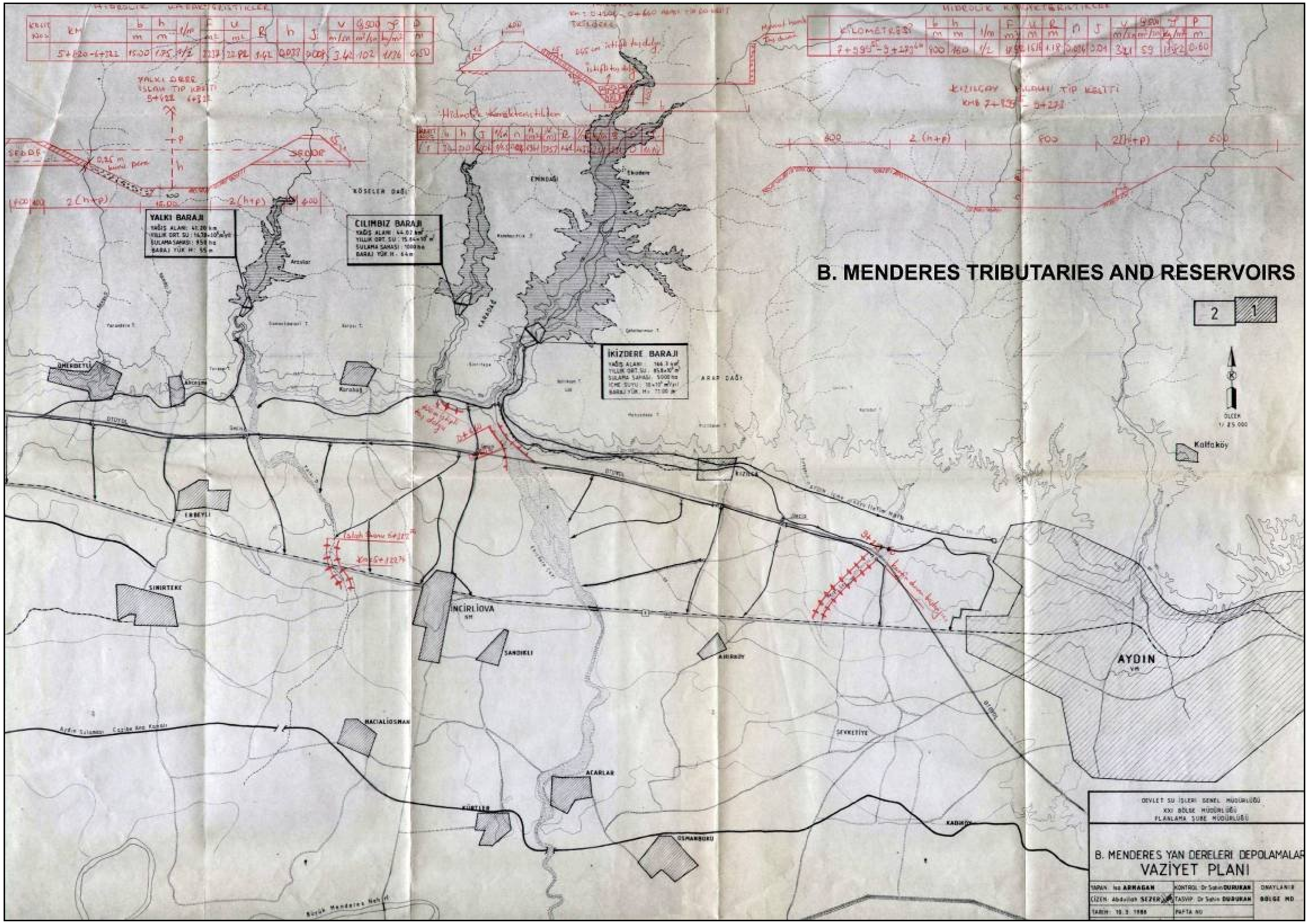


Figure 4.14: B. Menderes Basin and Its Tributaries
(Source: Official Document of DSİ dated 12.01.1988)

Table 4.12: Exact Dates of Major Floods in Aydın Province

SEASON	MONTHS	WEEKS	MAJOR FLOOD EVENTS
WINTER	December/January	Week 1	
	January	Week 2	
	January	Week 3	
	January	Week 4	**2004** (agricultural fields in 189 farms inundated)
	January/February	Week 5	**1956, 1998, 1999**
	February	Week 6	**1956** (irrigation lines, agricultural fields inundated)
	February	Week 7	
	February	Week 8	
	February	Week 9	
SPRING	March	Week 10	
	March	Week 11	
	March	Week 12	
	March	Week 13	**1958** (agricultural fields inundated)
	March/April	Week 14	
	April	Week 15	
	April	Week 16	
	April	Week 17	**1965** (agricultural fields inundated)
	April/May	Week 18	
	May	Week 19	**1993**
	May	Week 20	**1998** (agricultural fields and illegal houses inundated)
	May	Week 21	
	May	Week 22	
	May/June	Week 23	
SUMMER	June	Week 24	
	June	Week 25	
	June	Week 26	
	June/July	Week 27	
	July	Week 28	
	July	Week 29	**1995**
	July	Week 30	
	July/August	Week 31	
	August	Week 32	
	August	Week 33	
	August	Week 34	
	August	Week 35	
	August/September	Week 36	
AUTUMN	September	Week 37	
	September	Week 38	**1996** (coasts eroded, agricultural field, 60 building inundated)
	September	Week 39	
	September/October	Week 40	
	October	Week 41	
	October	Week 42	
	October	Week 43	
	October	Week 44	
	November	Week 45	
	November	Week 46	
	November	Week 47	
	November	Week 48	
WINTER	November/December	Week 49	
	December	Week 50	**2007**
	December	Week 51	**1997** (8 buildings inundated)
	December	Week 52	**2001** (305 buildings inundated)

Although B. Menderes does not directly affect Aydın central sub-province, some of the tributaries, inner-city Brooks, Tabakhane and Kemer Brooks have caused flood losses in the city. There are also inundations after flash floods due to inefficient rainwater and sewage systems of the city center.

Table 4.13: Documents Related to Aydın City Flood Events

Date	Type of the event/activity/project/development plan/aerial photos available
1951	Development Plan by A. Kömürcü
30.01.1956-05.02.1956	Büyük Menderes & Tributaries Flood Event
05.07.1956	Flood Survey (DSİ)
20.03.1958	Büyük Menderes & Tributaries Flood Event
1959	Aerial Photo of Aydın (Harita Genel Komutanlığı 2008)
1959	Development Plan Modifications
13.04.1964	Flood Survey (DSİ)
22.04.1965	Büyük Menderes & Tributaries Flood Event
03.05.1966	Debris Survey (DSİ)
1977	Aerial Photo of Aydın (Harita Genel Komutanlığı 2008)
1977	Request for closed channel
26.10.1978	Flood Survey (DSİ)
16.12.1985	Circular of the Ministry of Development and Public Works
1986	Development Plan by Esat Durak
12.09.1989	Debris Survey (DSİ)
05.05.1993	Flood Event
1993	Aerial Photo of Aydın (Harita Genel Komutanlığı 2008)
1993	Development Plan Revision
July 1995	Flood Event
1996	Development Plan, Partially Closed Channel (35m.) of Tabakhane River (MetroPLAN on behalf of Aydın Municipality)
06-08.09.1996	Flood Event
10.09.1996	Flood Survey (DSİ)
12-15.12.1997	Flood Event
02.02.1998	İncirliova & Germencik Flood Events
17.05.1998	Aydın Center Flood Events
22.05.1998	Flood Survey (DSİ)
29-31.01.1999	Flood Event
19.12.2001	Flood Event
January 2004	Büyük Menderes Flood Event
04.06.2004	Flood Survey (DSİ)
2006	Territorial Plan of Aydın-Muğla-Denizli (1/100000) by Kutluay Planning Office - Ministry of Forest & Environment
December 2007	Büyük Menderes Flood Event

According to the documents and survey reports (dated 1956, 1964, 1978, 1989, 1996, 1998, 2004) in DSİ Archive Files, contents of which are given in the Appendix B.3, main reasons of losses of these major floods are as follows:

- highest levels of rainfall and snow,
- rainfalls occurred (long meteorological observation series indicate as an outcome of global warming and climate change),
- soil erosion and transfer of debris from upper basin,
- topography, vegetation and soil features of the catchment area led erosion, drifting and accumulation effects,
- high volumes of water spread into lower plains in a very short time period together with large amount of debris and rubble,
- inadequacy of the existing urban infrastructure networks
- inefficiency in the riverbed capacity and the blockage of the riverbeds

After each flood event DSİ has prepared survey reports to analyze the possible factors that cause flood losses and to make recommendations about B. Menderes basin to protect floods. Some of these recommendations are:

- forestation and terracing of the southern slopes of northern mountains,
- construction of gradual desilting barrages to store debris transferred from upper basin,
- regular clearance of debris on riverbed,
- upper basin measures to control erosion and debris were noted as necessary,
- rehabilitation of some brooks and creeks,
- revision of development plans according to the rehabilitation projects,
- preservation of the prevailing vegetation,
- increase in the reforestation activities,
- extension of the capacities of flood routes and passages

4.1.3.1. Population Status, City Growth and Planning Decisions

Aydın central district is located on the northern edge of Büyük Menderes Plain. City macroform has shown slopes increasing towards the northern parts. Some parts of the city which are on the north of Gazi Boulevard (Denizli-İzmir connection) are located on the edge which identifies the end of the plain. Also plains, where Tralles (historical city that was demolished by Earthquake) remains exist, surround the city on the far north which is 50-100 m. higher than the city center. This plain is separated into two parts by deep valley of Tabakhane Brook passes through whole city from south to north (Figure 4.15).

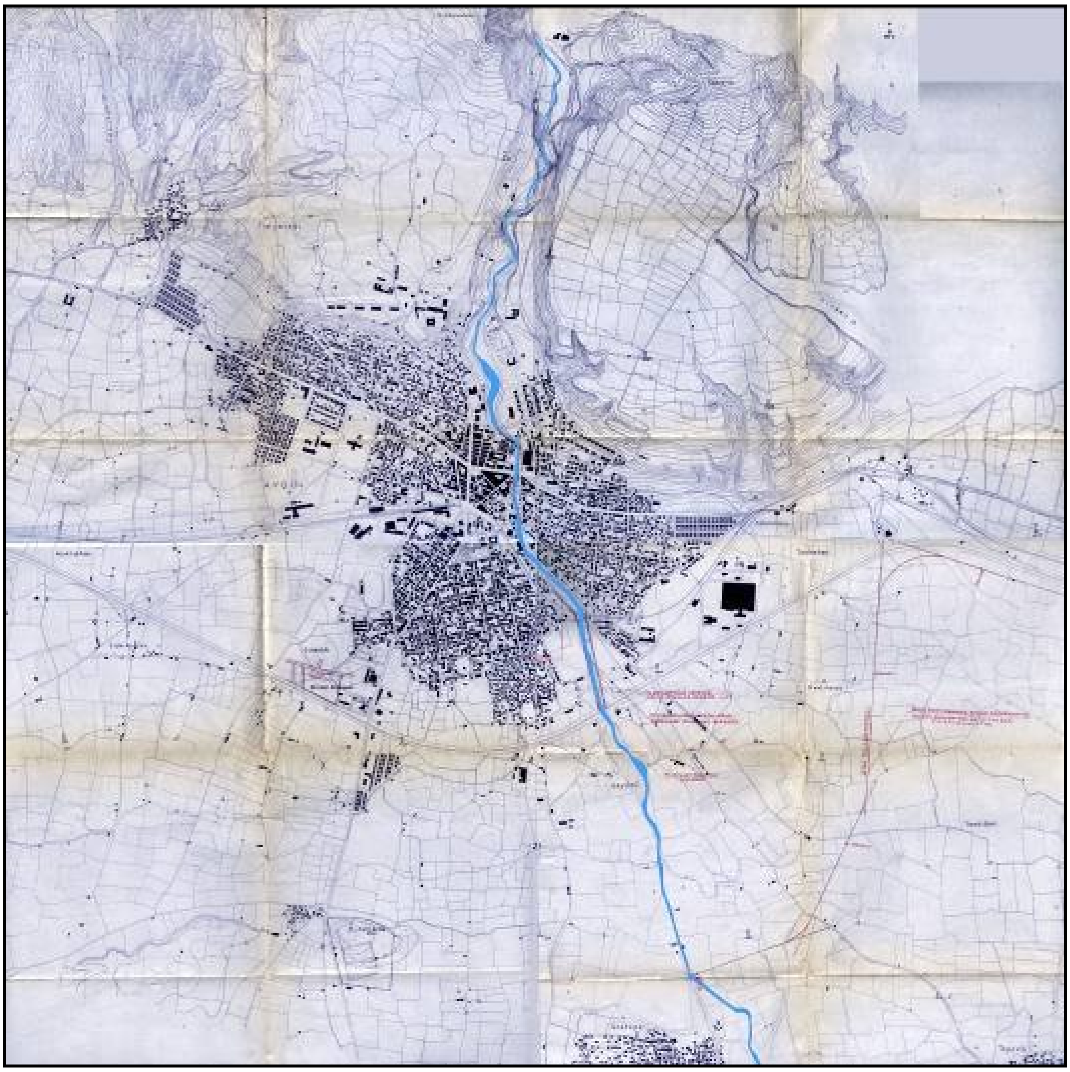


Figure 4.15: Natural Flow of Tabakhane River - Aydın 1965
(*Source: Official Document of DSİ dated 03.03.1965)*

Until 1950's Aydın city maintained its compact macro-form to benefit from surrounding valuable agricultural areas. However, after rapid population increase due to high migration rates by allowing settlements on agricultural lands the Aydın city has begun to expand towards southern and western directions. According to the analysis report held by Gazi University (2003) the first development plan was prepared by A. Kömürcü in 1951. The construction of Denizli-İzmir and Muğla-Aydın highway in 1953 passing from the southern parts of the city as a ring road where major land-uses are located has composed a significant part of settlement macro-form. And the plan of 1951 was revised in 1959 with some modifications in order to facilitate the implementations of a number of planning decisions.

Later the city experienced economic revival with new textile factories at the same period (1951-59) and began to grow at unprecedented rates. (Gazi Üniversitesi 2003). Although such growth could be controlled by the Development Plan of 1968, city became densely populated particularly in CBD and adjacent residential neighborhoods by additional storeys in buildings greater than designated by plan decisions. Therefore, the preparation of a new plan has been required. City Planner, Esat Durak prepared the development plan for Aydın city in 1986.

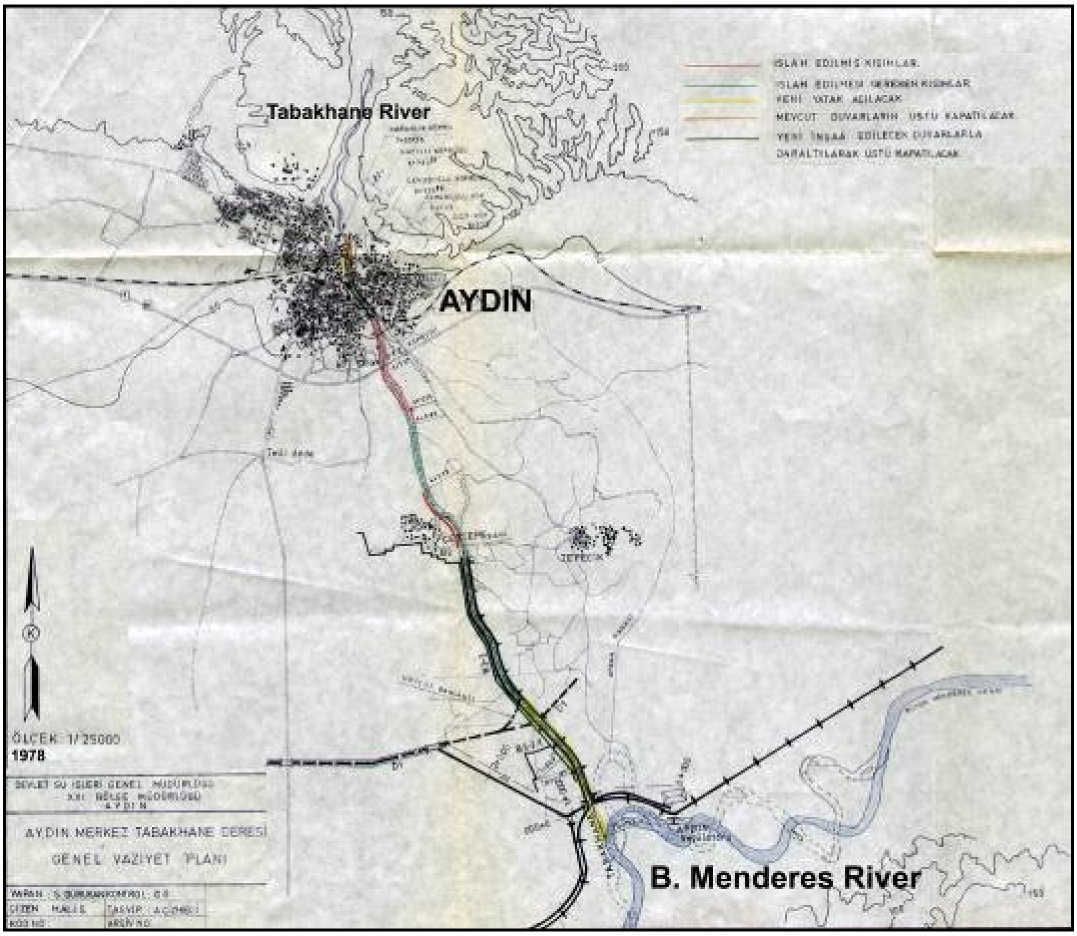


Figure 4.16: Partial Reclamation Works on Tabakhane River - Aydın 1978
(*Source: Official Document of DSİ date 05.12.1978)*

The rural settlements which have been economically and socially integrated with the Aydın urban center were spatially integrated in time. Since Aydın province has an extensive and valuable agricultural hinterland supported by a strong settlement hierarchy, total rural population has remained larger than the total urban population until 2000 (Table 4.14).

Table 4.14: Change in Urban-Rural Population of Aydın Province

	1950	1960	1970	1980	1990	2000
Urban	79.475	141.686	186.856	245.329	384.711	493.114
Rural	256.188	325.655	377.946	407.159	440.105	457.643
Total	335.663	467.341	564.802	652.488	824.816	950.757

(Source: TÜİK)

However, residential establishments not envisaged in the Plan of 1986 were observed in agricultural lands of southern parts of Aydın.

In addition to such expansion, the 1993 Revision Plan introduced a high rise and high density building stock with a decision allowing a storey rise in the whole city without providing any additional social and technical infrastructure or any other requirements and improvements such as roads, car parks, green areas, public open spaces and services, etc. With such a 'populist' decision taken one month prior to the local government elections, development capacity equivalent to 35.000 potential persons were introduced (Gazi Üniversitesi 2003). Thus, the increase in densities created extra loads even higher than design maximums of the existing urban infrastructure, also in terms of sewage and rainfall network, transportation system and public services.

With the Development Plan of 1996, the adverse impacts of such increases in densities had to be avoided by a series of new plan decisions like creating additional green areas/open spaces and 'canceling the right of storey rise'. An implementation called 'Z-Plan Restriction' was introduced (Aydın Development Plan Report 1996). According to this decision, which is also a precaution for floods, except for new commercial development areas ground floors are planned as a reserved space in every building for car-parks, play-grounds or other public uses. For instance, if a 4-storey apartment adopts such a condition, it is entitled to develop an additional storey. Such conditions are preferred by many apartment blocks which have no car-parks in the vicinity.

The riverbed of Tabakhane Creek passing from the city center where high land prices exist created a continuous conflict between DSİ and the Aydın Municipality because of the development requests on riverbed (Aksu 2008). In order to prevent Municipalities from such requests which are very common in most of the riverine municipalities of Turkey, DSİ-GM has sent the Circulars of the Ministry of Internal Affairs (given in Appendices E and F) to all Governorates and Municipalities including Aydın (see Appendix E and Appendix F). According to the circulars there are worse examples in areas where covered river channels are constructed. DSİ claims that the reclamation sections along rivers could prevent floods up to certain level of design discharges ($<Q_{500}$). However, if there are any interventions on the river channel, or any land-use changes in the upper basin that are not envisaged in design discharge, there can probably be blockages at such spots after heavy rainfall due to accumulation of debris coming from upper basins. In that case disastrous damages are inevitable. Thus, DSİ strictly insists on the regular maintenance of riverbeds and open channels except for limited transport crossings as states in the Circular (2006).

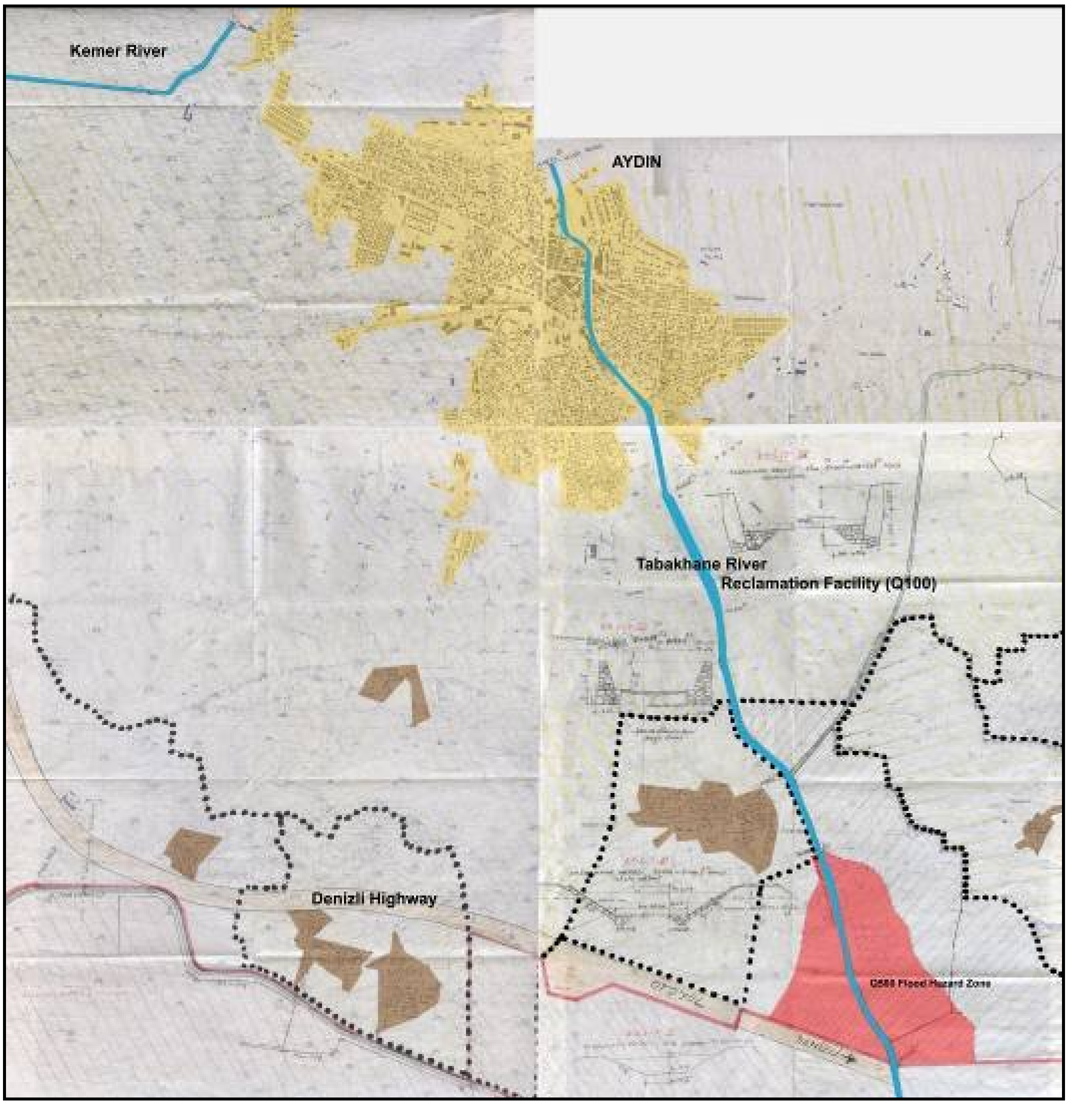


Figure 4.17: Tabakhane Reclamation Channel - Aydın 1996
(*Source: Official Document of DSİ dated 31.07.1996)*

In accordance with these claims, DSİ asserts the following points particularly about Tabakhane Creek in order to provide data for survey studies before preparing the 1996 Plan. Unless the reclamation and protection facilities are designed at safety levels for a 500-year flood discharge, (Q_{500}) the flood-prone areas defined by DSİ have to avoid new developments.

4.1.3.2. City Growth of Aydın towards Flood Areas

Aydın owes its valuable agricultural potential to the floods of the Büyük Menderes River and its tributaries nourishing the Büyük Menderes Basin. Floods, on the other hand, cause life and property losses particularly in the provincial center and in most of the municipalities of sub-provinces, local auxiliaries, districts and villages. Apart from climatic and geomorphologic factors of the basin and sub-basins, human interventions are also influential in the occurrence of such losses.

The city is located in a broad valley lying east-west direction having mountainous areas in the north and south directions. The northern tributaries with high sedimentation and debris transport characteristics due to the soil structure and slope conditions of the upper basin narrow down the carrying capacity of rivers in the south. On the other hand, rapid snowmelt in the mountainous upper basin leads to high volumes of water to inundate the whole valley in a short period. Recently the yearly precipitations are identified as in the increase due to the impact of global warming reported by 2004 survey report of DSİ (Official Document dated 04.06.2004).

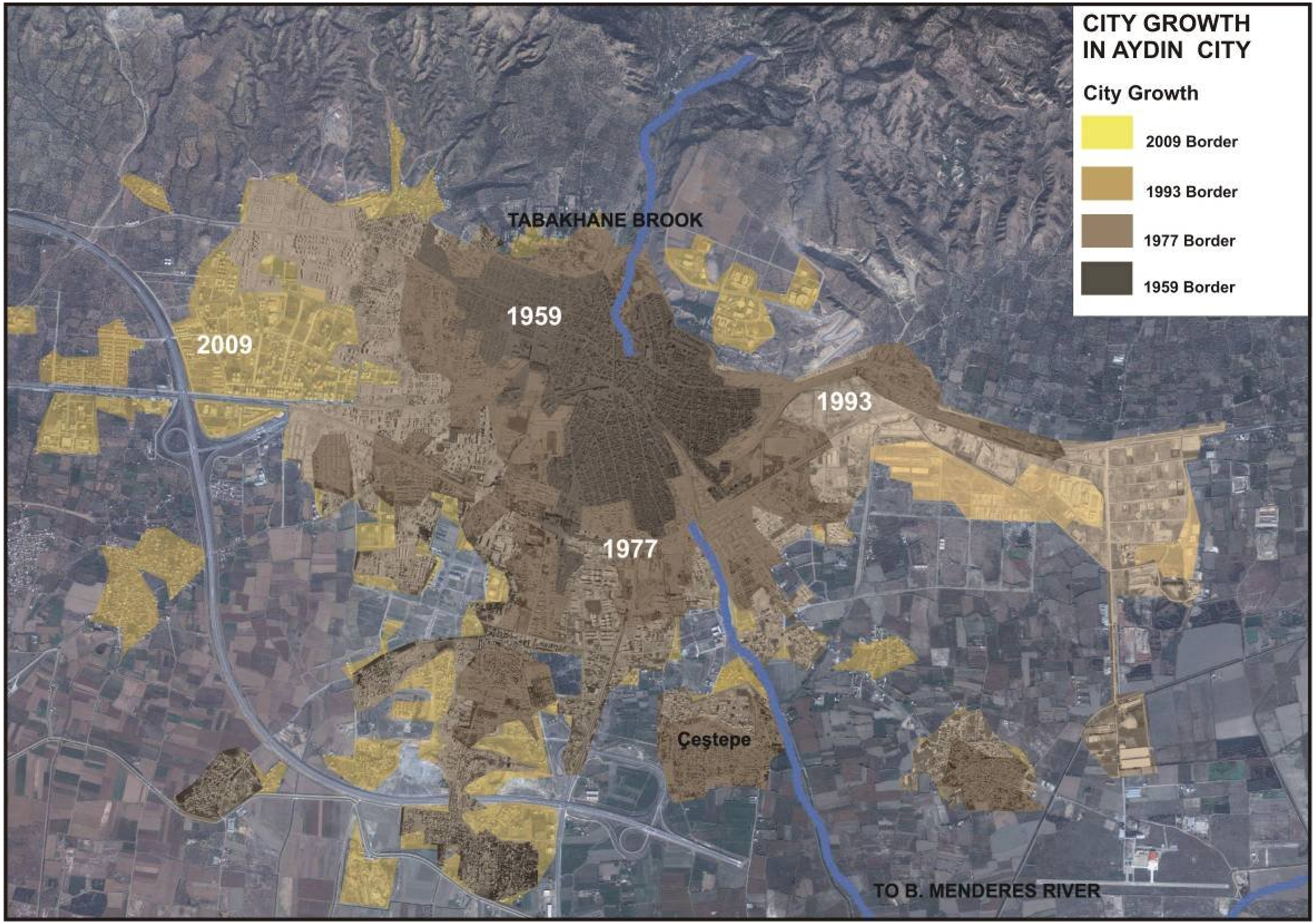


Figure 4.18: Aydın City Growth
(Based on Sources Harita Genel Komutanlığı, Google Maps)

Some of the human interventions that cause flood losses in Aydın are as follows.

- River bottom materials like sand and gravel are sometimes removed by construction firms without authorization (Official Document dated 07.04.1988). Such activities may directly affect river flow velocity and capacity.
- Due to rapid population increase after 50’s the compact macro-form of Aydın city changed.
- Unauthorized developments on southern agricultural plains have low drainage capacities creating flood-vulnerable districts. In 90’s the city-wide decision (Aydın Büyükşehir Belediyesi, 1996) to increase building densities with additional storey of the existing stock have caused extreme loads particularly on the infrastructure system, and decreases in public services such as open spaces/green areas. Together with river floods, therefore, urban flash floods have more frequently occurred.
- As claimed in the 1996 Plan (Aydın Büyükşehir Belediyesi), Tabakhane Brook is a barrier that divides the city into two parts. According to the municipality, it also creates environmental pollution so it is covered. In order to use the river as a main boulevard of the city, Aydın Municipality decided to cover the top of 35 m. of Tabakhane River that passes through city center. The Municipality could not refrain from such a decision despite the contrary advice of the DSİ Circular. This action hinders clearance and maintenance works of the river channel that may cause worst flood cases and losses.

Today there are still unauthorized establishments along the riverbeds of Çakırlar and Kemer Creeks as stated in semi-structured questionnaire (an example of the questionnaire is provided in Appendix I). Although it was planned in 1996 Development Plan to transfer these establishments into amelioration areas, they have not been transferred yet.

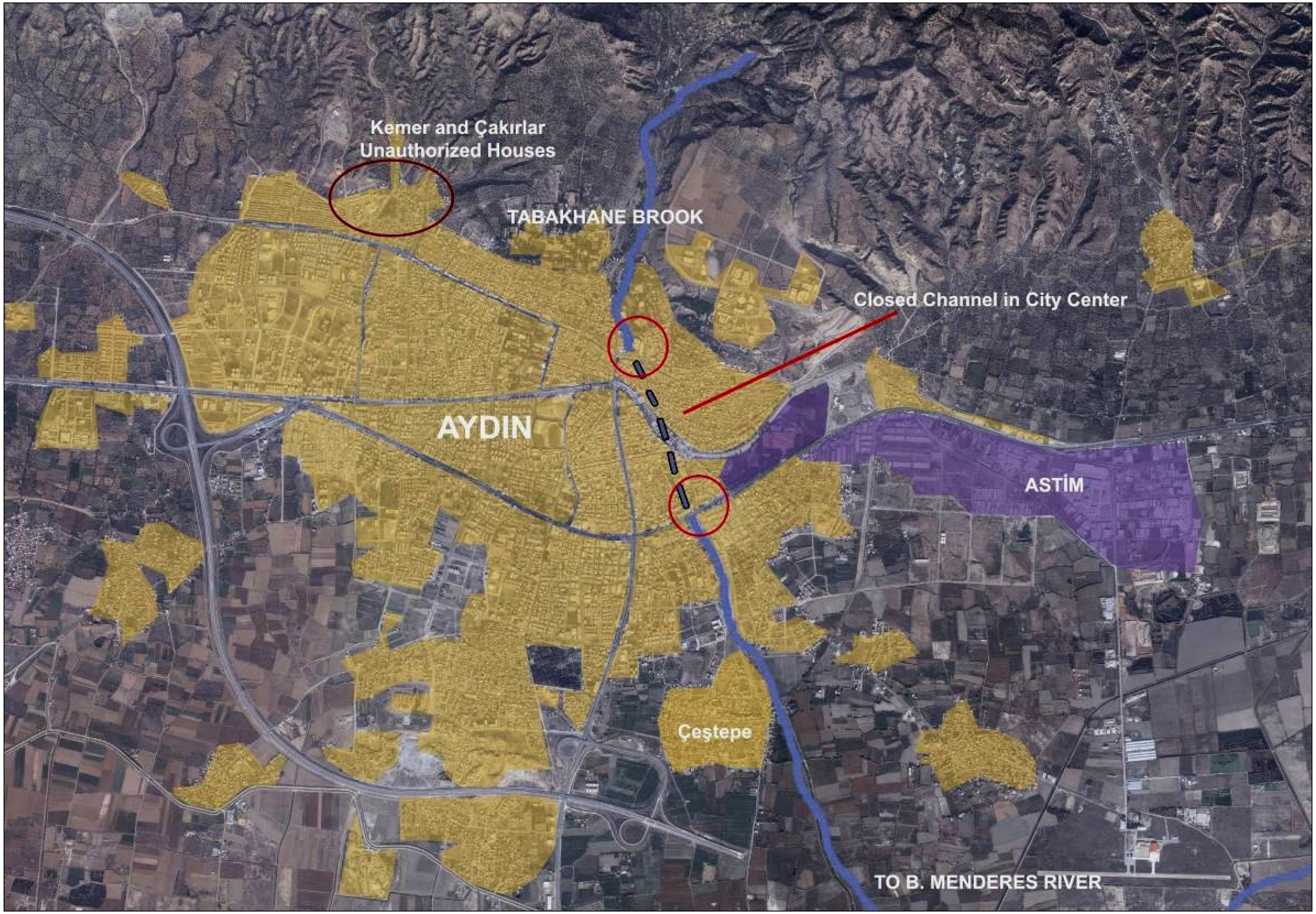


Figure 4.19: Aydın City Vulnerabilities and Tabakhane River
(Sources: 1996 Aydın Development Plan, Google Maps)

4.1.4 Asi Basin, Hatay (Antakya) River Floods and Antakya City

Asi Basin is surrounded by Ceyhan basin on the north, Amanos (Nur) Mountains and Mediterranean Sea on the west, Syria on the south-east. Amik Plain which covers major portion of Asi Basin is mostly large flat area that is surrounded by mountains from the west, south and east. On the north of the basin Kırıkhan-Hassa-Islahiye Plain, which is narrowed by mountains and streams, is located. Samandağ Plain, on the other hand, extends along Mediterranean Coast. On the north of Antakya it meets with Küçük Asi as being outflow of Amik Lake (Official Document of DSİ dated 15-16.05.2004).

In the upper parts of Asi basin, in Syria there are three large reservoir facilities on Asi River which are mostly used to lower flood discharges (Official Document of DSİ dated 08-09.05.2001). In Hatay province there are three dams; namely Yarseli, Tahtaköprü, Yayladağı, and two pond facilities; namely Demrek, Karmanlı, under construction as of the year 2004. Main Streams of this basin in Hatay provincial area are Asi River, Karasu Creek, Küçük Asi River, Afrin Creek, Sabunsuyu Creek.

Asi River is born in Mountains of Lebanon. After passing through Syria it constitutes 54 km. long Turkey-Syria border. It takes the name ‘Küçük Asi’ which drains water of Amik Plain when it enters Turkey’s lands (Official Document of DSİ dated 08-09.05.2001).

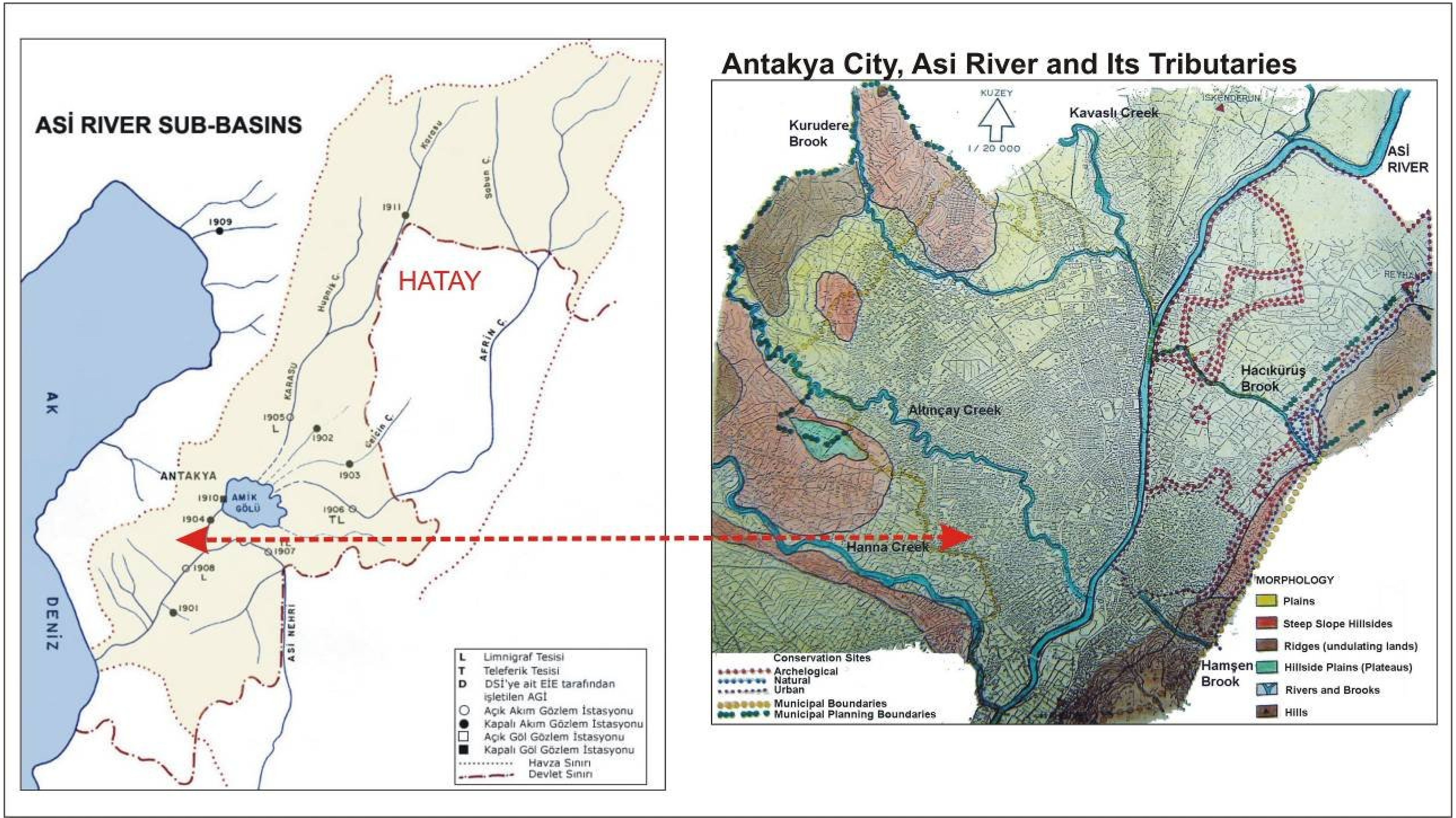


Figure 4.20: Asi River Basin, Its Tributaries and Antakya City
(Source: Mersinligil, 1997 & EIE Official Website)

Karasu Creek is born in Kahramanmaraş – Gaziantep provincial border. After passing through Islahiye Plain it joins Tahtaköprü Dam. Then it constitutes 20km. long Turkey-Syria border before going into lands of Turkey. On the south of Amik Plain it constitutes Küçük Asi River after meeting with Afrin Creek which is composed of Sabunsuyu and Afrin main branch in Syria. It enters Turkey at Reyhanlı district then it meets with Karasu Creek at the place where Amik Lake had existed until 1968. After these creeks compose Küçük Asi, it meets main branch of Asi coming from Syria. Then it gets the name 'Büyük Asi River' passing through Antakya City. After that it reaches Samandağ location on the south coast and flows into the Mediterranean Sea gathering water from Samandağ catchment area (Official Document of DSİ dated 08-09.05.2001).

Total area of Hatay is 5403 km^2. Amik, Dörtyol, Erzin, Payas, Arsuz and Samandağ plains are main agricultural lands of Hatay. It has Mediterranean climate, hot and dry in summers; mild and rainy in winters. Annual mean precipitation is between 1000-1200 mm (Official Document of DSİ dated 15-16.05.2004).

Hatay province has been subject to floods of the River Asi and its tributaries (Afrin Karasu Creeks and Hacıkürüş, Sabunluk, Altınçay, Karaçay Brooks) gradually increasing size and impacts like in 1956, 1960's, 1975, 1980's, 1998, 2001, 2002, 2003, 2004 and September 2008 (Figure 4.22, 4.22). According to records in DSİ archive files, contents of which are given in the Appendix B, 2 persons were killed, and approximately 96.291 persons were affected, and 1526 hectares of agricultural land was inundated as a result of 2004 floods.

Hatay province is regularly exposed to floods of streams as listed above. For example, Antakya (Hatay central sub-province), Altınözü, Dörtyol, Hassa, İskenderun, Kırıkhan, Reyhanlı and Samandağ are sub-provinces that faced chronic flood losses through the years (Table B.4 in Appendix B). The seasonal distribution of the past flood events in Hatay is presented on Table 4.15. As shown on the table, spring season has been the most frequent in terms of flood occurrence.

Table 4.15: Exact Dates of Major Floods in Hatay Province

SEASON	MONTHS	WEEKS	MAJOR FLOOD EVENTS
WINTER	December/January	Week 1	
	January	Week 2	
	January	Week 3	
	January	Week 4	**1968**
	January/February	Week 5	
	February	Week 6	**1968** (320 buildings damaged, 219 buildings, 5.320 ha agricultural field inundated)
	February	Week 7	**2003** (10.000 ha agricultural field, 322 buildings damaged)
	February	Week 8	**1962** (7 villages inundated)
	February	Week 9	**1976**
SPRING	March	Week 10	
	March	Week 11	
	March	Week 12	**1969** (15.780 ha agricultural field inundated)
	March	Week 13	
	March/April	Week 14	**1987**
	April	Week 15	**1980**
	April	Week 16	**1965, 1967, 2008**
	April	Week 17	**1967** (77 buildings, 110 ha agricultural field, damaged 12 animal perished), **1975** (1.500 ha agricultural field inundated)
	April/May	Week 18	
	May	Week 19	
	May	Week 20	**2001** (Amik plain inundated, 285 buildings, irrigation lines, transportation network, flood protection facilities damaged)
	May	Week 21	**2004**
	May	Week 22	**1998**
	May/June	Week 23	
SUMMER	June	Week 24	
	June	Week 25	**2002** (2.600 ha agricultural field inundated)
	June	Week 26	
	June/July	Week 27	
	July	Week 28	
	July	Week 29	
	July	Week 30	
	July/August	Week 31	
	August	Week 32	
	August	Week 33	
	August	Week 34	
	August	Week 35	
	August/September	Week 36	
AUTUMN	September	Week 37	
	September	Week 38	
	September	Week 39	
	September/October	Week 40	
	October	Week 41	
	October	Week 42	
	October	Week 43	
	October	Week 44	
	November	Week 45	
	November	Week 46	
	November	Week 47	**1986**
	November	Week 48	
WINTER	November/December	Week 49	
	December	Week 50	
	December	Week 51	
	December	Week 52	

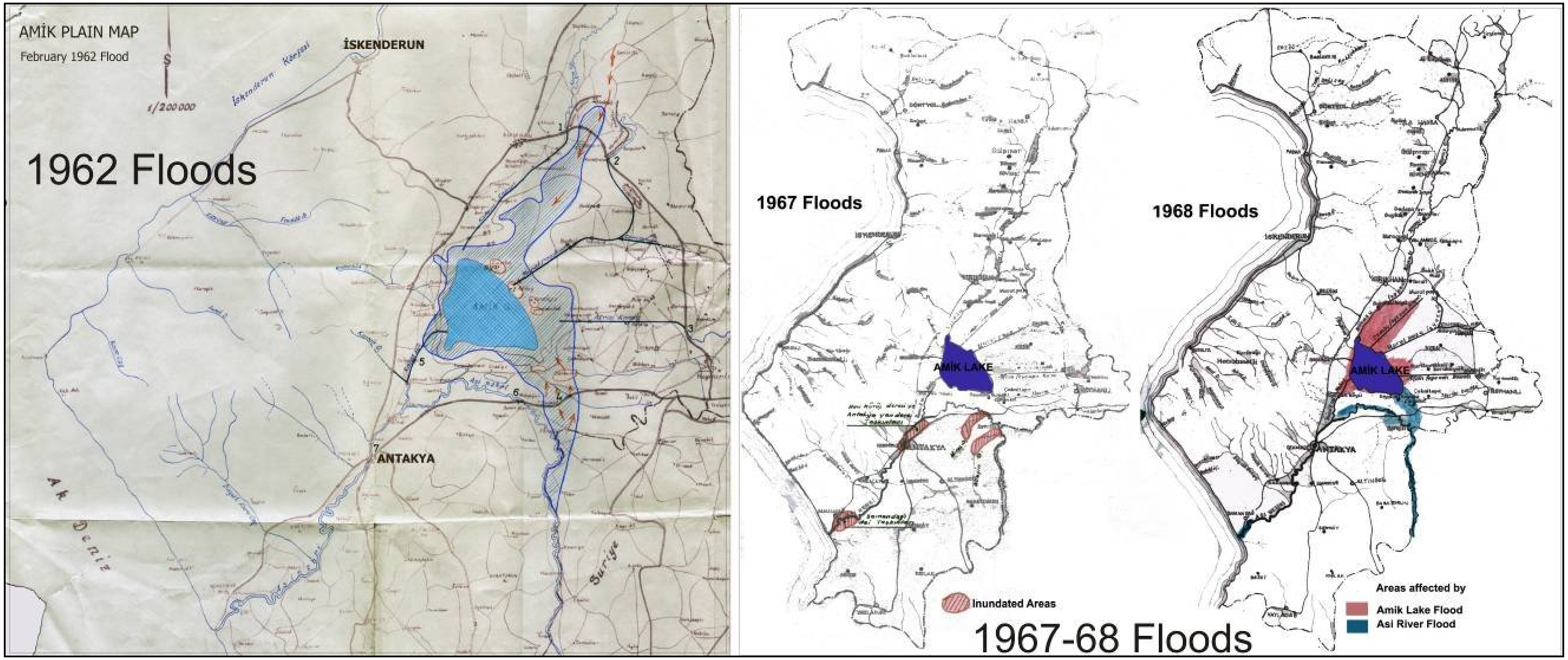


Figure 4.21: Major Floods in Hatay Province
(Sources: Official Documents of DSİ dated 02.03.1962, 18.04.1967 and 14.01.1968)

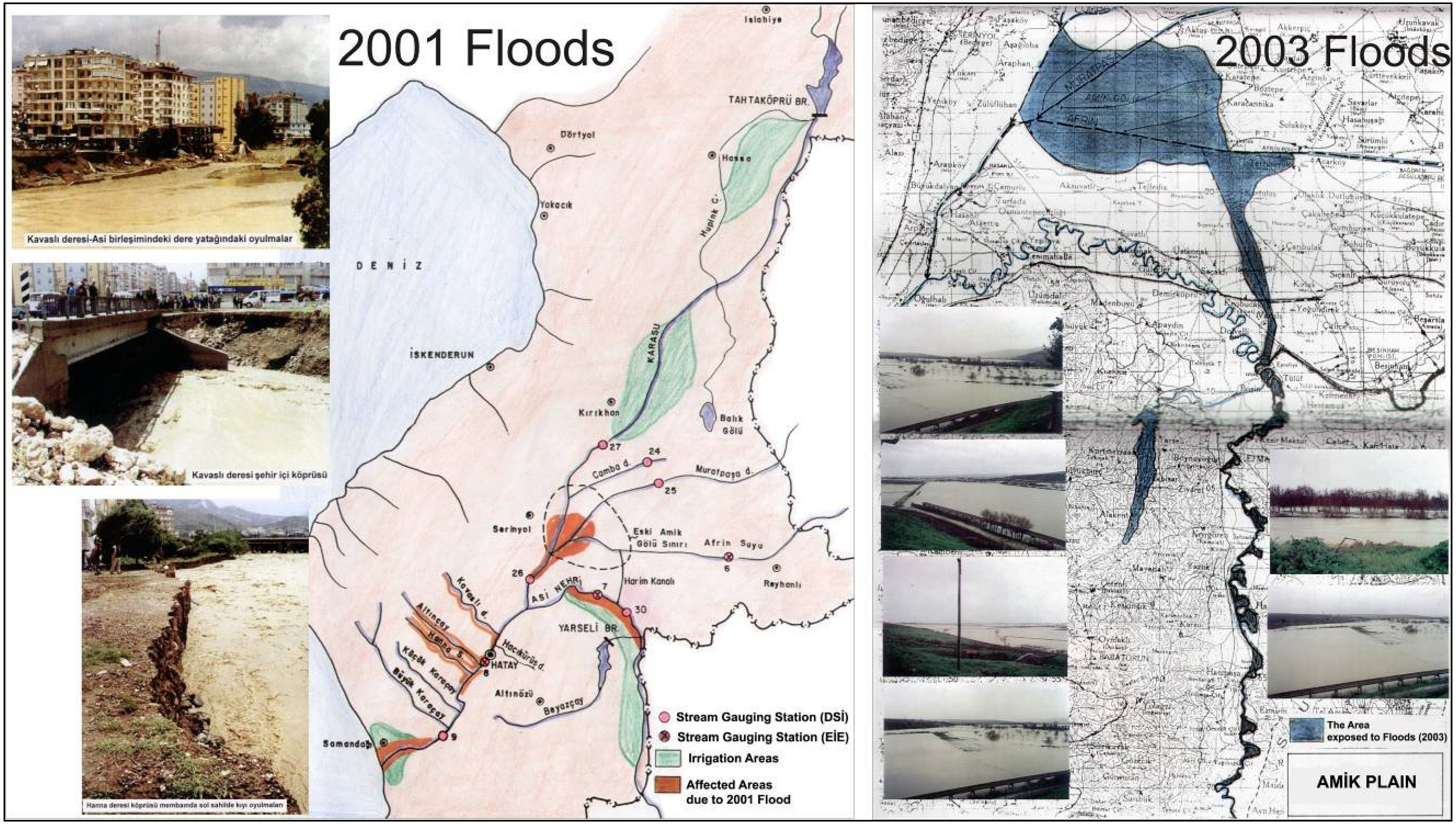


Figure 4.22: Major Floods in Hatay Province

(Sources: Official Documents of DSİ dated 09.05.2001 and 15.02.2003)

Asi River has a broad basin whose up stream is located in the borders of Syria. Therefore, any action taken in Syria may probably affect lower basins in Hatay. Dam breaks (like in 04.06.2002) or rapid water releases from dam reservoir in order to protect Syria's lands without warning have caused greater losses in Turkey (Official Document of DSİ dated by 16.05.2004). Hence, such kind of basins should require special attention that can only be organized in collaboration with the governments of Turkey and Syria.

After each flood event following factors that have possibly created flood losses were mentioned in a number of survey reports of DSİ (see Appendix B.4).

-

- continual rainfall exceeded 16% of the annual precipitation in a week,
- occurrence of rainfall corresponds to that of 1000-year-period,
- reduction of discharge capacity of the river by bridges
- soil character, topography and loose vegetation in the catchment area, which causes soil erosion,
- illegal residential establishments on riverbeds and in catchment area,
- interruption of precipitation-runoff balance,
- intense sediment and debris movements from upper basin due to slope erosion
- destruction or uncontrolled operation of dams in Syria
- human interventions on the riverbeds, such as plantation of trees, dumping of solid wastes, etc.

-

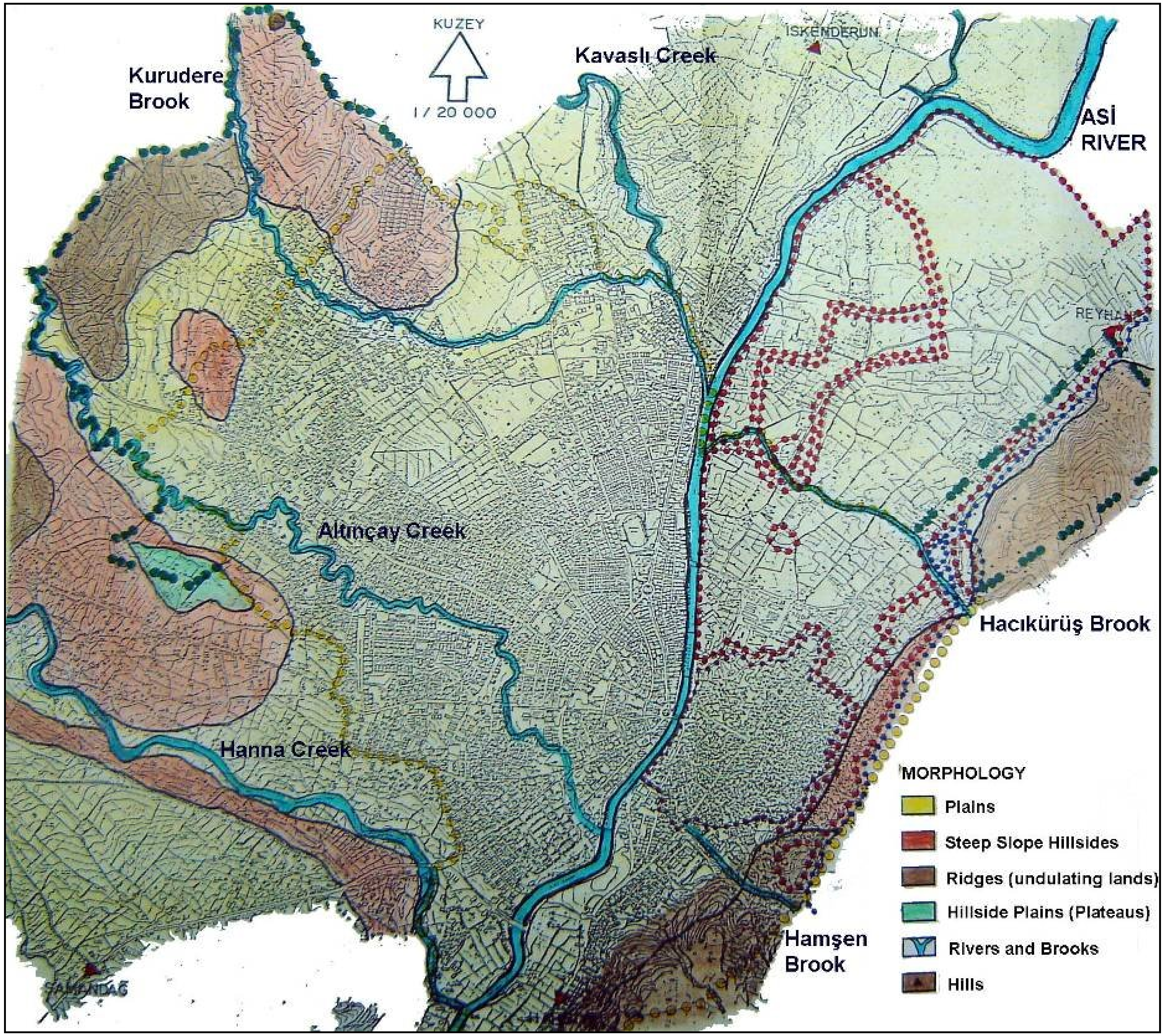


Figure 4.23: Morphological Structure of Antakya and Main Rivers
(Source: Mersinligil 1997)

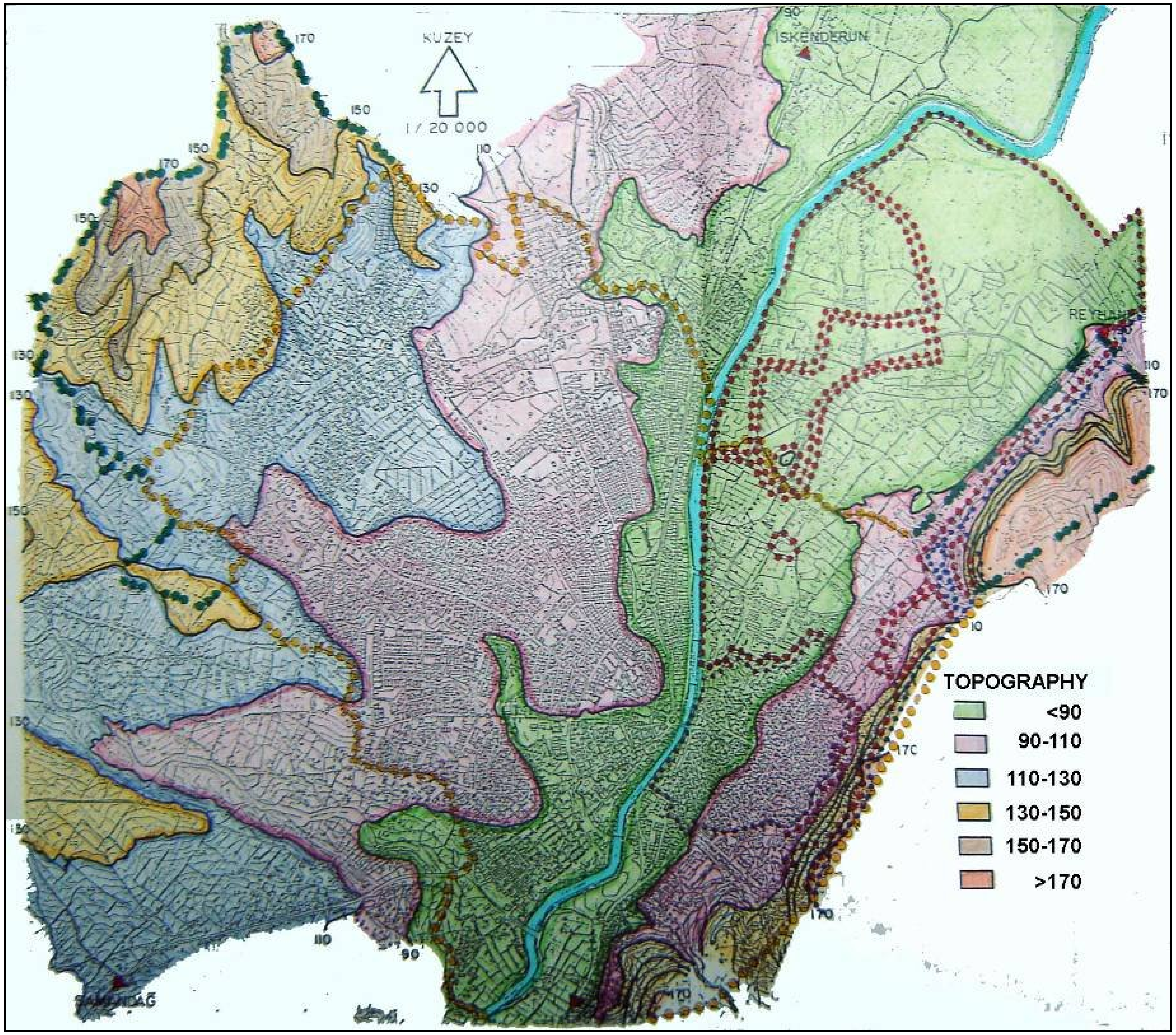


Figure 4.24: Topographical Structure of Antakya City
(Source: Mersinligil 1997)

Table 4.16: Documents Related To Antakya City Flood Events

Date	Type of the Event/Activity/Project/Development Plan/Aerial Photos Available
1948	Development Plan by Asım Kömürcüoğlu
1956	Afrin, Karasu, Asi Flood Events
1956	Aerial Photo of Antakya (Harita Genel Komutanlığı 2008)
22.07.1957	Erosion and Debris Control of Afrin, Karasu (DSİ)
1957	Development Plan by Gündüz Özdeş
25.02.1962	Flood Event
02.03.1962	Flood Survey (DSİ)
19.04.1965	Flood Event
17-18.04.1967	Hacıkürüş, Altınçay, Sabunluk Flood Events
18.04.1967	Flood Survey (DSİ)
21.04.1967	Flood Event
13-14.01.1968	Flood Event
14.01.1968	Flood Survey (DSİ)
05.02.1968	Afrin Channel and Amik Lake Afflux Flood
06.04.1968	Afrin Flood
December1968	Asi Flood, Amik Lake Afflux
March 1969	Afrin, Karasu, Asi Floods
17.04.1969	Flood Survey (DSİ)
1973	Aerial Photo of Antakya (Harita Genel Komutanlığı 2008)
02.10.1973	Survey for Development Plans (DSİ)
April 1975	Asi Flood
February 1976	Afrin, Karasu, Asi Floods
1978	Development Plan by Yavuz Taşçı
June 1979	Hatay-Amik Lake Dried up (DSİ)
March-April1980	Karasu, Afrin, Asi Floods
1985	Rehabilitation Plan by Öner Mersinligil
November1986	Afrin, Karasu, K. Asi, Asi Floods
March 1987	Afrin, Karasu, K. Asi, Asi Floods
22.09.1987	Survey for Development Plans (DSİ)
1992	Aerial Photo of Antakya (Harita Genel Komutanlığı 2008)
03.02.1993	Survey for Flood Protection (DSİ)
29.05-22.12.1995	Survey for Development Plan of Çekmece and Kuzeytepe towns of Antakya (DSİ)
19.04-03.05.1996	Survey for Development Plan of Gümüşgöze and Karasu towns of Antakya (DSİ)
1997	Development Plan by Öner Mersinligil
21.05.1998	Altınçay, Samandağ, Büyük Karaçay Brook Floods
02.07.1998	Flood Survey (DSİ)
8-9.05.2001	Most of the tributaries of Asi River flooded
4-5.06.2002	Asi River Flood
15.02.2003	Asi River Flood
15-16.05.2004	Beyaz Creek, Favvur, Şelale, Hatim and Madenboyu Brooks Floods
2006	Territorial Plan of Hatay (1/100000) by İşlem CBS on behalf of Ministry of Forest and Environment
16.04.2008	Antakya Flood

A number of recommendations and proposals to control floods are made by DSİ Survey Reports after each flood event as listed in Table 4.16.

-

- construction of a dam on Eşrefli location,
- construction of embankments on both sides of Asi River and reclamation of Asi riverbed,
- reconstruction of bridges in accordance with the required standards,
- increase in the riverbed capacities and enlargement of floodway sections,
- repair and rehabilitation of fresh water and sewerage networks,
- preparation of embankment works for both banks of Asi River,
- deepening and enlargement of riverbeds,
- relocation of the villages and neighborhoods around the Amik Lake on lands higher than 83 meters above the sea level,
- erosion control on the upper basin and reclamation works of lower basin to be done complementarily
- preparation and implementation of flood protection projects in collaboration with Syria
- reclaiming of the riverbeds and avoidance of solid waste removal,
- regular clearance of sediments on the riverbeds,

Following the outgoing tide of Amik Lake during dry seasons, these vast empty lands had been invaded several times by unauthorized rural settlements, so such settlements have been exposed to floods continually since 1950’s. Then, this lake area (75 km^2) had been dried up through four channels; namely Afrin, Karasu, Muratpaşa; Comba draining water into Asi River during the period of 1966-1972 (May 2001 Flood Survey Report of DSİ). This land six meter below the surrounding areas has been used as agricultural land and usually resumes its original position as a lake when intensive rainfall occurs. Such process of drying of the Asi Lake so as to create more agricultural lands may probably create worse situations in terms of flood losses. Rather, such a lake reservoir could be preserved as a detention pond for flood control.

4.1.4.1. Population Status, City Growth and Planning Decisions

Hatay province is made up 356 villages, 76 municipalities twelve of which is sub-provincial municipalities. Antakya is the administrative capital as the central sub-province, while İskenderun is the largest city with its advantageous sea-port in the province.

The first Development Plan study for Antakya city was prepared by Asım Kömürcüoğlu and approved in 1948 by the Ministry of Public Works and Settlement. Second plan was prepared by Gündüz Özdeş, approved in 1957 by the Ministry (Mersinligil 1997).

As explained in Antakya Development Plan Report (Mersinligil 1997) in the Özdeş Plan it was proposed that city of Antakya would grow in three different directions. According to the plan western parts of Asi River, towards Reyhanlı, and the southwest parts towards Harbiye were determined as major directions for urban growth. By this plan İstiklal Boulevard was designed beginning from northeastern parts of old Antakya as well. Industrial establishments were located on wide plains towards Amik Plain. However, this plan was criticized for its proposal about large blocks of plots defined by the new road network in the western part of Asi River.

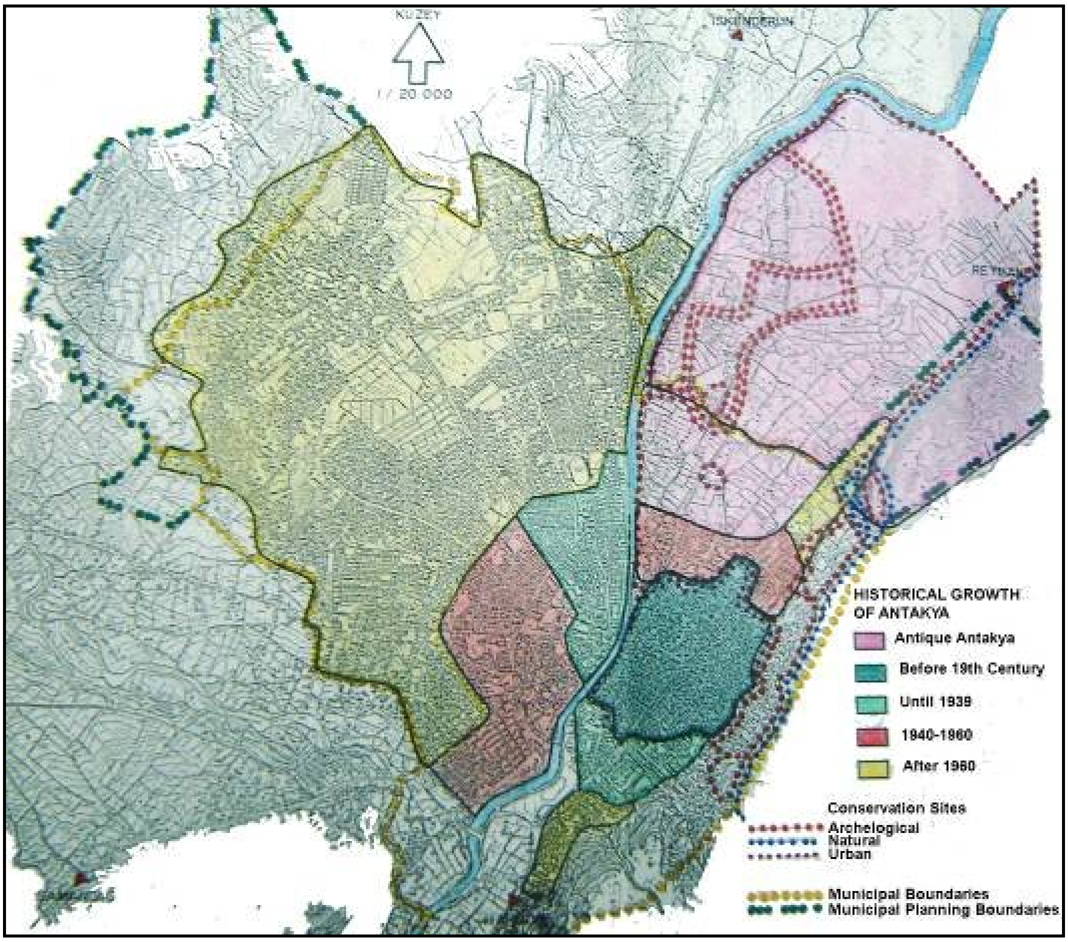


Figure 4.25: Historical Growth of Antakya
(Source: Mersinligil 1997)

Due to rapid increase in urban population, housing and public services needs were supplied by means of a number of plan modifications. However, such modifications have jeopardized the internal unity and consistency designated in the 1957 Plan.

For this reason, a third development plan was prepared by Yavuz Taşçı and was approved in 1978. It included significant decisions about conservation of the historical quarter and registered buildings. It has also changed the development decision of the previous plan on the plains of the northeastern parts towards Reyhanlı. According to the author of the plan, these areas were to be conserved in agricultural use. On the other hand, 1978 Plan introduced multi-storey buildings and high building density rights particularly in the western parts of Asi River, the new Antakya. Nevertheless, most of the plan decisions were not realized except the proposals like prestigious quarters and major roads. Rather, there were unauthorized establishments in the western parts of Asi River as in old Antakya. After the transfer of approval right of development plans to the Municipal Assembly by Law (3194) in 1985, Antakya Municipality launched a planning study to regulate such illegal settlements by Rehabilitation Plans in six separate locations (Mersinligil 1997)..

After the implementation of such plans, between 1987 and 1996 there were 712 subjects issued for change by the request of the Municipality. More than 50% of these involved increasing of the number of storeys and building densities, and decreasing the setback distances between buildings. 18% of these are about canceling the decisions of green areas, urban and social service areas and roads, and 20 % are about modifications to overcome implementation difficulties and to conform the design of proposed roads to cadastral maps. Other requests are about increasing the services like education, health and religious facilities. Hence, during the 10 year period of the 9th Development Plan Additions were prepared.

Eighty percent of Antakya city has sewage system according to the 1997 Development Plan survey report. However, urban infrastructural services were not implemented based on any particular plan and program. Rather, the interventions in infrastructure are usually realized by short-term solutions when urgent necessities emerge.

As shown on land-use map of new Antakya in 1997 (Figure 4.26), 392 hectares City Park along Asi River was opened in the French occupation period. Other than the cemetery area in the north-western part of Asi River there is a lack of open areas.

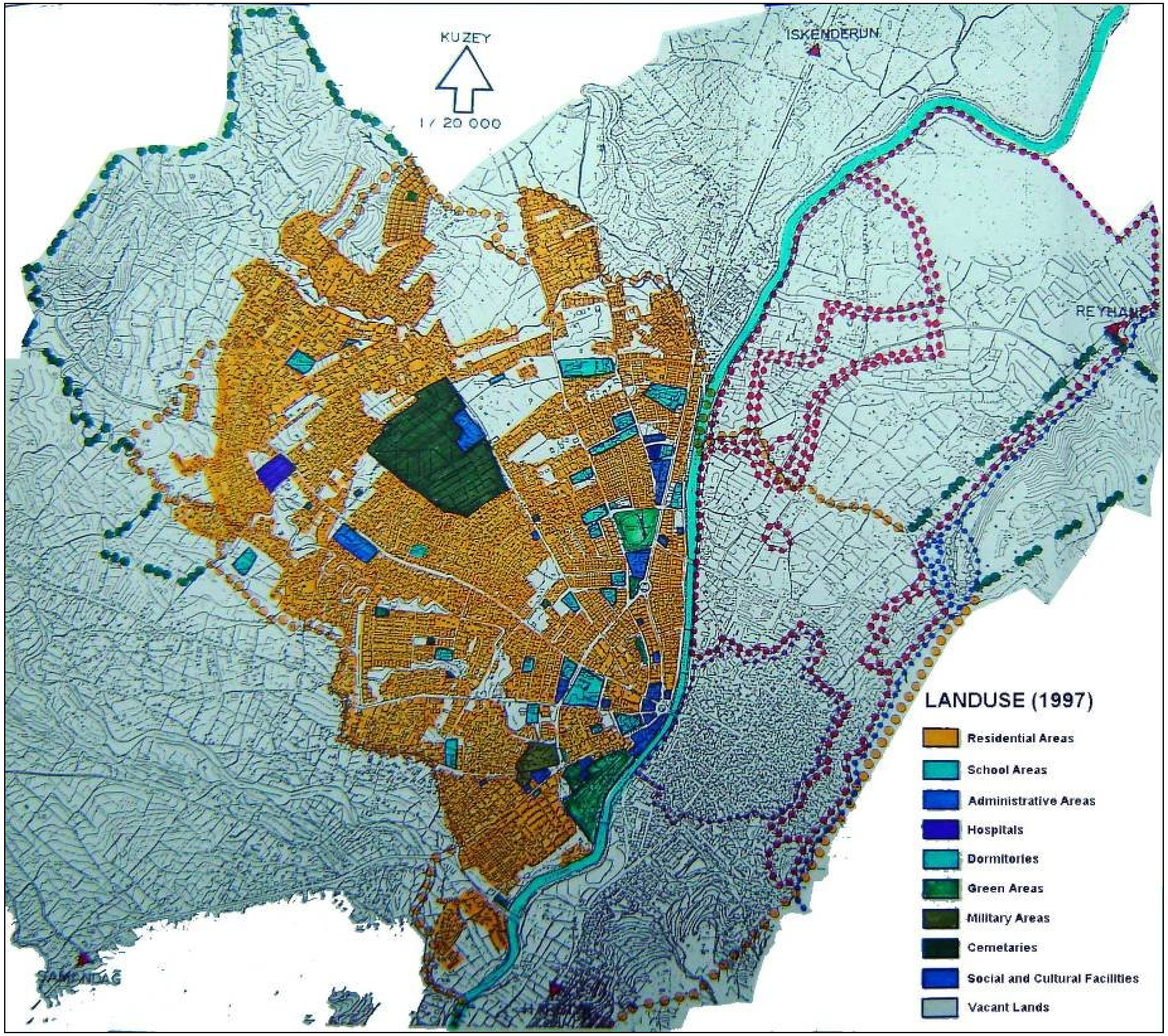


Figure 4.26: Land-use Map of new Antakya in 1997
(Source: Mersinligil 1997)

With the Development Plan of 1997 net population densities planned were in the average 265 person/ha in the new Antakya (1997). This was to increase densities to an average 400 person/ha and accommodate more than 150.000 additional population and projected housing needs for this future population. By such a density increase, and new development areas on the western lands of Asi, it was planned to rehabilitate archaeological, natural and urban conservation sites in the eastern parts where old Antakya is located. In this plan it is proposed that along Kavaslı and Hanna Creeks and Kurudere Brook additional reforestation areas, green and recreational spaces are introduced, as well as on the slopes of eastern mountains broad reforestation lands are reserved (Figure 4.26). However, today Antakya has no additional open space than is City Park and cemetery but only highly dense neighborhoods (Figure 4.27).

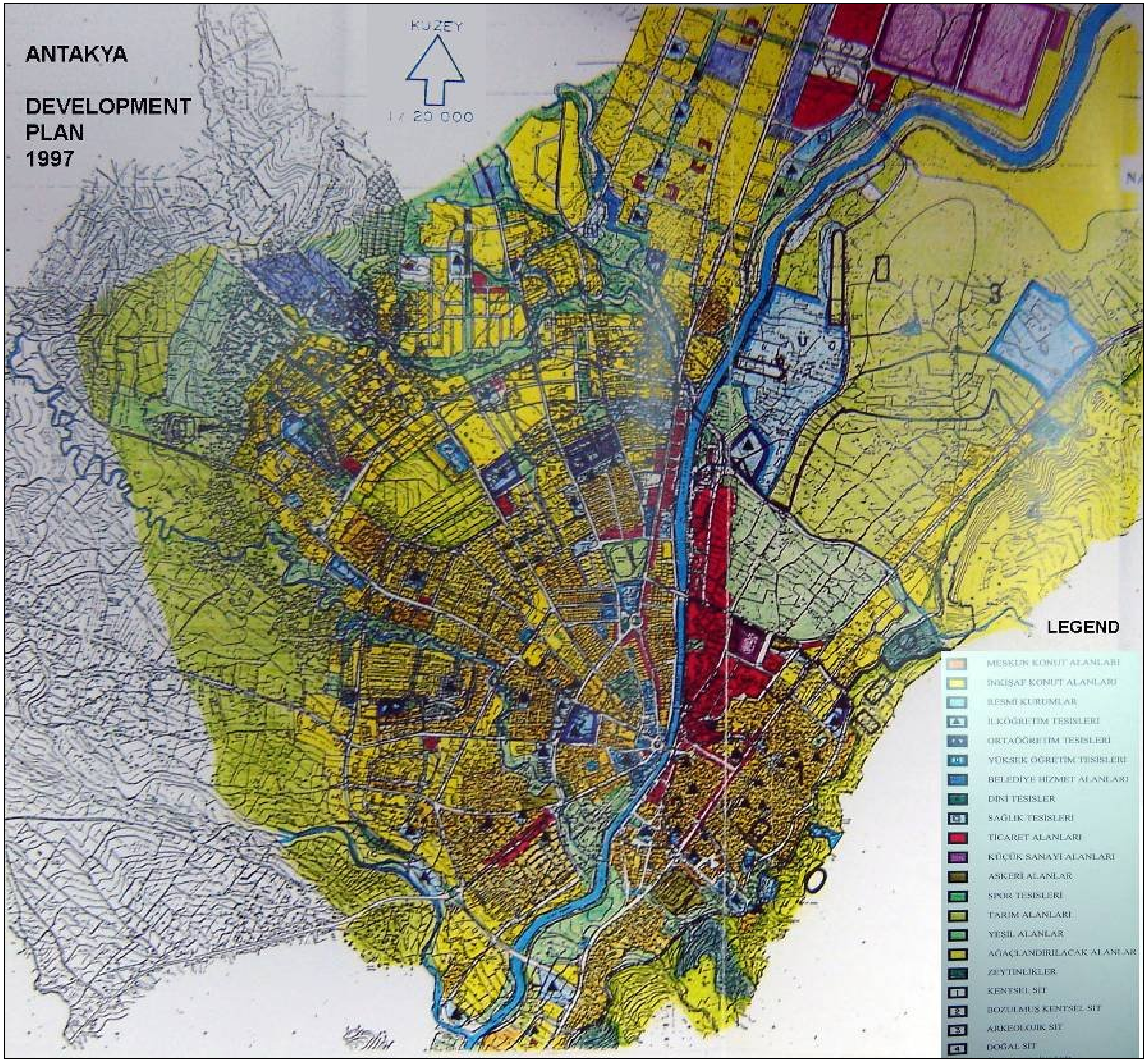


Figure 4.27: 1997 Development Plan
(Source: Mersinligil 1997)

4.1.4.2. Flood Vulnerability and City Growth of Hatay

According to the Antakya Municipality there is a gradual increase in rainfall (Soğuksu 2008). The rainfall that corresponds to the total of one month-long precipitation occurs in a very short time. Therefore, neither Asi river elevation nor city infrastructural system is effectively likely to work to carry such quantity in a very short span of time. At the same time, the natural flow of upper basin sources originating from the eastern mountains of Antakya to Asi River through the topographical and morphological settings is not effective anymore. Due to densely populated neighborhoods on these natural drainage channels, such as valleys, riverbeds the city is extremely vulnerable. Densities are still in the increase today. The urban population of Antakya was 144’910 according to 2000 Census, and declared as 188’310 according to 2008 Census based on address (TÜİK 2009)

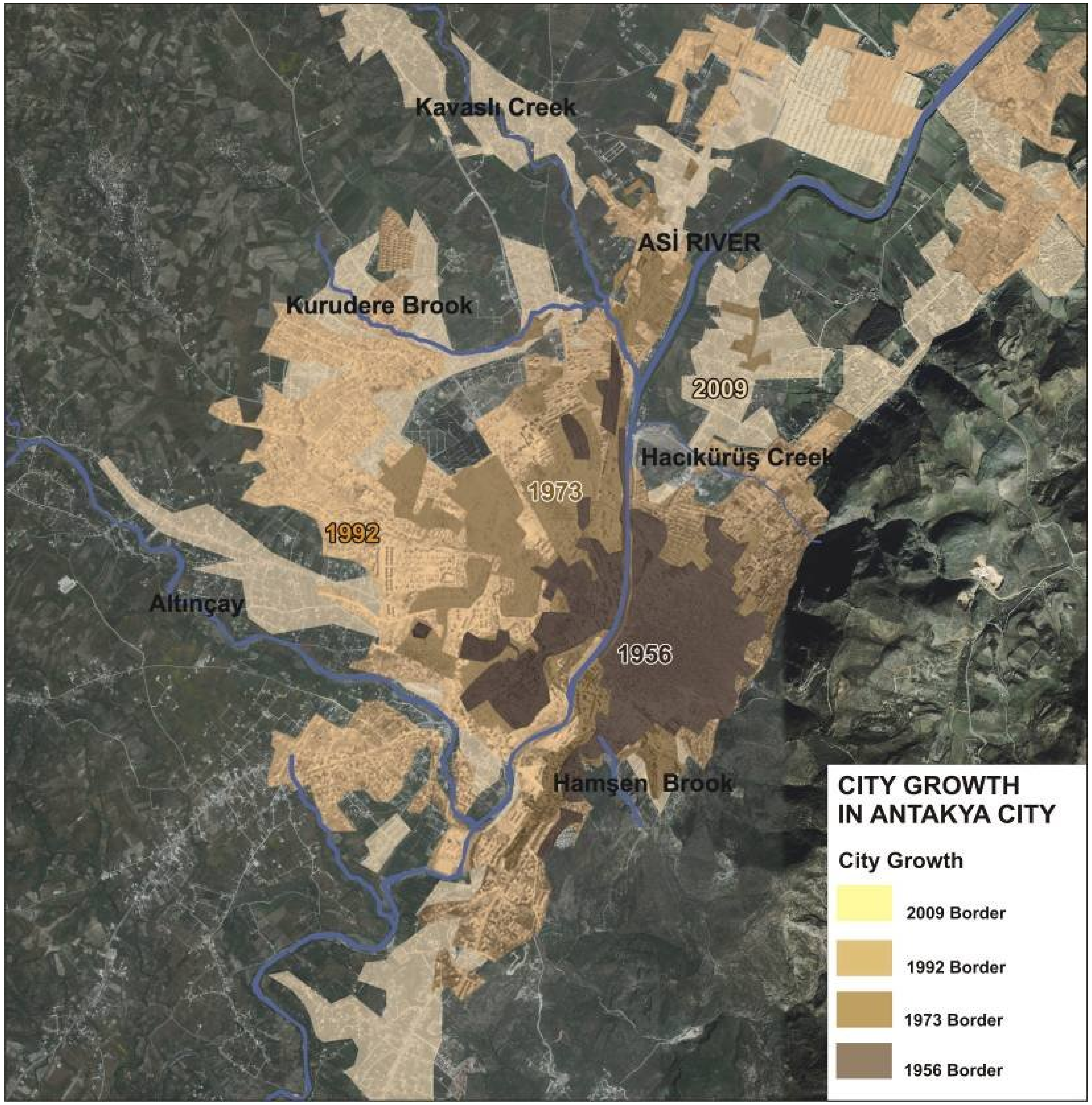


Figure 4.28: Antakya City Growth *(Sources: Harita Genel Komutanlığı, Google Maps)*

Another factor is the land-use change of forest areas on steep slopes of eastern edge of Habibnecar Mountains of Antakya. Most of the upper basin has been used for agricultural activities. Because of such land-use change, soil erosion and flash floods are more frequently observed in recent years.

The unauthorized establishments along Asi River and other creeks in 1950 were authorized in time by the local governments. However, such areas are still exposed to regular floods of them.

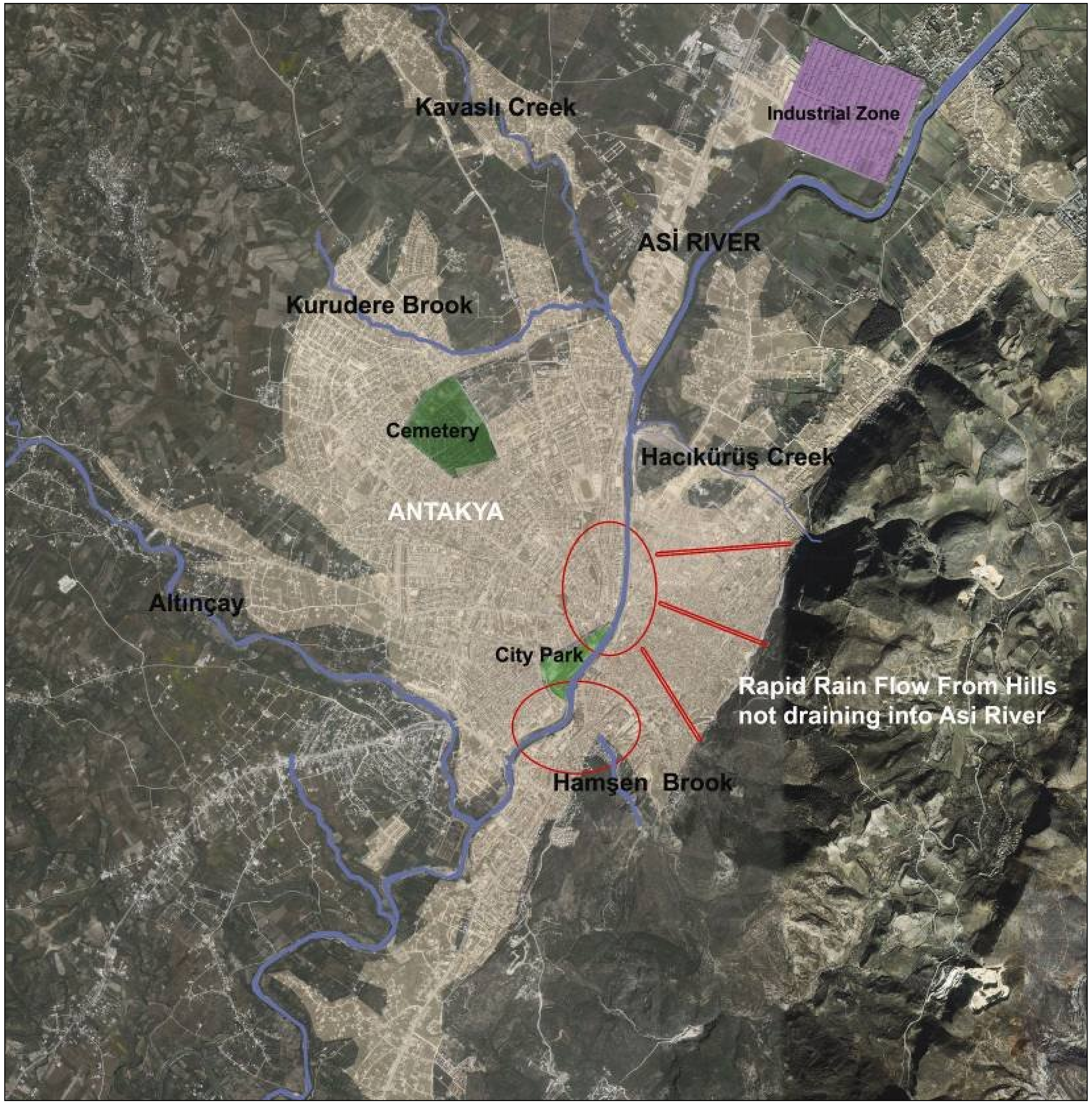


Figure 4.29: Antakya City Vulnerabilities, Asi River and Tributaries

4.2. EVALUATION IN TERMS OF PLANNING DISCIPLINE

Findings of the research on each case (Bartın from West-Black Sea Basin, Aydın from Büyük Menderes Basin, Batman from Dicle Basin and Hatay from Asi Basin) provide an opportunity to categorize the main causes of flood events in Turkish riverine cities. Besides, the detailed vulnerability analyses made for two case provinces (Bartın and Batman) indicate the volume of potential losses in terms of number and value of stock and population using that stock.

The seasonal distribution of major flood events took place in case provinces are presented in Table 4.17. Although there are some differences between the cases, floods seem to have occurred mostly in spring seasons. The reasons are the increasing volumes of precipitation during spring together with the melting of snow on upper basins. As a general finding it is appropriate to state that the reasons of chronic flood losses in urban areas in Turkey depend on both local physical settings such as climate, geomorphology, plantation and soil structure and common human activities within the development process in time.

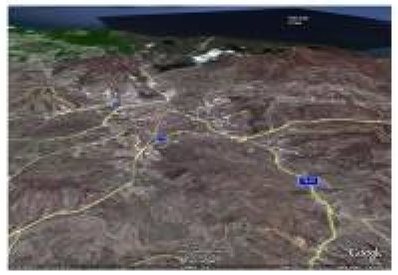
Two of the four cases, Hatay and Aydın provinces are different than the other two in terms of their provincial area size, and settlement pattern (dispersion) on provincial area, as well as stream network and characters that pass through central sub-provinces. For instance, B. Menderes River does not directly affect Aydın provincial center, rather it has great impacts on urban and rural settlements on the southeastern parts within Aydın provincial borders. There are a number of tributaries of B. Menderes that create flood damage within Aydın provincial center itself. Hatay, on the other hand, including provincial center (Antakya) is affected by the floods of Asi and its tributaries whose upper basin is located in Syria. However, relatively smaller provinces in terms of total provincial area, municipalities and total population they have, Bartın and Batman provincial centers, are more frequently affected by flood damages compared to other municipalities they have.

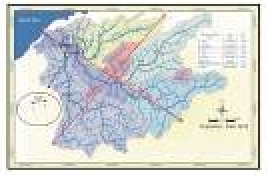
Table 4.17: Seasonal Distribution of Major Flood Events in Selected Case Provinces

SEASON	MONTHS	WEEKS	BARTIN	BATMAN	AYDIN	HATAY
WINTER	December/January	Week 1				
	January	Week 2				
	January	Week 3				
	January	Week 4			2004	1968
	January/February	Week 5			1956, 1998, 1999	1968
	February	Week 6			1956	
	February	Week 7				2003
	February	Week 8	1998			1962
	February	Week 9				1976
SPRING	March	Week 10				
	March	Week 11				
	March	Week 12		1995		1969
	March	Week 13			1958	
	March/April	Week 14				1987
	April	Week 15				1980
	April	Week 16		1969		1965, 1967, 2008
	April	Week 17			1965	1967,1975
	April/May	Week 18	1975	1972		
	May	Week 19			1993	
	May	Week 20			1998	2001
	May	Week 21	1998	1972		2004
	May	Week 22				1998
	May/June	Week 23				
SUMMER	June	Week 24	2000			
	June	Week 25	1973			2002
	June	Week 26				
	June/July	Week 27				
	July	Week 28	1991			
	July	Week 29			1995	
	July	Week 30	1995			
	July/August	Week 31				
	August	Week 32				
	August	Week 33				
	August	Week 34				
	August	Week 35	1983			
	August/September	Week 36				
AUTUMN	September	Week 37				
	September	Week 38			1996	
	September	Week 39				
	September/October	Week 40				
	October	Week 41				
	October	Week 42				
	October	Week 43				
	October	Week 44		2006		
	November	Week 45		1991		
	November	Week 46				
	November	Week 47				1986
	November	Week 48				
WINTER	November/December	Week 49				
	December	Week 50				
	December	Week 51			1997, 2007	
	December	Week 52			2001	

CASE STUDY AREAS	Physical Settings of Major River Basin Located	Flood events, Reports and Recommendations (SHW Records)	Plan Preparations and Major Decisions Reviewed

BARTIN





Flood Events:

Eight major flood events, first one in 1973 and the rest are in 1975, 1983, 1991, 1995, 1998 and 2000, have taken place.

Reasons of Floods:

- accumulation of debris in the riverbed,
- irregular tree plantation
- blockage effect of some infrastructural facilities such as bridges
- intensive rainfall and overflow of high river waters,
- exceeding of the level of soil saturation,
- fast snowmelt on the upper basin,
- the deforestation in lower basin,
- the sharp decrease in steep slopes of the upper basin,

Recommendations and Proposals:

- transfer of some of the properties in flood-prone areas,
- clearance of riverbeds,
- prevention of interventions on riverbeds,
- reforestation to prevent soil erosion,
- redesigning coastal area where Bartın River connects to Black Sea in order to prevent from backwash effect of Black Sea
- repair works on damaged embankments
- construction of dams at the upper basin, particularly on Kozcağız and Gökırmak,
- stabilization of riverbed slopes of the district center
- reconstruction of bridges to meet the hydrological standards
- redesigning some segments of the river channel

Development Plans in Chronological Order:

- 1970 Development Master Plan for Bartın
- 1980 Development Master Plan for Bartın
- 1982 Implementation Development Plan for Bartın
- 2006 Development Master Plan for Bartın

Major Land-Use Decisions and Outcomes:

- Transformation of Dock Square into Timber Industry Square
- Construction of the new hospital, marketplace and bazaar
- Decentralization of industrial facilities, expansion of industrial facilities towards river-dock area and Bartın Strait
- Allowing residential developments spread over the plains and agricultural lands
- Permitting urban development on flood-prone areas and low drainage sites,
- Designation of the all municipal lands as residential areas

Impacts of Settlement's Growth regarding floods	Territorial Plan Decisions	Persisting Vulnerabilities and Values in Cities

No specific provisions and measures on flood risks and mitigation are observed in Territorial Plan. Only big-scale ongoing projects and investments such as dams, reservoirs, etc. are mentioned

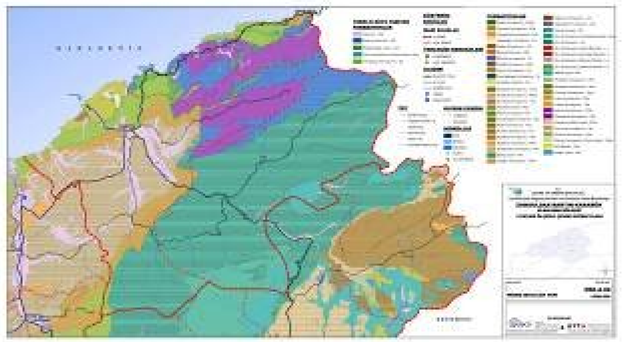
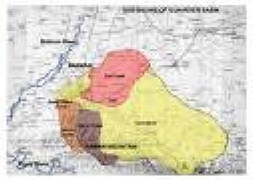
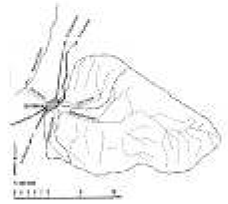


Figure 4.30: Summary of Evaluation of Bartın with respect to Floods and Planning

CASE STUDY AREAS	Physical Settings of Major River Basin Located	Flood events, Reports and Recommendations (SHW Records)	Plan Preparations and Major Decisions Reviewed

BATMAN





Flood Events:

Flood events in 1969, 1971, 1972, 1991, 1995 and 2006 have resulted in gradually increasing damages.

Reasons of Floods:

- inefficiency of the riverbed due to direct discharge of sewerage,
- blockage of natural link between Çay and İluh River by urban developments & facilities
- construction of buildings on floodway and floodplains of İluh River,
- decrease in the riverbed flow capacity due to the construction of bridges over İluh River, to the direct discharge of sewerage and solid waste and to the construction of sewage water collectors,
- lack of effective and regular clearance of the debris agglomerated on İluh riverbed
- blockage effect of Batman-Midyat Road and TPC Facilities on Çay river,
- closure of Savara, Aşağıkonak, Şakuli tributaries and conversion of them into streets,
- inefficiency of existing infrastructure like rain-water and sewage systems,

Recommendations and Proposals:

- transfer of dwellings on floodplains to safer locations,
- rehabilitation of İluh and Çay Rivers,
- clearance of solid waste and debris,
- avoidance of direct sewage discharge,
- reconstruction of sewage connectors of TPC outside the riverbed,
- reconstruction of bridges according to hydraulic standards,
- revitalization of the riverbeds
- extension of the existing flood protection facility 500 m. long to protect newly developed areas,
- provision of earth channel reclamation towards Batman River and creation of 30 m buffer zone behind both banks,
- flood waters of Çay River should discharge into İluh River or rain-water collectors of city by GD of Bank of Provinces,
- revision of development plan for the adaptation of İluh reclamation project,
- expropriation of certain areas to implement the reclamation project,
- opening of tributaries and construction of reclamation facilities as well as service road for maintenance-clearance works

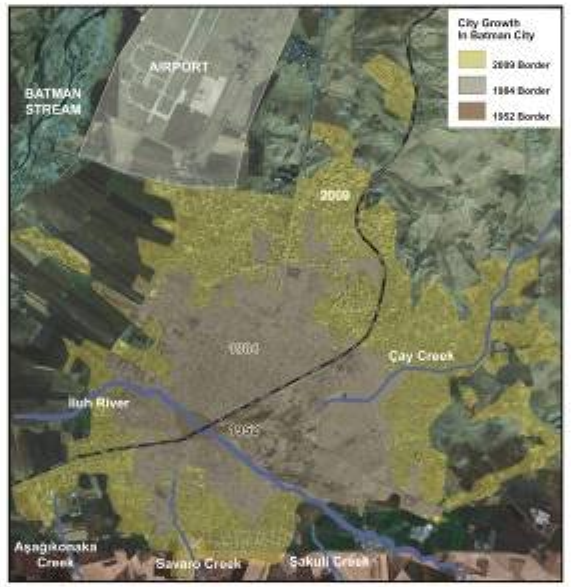
Development Plans in Chronological Order:

- 1959 Development Master Plan for Batman
- 1976 Development Master Plan for Batman
- 1991 Development Master Plan for Batman
- 2000 Revision Plan for Batman
- 2006 Revision Plan for Batman

Major Land-Use Decisions and Outcomes:

- In earlier plans;
  - New developments were directed towards the northern parts of the city
  - Industries and related activities were located in the southern parts of the city
  - Western parts were left as state farms, agricultural land, etc.
  - Commercial center of the town was proposed to be developed along Diyarbakır highway on the northern direction
  - Most of the decisions in earlier plans remained unimplemented
- Huge flow of rural immigrants led to the sprawl of unauthorized developments on public lands and on shared properties
- Unauthorized developments were legalized by the approval of new development plans and decisions

Impacts of Settlement's Growth regarding floods	Territorial Plan Decisions	Persisting Vulnerabilities and Values in Cities

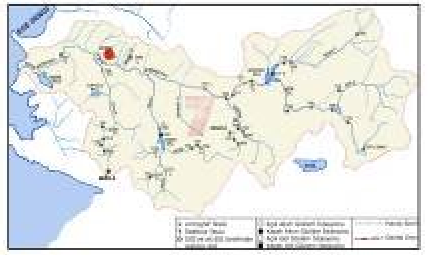


No Territorial Plan is developed for Batman City.

Figure 4.31: Summary of Evaluation of Batman with respect to Floods and Planning

CASE STUDY AREAS	Physical Settings of Major River Basin Located	Flood events, Reports and Recommendations (SHW Records)	Plan Preparations and Major Decisions Reviewed

AYDIN



Flood Events:

Flood events in 1956, 1958, 1966, 1989, 1993, 1995, 1996, 1997, 1998, 2001 and 2004 have resulted in serious damages in Aydın.

Reasons of Floods:

- highest levels of rainfall and snow,
- rainfalls occurred beyond long meteorological observation series as an outcome of global warming and climate change,
- soil erosion and transfer of debris from upper basin,
- topography, vegetation and soil features of the catchment area led erosion, drifting and accumulation effects,
- high volumes of water spread into lower plains in a very short time period together with large amount of debris and rubble,
- insufficiency of the existing urban infrastructure networks
- inefficiency in the riverbed capacity and the blockage of the riverbeds

Recommendations and Proposals:

- forestation and terracing of the southern slopes of northern mountains,
- construction of gradual desilting barrages to store debris transferred from upper basin,
- regular clearance of debris on riverbed,
- upper basin measures to control erosion and debris were noted as necessary,
- rehabilitation of some brooks and creeks,
- revision of the development plans in accordance to the rehabilitation projects,
- preservation of the prevailing vegetation,
- increase in the reforestation activities,
- extension of the capacities of flood routes and passages

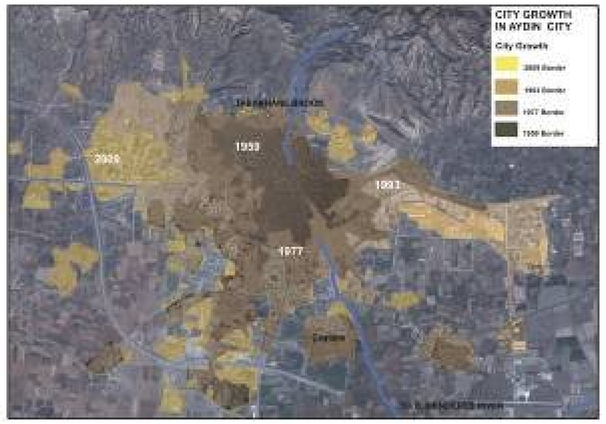
Development Plans in Chronological Order:

- 1951 Development Master Plan for Aydın
- 1959 Various Plan Modifications
- 1968 Development Master Plan for Aydın
- 1986 Development Master Plan for Aydın
- 1993 Revision Plan
- 1996 Development Plan
- Various Plan Revisions and Modifications

Major Land-Use Decisions and Outcomes:

- Unprecedented growth due to the rise in textile industry
- Agglomeration of population around CBD
- Increase in residential densities in built-up area
- Inconformity between actual densities and plan considerations
- Sprawl of unauthorized residential developments over agricultural lands in southern parts
- Provision of an increase in the existing building heights in the entire urban area
- Efforts to create additional open and green areas but limited progress

Impacts of Settlement's Growth regarding floods	Territorial Plan Decisions	Persisting Vulnerabilities and Values in Cities

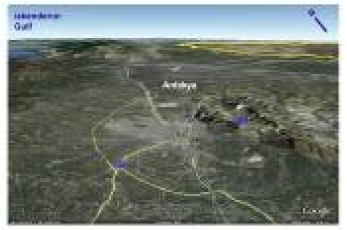


No specific provisions and measures on flood risks and mitigation are observed in Territorial Plan. Only big-scale ongoing projects and investments such as dams, reservoirs, etc. are mentioned

Figure 4.32: Summary of Evaluation of Aydın with respect to Floods and Planning

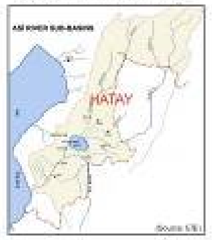
CASE STUDY AREAS	Physical Settings of Major River Basin Located	Flood events, Reports and Recommendations (SHW Records)	Plan Preparations and Major Decisions Reviewed

HATAY



Asi Basin and Neighboring basins

Asi River Basin and Stream Network



Antakya City and Upper Basin Flow

Flood Events:

Various flood events have taken place particularly in 1962, 1965, 1967, 1968, 1975, 1976, 1980, 1987, 1998, 2001, 2002, 2003 and 2004

Reasons of Floods:

- continual rainfall exceeded 16% of the annual precipitation in a week,
- occurrence of rainfall corresponds to that of 1000-year-period,
- reduction of discharge capacity of the river by bridges
- soil character, topography and loose vegetation in the catchment area, which causes soil erosion,
- illegal residential establishments on riverbeds and in catchment area,
- interruption of precipitation-runoff balance,
- intense sediment and debris movements from upper basin due to slope erosion
- destruction or uncontrolled operation of dams in Syria
- human interventions on the riverbeds, such as plantation of trees, dumping of solid wastes, etc.

Recommendations and Proposals:

- construction of a dam on Eşrefli location,
- construction of embankments on both sides of Asi River and reclamation of Asi riverbed,
- reconstruction of bridges in accordance with the required standards
- increase in the riverbed capacities and enlargement of floodway sections
- repair and rehabilitation of fresh water and sewerage networks
- preparation of embankment works for both banks of Asi River,
- deepening and enlargement of riverbeds,
- relocation of the villages and neighborhoods around the Amik Lake on lands higher than 83 meters above the sea level,
- erosion control on the upper basin and reclamation works of lower basin to be done complementarily
- preparation and implementation of flood protection projects in collaboration with Syria
- reclaiming of the riverbeds and avoidance of solid waste removal,
- regular clearance of sediments on the riverbeds.

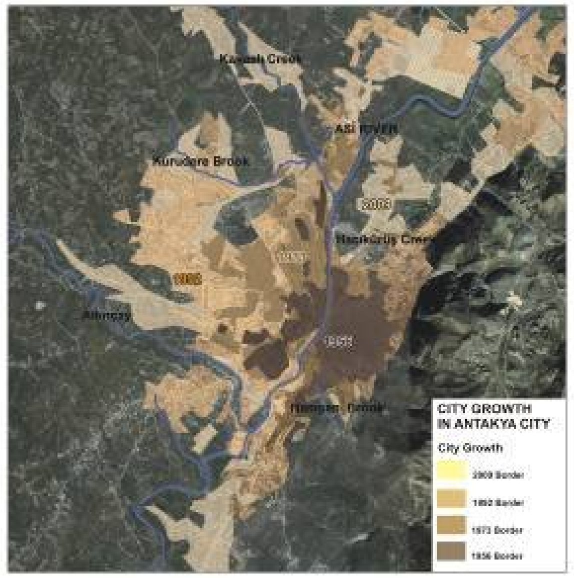
Development Plans in Chronological Order:

- 1948 Development Master Plan for Antakya
- 1957 Development Master Plan for Antakya
- Various Plan Modifications at different dates
- 1978 Development Master Plan for Antakya
- 1985 Rehabilitation Plan
- 1997 Development Master Plan for Antakya

Major Land-Use Decisions and Outcomes:

- The town was proposed to grow towards three different directions
- Industrial establishments were located on wider plains towards Amik Plain
- Internal unity and consistency of development plans were jeopardized by partial plan modifications
- Historical quarter and registered buildings were proposed to be conserved
- New developments towards Reyhanlı were prohibited to preserve the agricultural lands
- Multi-storey buildings and high density development rights were proposed to western parts of Asi
- Most of the plan decisions remained unimplemented
- Rehabilitation plan was resulted in physical transformation in the built up area, building heights and densities were increased and the distance between buildings was decreased
- Infrastructure provision and improvement did not match with development plans
- 1997 plan increased the residential densities in built up area
- New and additional green areas, open spaces were proposed along some of the creeks and brooks
- Plan decisions concerning the provision of green areas was not implemented, Antakya city center is suffering from the lack of such areas in the current situation

Impacts of Settlement's Growth regarding floods	Territorial Plan Decisions	Persisting Vulnerabilities and Values in Cities



No specific provisions and measures on flood risks and mitigation are observed in Territorial Plan. Only big-scale ongoing projects and investments such as dams, reservoirs, etc. are mentioned. Buffer Zone on both sides of Asi and its tributaries are designated as development control area.

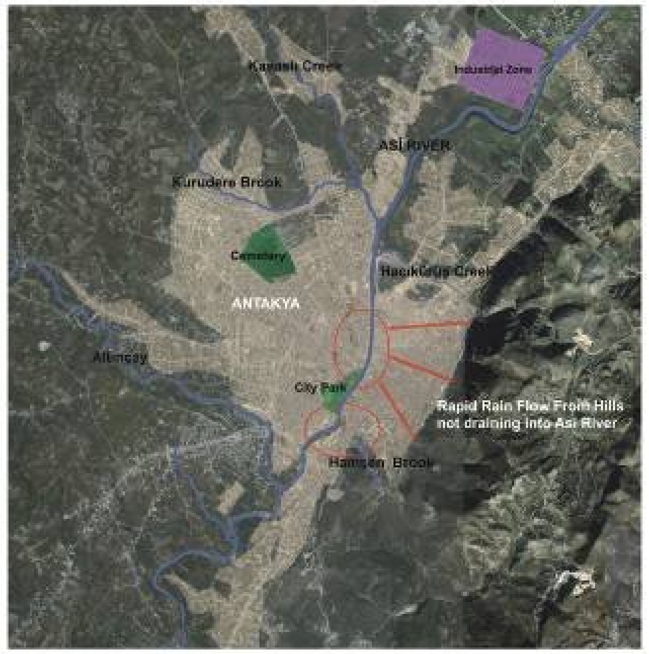


Figure 4.33: Summary of Evaluation of Hatay with respect to Floods and Planning

Common causes of floods derived from the findings of the research are categorized and discussed in two levels, namely river basin level and urban level. Flooding, as a hydro-meteorological event is vital for the continuation of habitat and ecological cycle of surrounding areas. When this cycle is interrupted by human interventions and settlements, flood events turn into flood disasters damaging life and property. Hence, river flood mitigation measures should be taken by considering the existing situation of the entire basin and sub-basins because any change in the catchment area directly affects flow discharges of streams and tributaries.

Nevertheless some of the protection measures or emergency responses to protect an area in the upper basin generally result in unexpected problems in other locations of the catchment area. These uncoordinated and non-concerted actions could lead to shift problems from one location to another along a stream. Such occasions are usually observed in places where transnational rivers exist. For instance, due to heavy rainfall on the upper basin, which exists in another country, a dam failure or any emergency response like letting excessive water outside the reservoir create flood losses in the lower basin, in which no actual rainfall occur. Hatay faces similar upper basin problems because of trans-boundary Basin of Asi River. Flood management and mitigation studies and measures in Asi Basin require a basin-wide cooperation between Syria and Turkey.

Similarly, any land-use decision such as converting forestry into agriculture or any unexpected changes on the upper basin, like flash snowmelt on mountains of upper basin affect river discharges and cause floods at the lower basin areas. This is a frequently observed situation in the case of Aydın. Hence, it can be stated that such kind of upper basin problems are observed among districts, sub-provinces, provinces, regions of Turkey as well as between Turkey and bordering countries that share rivers.

Therefore, the monitoring and controlling of all natural events and human-induced activities that occur in any river basin should be considered as a whole due to its hydro-meteorological character. Territorial Plans in Turkey seem to be instrumental for such monitoring and controlling actions. In other words, it is appropriate to state that major river basins of Turkey could be monitored and controlled by provisions of Territorial Plan approved by the Ministry of the Environment and Forestry.

The main purpose of Territorial Plans (1/100’000 scale) is to maintain ‘sustainable development’ in the confines of the planning area. In order to achieve this goal, all sectoral developments, as well as urban and rural development should be assessed, and ‘conservation-use balance’ should be determined. Once the Territorial Plans (TPs) are prepared, they should provide a general framework for lower-scale and subordinate plans, such as Urban Master Plans (1/25000 scale), Development and Implementation Plans (1/5000 ans 1/1000 scales), which put forward strategies and land-use decisions. However the current situation in Turkey is quite different. Most of the Territorial Plans are far away from being a general framework providing decisions to achieve sustainability and ‘conservation-use balance’. Rather they are prepared as ‘tendency plans’, bringing together the provisions of existing lower-scale and subordinate plans as well as the existing investment decisions.

Based on the Law numbered as 4856, which gives the responsibility regarding Territorial Planning to the Ministry of Environment and Forestry, a number of Territorial Plans were prepared for several regions including Hatay (2006), Zonguldak-Bartın-Kastamonu (2005), Aydın-Muğla-Denizli (2006).

According to the Territorial Plan of Hatay residential and non-residential developments on agricultural lands are absolutely prohibited. In the sub-region planning area in Antakya, flood-prone areas are identified and decided as “Special Planning Areas” in order to protect settlements in the disaster zone. However this is an ambiguous decision. Types of land-uses to be permitted in these special areas and the tools to implement this decision are not clearly designated in the plan. For existing settlements in protection zone and areas within 50-meters distance from Creeks; Altınçay, Kuzeytepe, Kavaslı and Hanna, Territorial Plan only refer to the provisions of Building Construction Regulation on Disaster-Prone Areas, and states that new establishments could be permitted on the basis of this regulation. In short, no special and well-determined provisions are provided regarding flood risk mitigation in Territorial Plan of Hatay.

2006 Aydın-Muğla-Denizli 1/100'000 Territorial Plan, on the other hand, does not include any notification for flood vulnerable areas for protection, and for flood risk mitigation. The only decision in the plan regarding flood issue is the designation of the boundaries of Water Catchment Areas.

In sum, it is appropriate to state that Territorial Plans investigated in the context of selected cases do not have provisions, strategies and/or decisions regarding the effective monitoring and control of all related activities against flood disasters.

As the second level of our final evaluation, the urban level is considered. Case studies indicated that urban areas are exposed to continual floods through years. Findings of the case-study research in selected case areas highlighted many examples of inaccurate implementations and developments. As observed from the cases, municipal governments connive at uncontrolled growth of urban areas on flood-prone areas and riverbeds either with development plans or individual plan modifications. Such implementations have been frequently observed after the enactment of Law numbered as 3194, which transferred the rights of approval of plans to Municipal Councils open to pressures of various local interest groups.

The problems occur at urban level could be categorized in four groups.

1. There are deficiencies and inefficiencies in the design and implementation of infrastructure systems in most cities, and there are sub-standard implementations such as the direct and simultaneous discharge of sewage and rainwater systems.

    a. Sewage water and rainwater in urban areas have been usually collected by the same infrastructural network and directly discharged into nearby rivers or seas. Despite a few exceptions this is common in urban areas in Turkey. So it is inevitable during heavy rainfalls that highly increased river discharges cause much worse floods and environmental pollution due to the contribution of extra water load of these infrastructures.

    b. There is also a problem of deficiency in urban infrastructure capacities. All cases have the same problem of density increase in current built-up areas. So existing infrastructure systems that are designed to hold a certain population densities at the maximum can not function efficiently, particularly during rainfalls.

2. There are deficiencies in the maintenance services of river beds and reclamation facilities, and these deficiencies end up with the decrease in capacities of riverbeds due to solid waste dumping, sediment agglomeration and blockage of river system.

    a. During dry seasons, riverbeds that should be cleared regularly and be ready for natural river-flow are generally used as solid waste dumping areas. However during rain seasons, these wastes decrease riverbed capacity, and block rivers at the bottlenecks. Rivers therefore flood and inundate nearby areas.

    b. Depending on the type of plantation, geomorphology and soil structure a certain quantity of sedimentation coming from the upper basin is agglomerated in the riverbeds in certain periods. Considering the physical conditions these agglomerations on the riverbeds should be cleared regularly.

    c. DSİ always requires a minimum of 5 meters wide service path at least on one bank of a river for reclamation activities and facilities. Nevertheless, as observed in case cities and in many other cities in Turkey, rivers and dry riverbeds, which should be preserved in their natural state with open channels, are mostly converted into closed channels. Aydın is an example for this situation. In some cases the closed river paths are used as streets. In Batman there are several examples of this situation.

3. Inadequacy of urban open and green surfaces, the decrease in agricultural land, and the increase in green and open spaces engulfed by concrete spaces, pavements and buildings are common problems in many cities.

    a. Densely built areas and concrete surfaces have increased while open and green spaces, where rain meets with soil, have decreased in most urban areas of Turkey. Therefore, after a rainfall, in a very short time urban services and uses located at lower elevations are exposed to flash floods. Batman provincial center and Antakya are the most extreme examples with almost no green areas in cities.

4. Implementations of structural measures and engineering interventions as the mere protection facility create deficiencies and led to the aggravation of problems. Inaccurate design of transportation bridges and the confidence based on structural measures contribute substantially to occurrence of floods.

    a. It is observed that the bridges, which are used as roads or pedestrian paths between two banks of rivers, become bottlenecks in river flows when they are not designed by considering necessary hydraulic calculations of river flows, or reconstructed without any regard to the changing hydraulic conditions by local governments.

    b. The only public institution responsible from flood protection is DSİ. They prepare flood hazard maps displaying 2-dimensional flood boundaries determined according to the discharge of 500-year floods. If considerable inhabitants exist in flood-prone areas, the river channel reclamation and/or the construction of embankments are proposed to increase river channel capacity to accommodate a certain flood discharge volume. The boundary is declared by the development plan as ‘restricted for settlement’ until these protection facilities are constructed. After the completion of such constructions these areas are declared as ‘safe locations for settlements’. Although there is always a possibility to experience more intensive flood discharges, surrounding areas that are supposedly ‘totally safe’ behind these flood protection facilities are used for new developments. Besides, these flood protection works that change the natural river-ways into artificial river channels make the flows faster and stronger sometimes causing destructive effects on flood protection facilities.

5. ‘Hazard maps’ of stream basins indicate the areas where development should be avoided. These maps are in principle used as base maps for development plans prepared by local governments, Yet in the current situation such decisions are overridden by unauthorized developments and flood-prone areas are either encroached by residential buildings or used for streets, public buildings, residences, etc. In other words, flood prone zones of a basin determined as restricted for settlements by central government, unwillingly registered by the local administrations are usually ignored in practice. Hence; there is a lack of an administrative unit among the related public bodies to supervise (coordinate, control and monitor) future urban developments and appropriate implementations about flood management programs **at the river basin level.** Local ad-hoc interventions may temporarily solve the flood problem at that specific location; however, this leads to the transfer of flood problem to another location. Any change in land-use or the course of river may have basin-wide effects depending on the hydrological cycle.

6. The analyses of the inventory of vulnerabilities in two of the case cities enable us to conclude that the rational decision and strategy in riverine cities is to avoid urban developments on flood-prone areas. Once development is not controlled or permitted on such areas the volume of potential losses increase rapidly. In both cases it is calculated that 30% of the resident population is living on areas prone to flood hazards. Besides, the value of the existing properties on flood-prone areas is appeared to be at least 3 times more than the total cost of structural investments made. Therefore there is the risk of loosing substantial amount of monetary resources and human life on flood-prone areas. This amount includes not only the investments made for the existing vulnerabilities on risky areas but also the money spent for the structural measures, which are not adequate and efficient to solve the problem.

CHAPTER 5

CRITICAL EVALUATION OF TURKEY'S FLOOD MANAGEMENT SYSTEM IN THE LIGHT OF INTERNATIONAL EXPERIENCES

The research on case study provinces presented in Chapter 4 indicates that human interventions either planned or unplanned (unforeseen) create irreversible circumstances contributing to the continual increase of flood losses in riverine settlements. However, a number of common factors originating from the institutional relations within the existing administrative and legislative framework enable such human interventions.

This chapter has several aims. First of all, it aims at identifying and assessing the main tasks and responsibilities of related institutions regarding flood protection system in Turkey. The second aim has been to evaluate the relationships between flood protection legislation and urban planning system in Turkey. Finally it is intended to derive some lessons to improve the current system in Turkey by considering the related international experiences.

The analyses in this chapter are based on

- Legal provisions; such as laws, regulations, circulars etc.
- Academic material on national and international experiences,
- Official correspondences in DSİ archive files of case study provinces,
- Semi-structured interviews made with
    - officials such as planners, engineers, and technicians working for the responsible Ministries, Regional Directorates of Ministries;

- majors and technical staff from local authorities in case study provinces, and
- related private planning offices.

There no prevailing flood management system exists in Turkey. Rather flood protection activities are usually realized by the General Directorate of State Hydraulic Works (DSİ), which is a central governmental institution. River flood issues in Turkish settlements are considered as a 'technical problem' to be solved by protective and structural measures of DSİ. The usual and preferred technical solutions include the preparation of structural measures; such as dams, reservoirs and river training and reclamation facilities so as to protect the areas frequently flooded and the affected populations. However urban inundations (flash floods) occur largely due to the infrastructural deficiencies caused by irrational interventions of local authorities such as increase of building heights and densities, allowance of urban developments on flood-prone areas, etc.

As there is no formal 'flood management system' in Turkey, tasks, responsibilities and implementations of related institutions are examined and discussed in order to highlight the basic dimensions of the Turkish system. Moreover, plan preparation, approval and implementation processes regarding measures to curb the impacts of natural hazards, are also examined.

Flood management experiences as well as administrative and legislative structures of France, Netherlands and Germany are examined in the second part of this chapter. Following this examination flood protection framework in Turkey is compared and assessed with respect to the solutions in examined countries. Different approaches and solutions observed are used to provide essential inspirations and ideas for the Turkish case.

International experiences on flood risk management are examined in two steps. In the first step, works of regional or supranational establishments are researched in order to identify the common ideas or concepts seem to be useful in understanding the flood management framework. European Union as a regional or supranational establishment recently produced 'Legal

Documents' about Water Management and Flood Risk Management. These documents include broad decisions, preparation of flood risk maps, and operational plans regarding particularly shared streams and basins by many European Countries. These documents are examined as the first part of the research on international experiences. In the second step, mitigation strategies and tools of the selected countries are investigated. The administrative structures of the selected countries and the ways they handle flood issue has been the major focus of interest of this research.

5.1. REVIEW ON TURKEY'S CURRENT INSTITUTIONAL AND LEGISLATIVE STRUCTURES ABOUT FLOOD PROTECTION AND URBAN PLANNING

In this section Turkey's current institutional and legislative structures regarding flood protection are examined. While doing such an examination, it is critical to consider the relationships between flood protection legislation and urban planning.

In the current situation DSİ is the central authority regarding water works in Turkey. First of all, responsibilities of DSİ covering its entire components such as the central body and local branches are examined. Then a number of institutions involved in disaster and emergency management are examined by considering their relations with DSİ. One of these institutions is the General Directorates of Disaster Affairs (AİGM) based on Disasters Law numbered as 7269, and on the Protocol about Resettlement of Flood Victims. Other institutional bodies that have indirect relations with DSİ are also mentioned in this section. It is essential to identify and reevaluate their position within the whole framework of disaster emergency. The legal background of all these institutions is given in detail in Appendix J.

5.1.1 Institutions Responsible For Flood Protection and the Relations between Them

General Directorate of State Hydraulic Works (DSİ) was established in 1954, and was given the primary responsibility for identifying potable water sources and for routing them to consumers in cooperation with municipalities in urban areas (DSİ 1985, 6-7). Another task is to preserve and sustain both ground and underground waters and basins. DSİ performed these tasks under the Ministry of Public Works and Settlement (MPWS) until 1964; then it was annexed to the Ministry of Energy and Natural Resources (MENR). More recently in 2007, DSİ has organized as a General Directorate under the Ministry of Environment and Forestry (MEF).

Other tasks defined in the Foundation Law of DSİ numbered as 6200 are as follows:

- Construction of protective facilities from flood waters and flood plans,
- Establishments of irrigation facilities and preparation of maps and plans of irrigation areas,
- Management and maintenance of such protective facilities,
- Draining of swamp areas,
- Survey, approval and control of projects for drinking water and sewerage systems of urban areas,
- Improvements of stream, river and creek beds,
- Conducting observations, recording experience, statistics, researches and reconnaissance surveys in relation to above mentioned activities.

As part of the above mentioned tasks, DSİ is expected to provide and perform the following in order to manage flood protection in Turkey.

- Preparation of technical reports on flood disaster incidence, and technical projects along with major construction works for flood protection facilities. These facilities include large construction projects; reservoirs and dams, as well as relatively less costly construction works; embankments, riverbed improvements (reclamations), flood walls, levees, derivation canals and rain water disposal systems.

- Determination of flood prone areas of particular rivers with respect to 500-Year flood discharges, which would be considered in the preparation of ‘urban development plans’ and ‘urban implementation plans’.

- Implementation of management and maintenance activities of protective activities, hydrometric observation and hydrology works, erosion and debris controls.

The Department of Investigation and Planning depicted in the organizational chart of DSİ (Figure 5.1) is responsible for preparation and implementation of technically, economically, and environmentally viable projects designed to achieve the integrated land and water development in 26 river basins in Turkey (DSİ 2007, 8). These basins are shown on Figure 5.2.

The tasks of this department and its related divisions concerning flood control and protection are given below.

- Hydro-metric observation and hydrology works,

- Soil and drainage works,

- Water works that includes river reclamations, embankments, river training, maintenance works,

- Erosion and Debris Control works,

- Remote Sensing and GIS works and mapping (still developing)

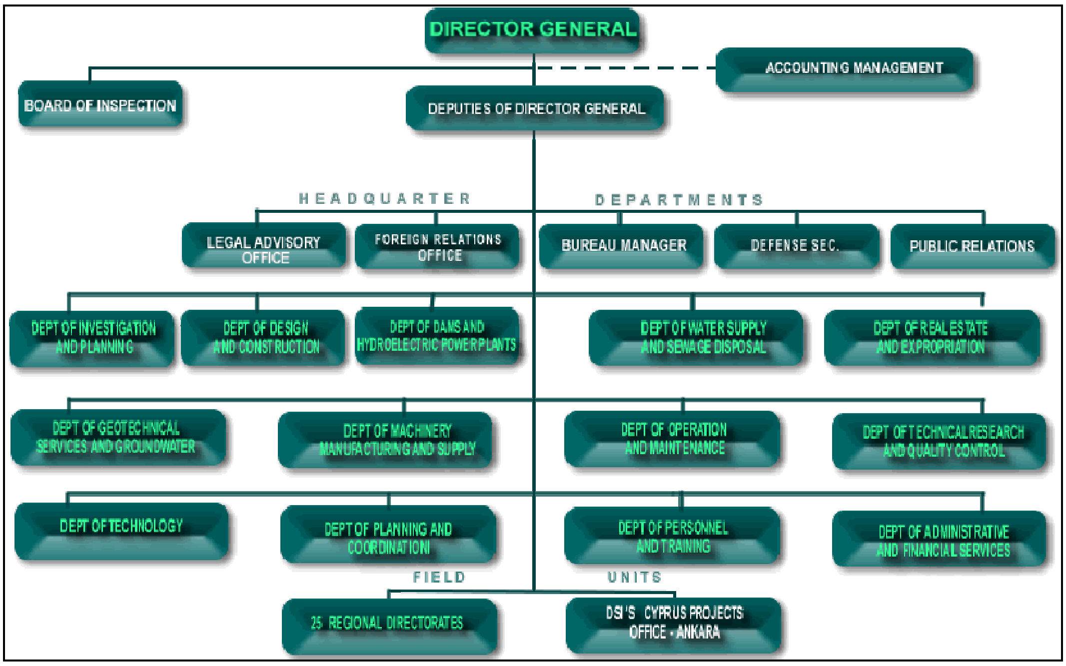


Figure 5.1: Organization Chart of State Hydraulic Works *(Source: http://www.dsi.gov.tr/english/about/orge.htm)*

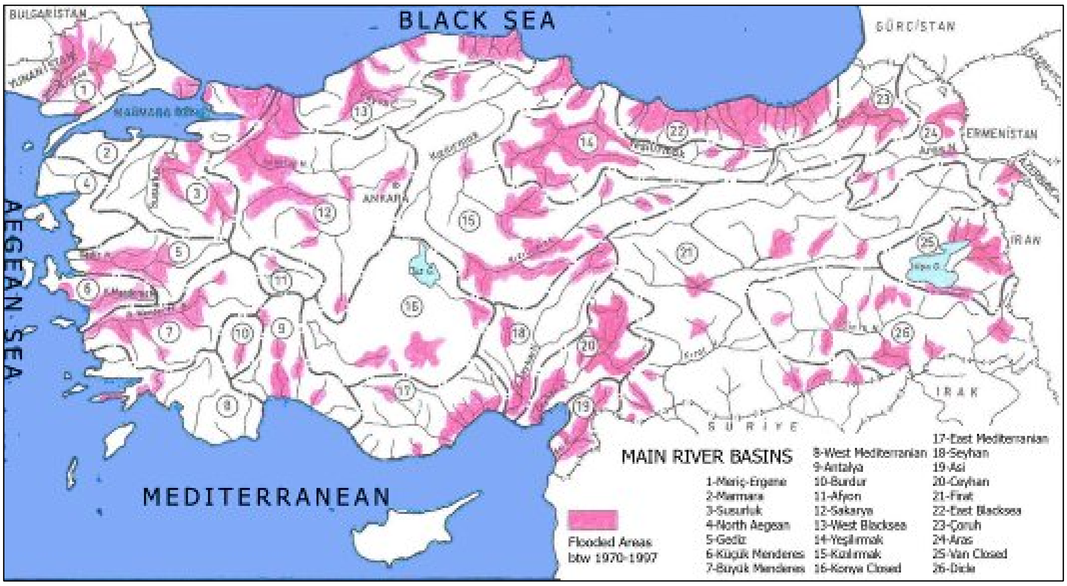


Figure 5.2: Major River Basins of Turkey *(FR 1998)*

Figure 5.3: Regional Directorates of DSİ *(DSİ Official Website)*

The division among major river basins (Figure 5.2) is only used for data collection about damage statistics, precipitation patterns, climatic and water potentials of stream systems and for calculation of hydrologic extremes regarding design discharges. Works and studies done by the Department of Investigation and Planning in DSİ are based on these data. **Regional Directorates of DSİ** (hereafter RDs) based on major basins are defined by the provincial borders (Figure 5.3).

There are 26 RDs, each of which is composed of Regional Center, Provincial Divisions and Provincial Sections. Regional Directorates are generally assigned to preparation of basin maps, hydrometric measurements, data collection about the topics like agricultural economy, land classification, drainage, groundwater, geology and evaluation of these data to plan, construct and operate water structures. In addition preparation of '**flood plans**' indicating flood protection project proposals and their construction costs for a major river basin is also a responsibility of RDs. The preparation-approval and construction processes between General Directorate and RDs are shown on Figure 5.4.

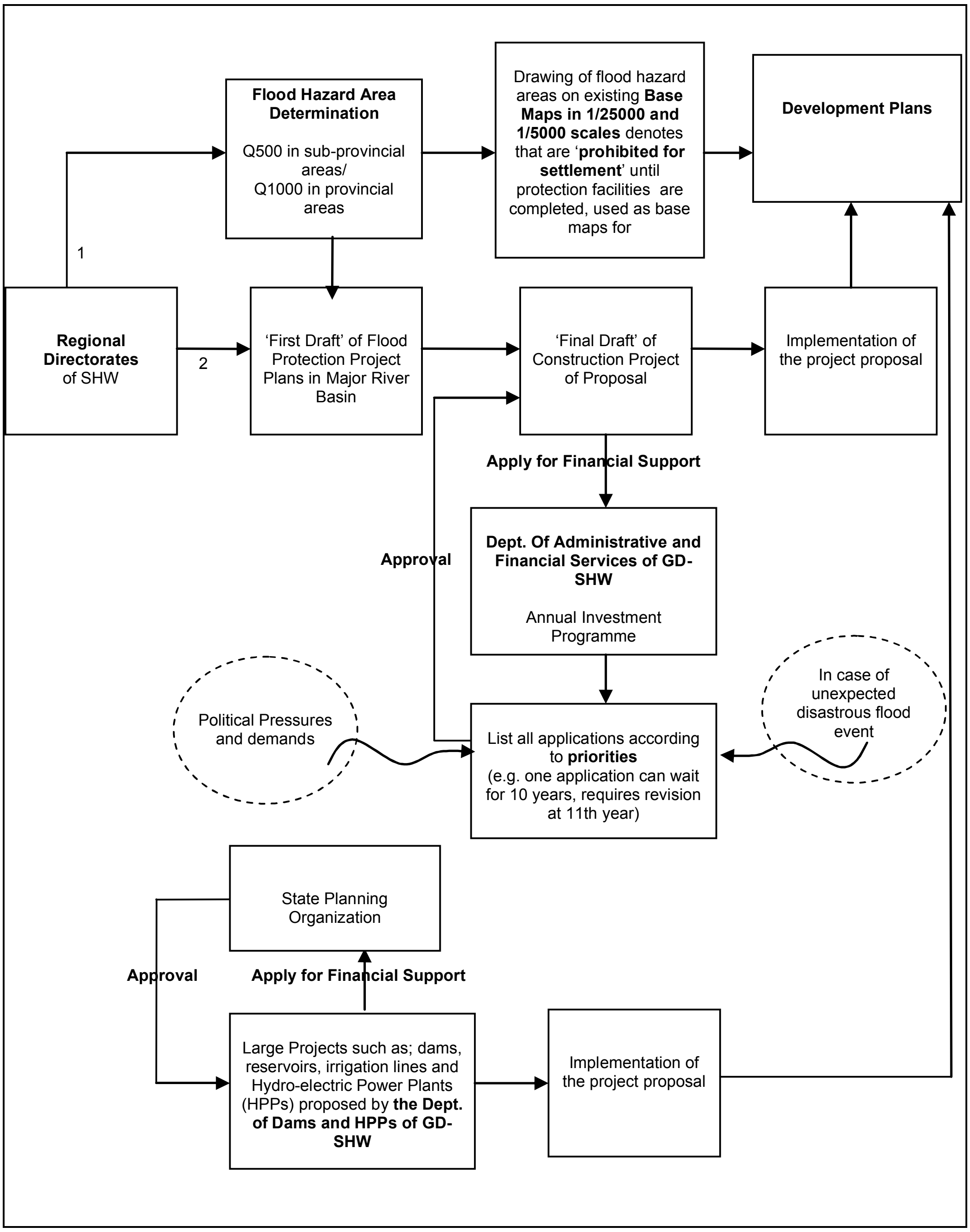


Figure 5.4: Flood Protection Plan Process of Regional Directorates
(Drawn by the author based on the interviews)

‘First draft’ of plans is sent to GD-DSİ to have an approval, which also means financial support. Such projects cannot be afforded by the financial sources of Regional Directorates. The Department of Administrative and Financial Services of GD-DSİ makes a list of the projects according to the priorities in the annual investment plan.

Interviews made with public officials in DSİ indicate that investment priorities are determined in the annual investment programmes but not always executed properly. It is mostly the political pressures and clientalist relations between local and central levels, which jeopardize the appropriate implementation of these priorities. However, in case of an unexpected disastrous flood event, the flood protection facilities; such as river training, reclamations, levees, etc. are treated as having high priority in investment programmes.

Regional Directorates are also responsible from the preparation of flood emergency plans. These plans are continuously updated according to the results of works in the drainage basin for water system development and sent to Governorates to be integrated with the **Provincial Disaster Plans** in accordance with the provisions of 7269 Disaster Act (Appendix J). Regular meetings are organized between the Governor, Major(s) and the Head of the Regional Directorate and technical staff in order to discuss disaster plans and preparation activities in every 6 months. The relationships between Governorates, municipalities and other local units of central government and units of Central Government; such as GD of Disaster Affairs (GDDA) were reorganized after the EQs occurred in 1999 (Figure 5.5). According to this reorganization Governorates were given responsibility to prepare Disaster Plans. It should be mentioned that these plans generally show the coordination between bodies that are organized to operate after a disaster event.

According to their surveys, GD-DSİ decides whether it is technically and economically feasible or not to protect a settlement by several structural measures. If it is not found as feasible, then relocation of the settlement is proposed. Relocations are performed by GDDA on the basis of the Protocol between GDDA and GD-DSİ since 1983 (Appendix J). In such a process, GDDA declares the related areas as ‘Disaster Area’ and inhabitants are relocated in ‘safer’ locations.

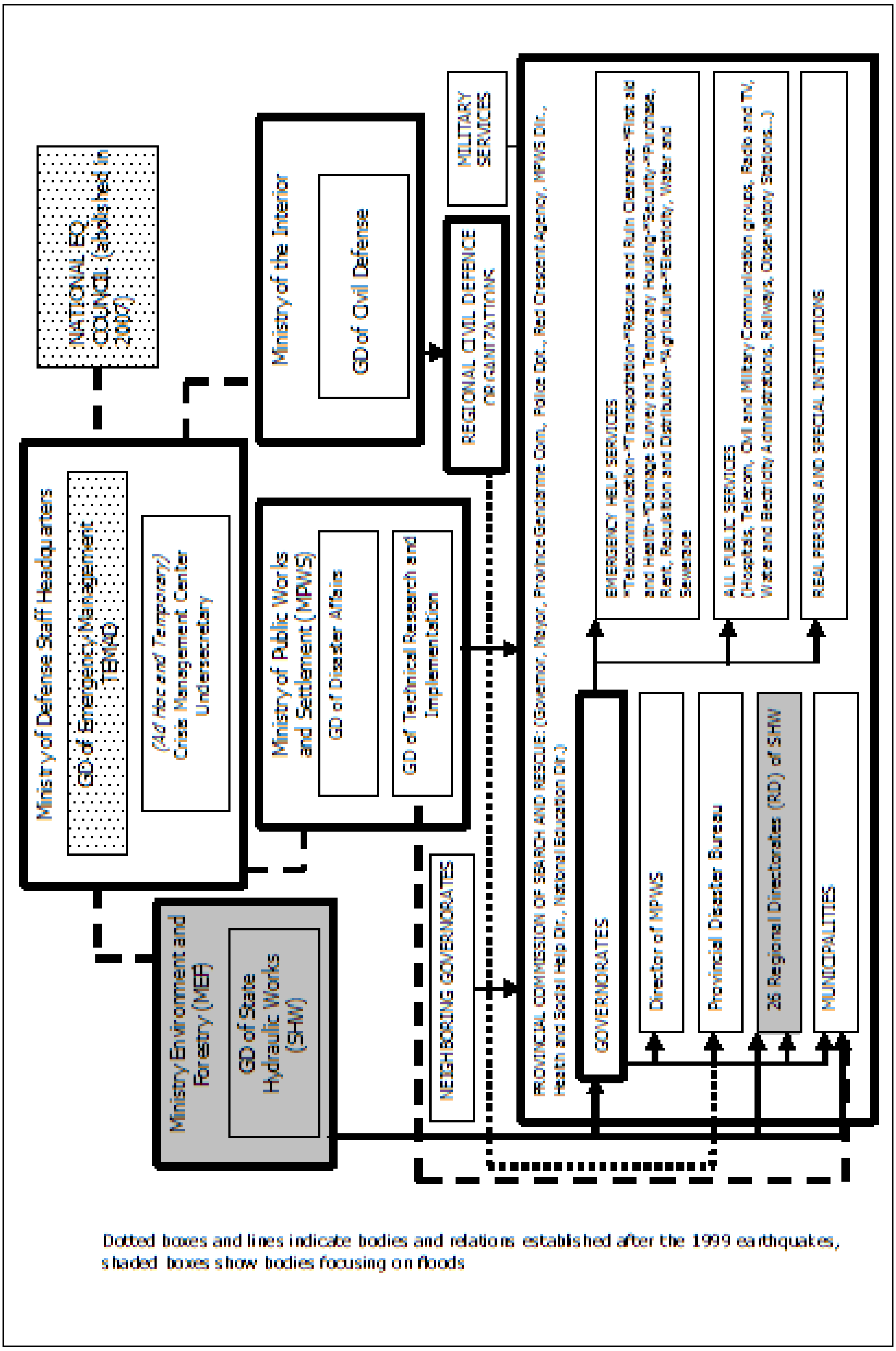


Figure 5.5: Bodies Involved in Natural Hazard Policy
(redrawn by the author based on Balamir's (2000) Scheme)

Recently a number of investments have been launched for the improvement of GD-DSİ particularly to deal with flood disasters. For example, the first pilot project and initiatives began after the disastrous floods of 1998 in the Western Black Sea Basin.

For hydrometric and meteorological observation project DSİ has completed installations in five pilot watersheds; namely Susurluk, West Black Sea, Gediz, B. Menderes, for online and real time data station within Turkish Emergency Flood and Earthquake Recovery (TEFER) Project signed in 1998 with World Bank (Karaca, 2003). Three principal objectives of the TEFER Project are as follows:

- Restoring the basic infrastructure in municipalities and rural areas affected by floods;
- Providing assistance to restore the housing in earthquake affected Province of Adana;
- Reducing the vulnerability to future floods and earthquakes.

The first three components contain technical assistance, design, and supervision of the investments. Flood management and hazard reduction strategies of the project plan to repair hydro-technical infrastructure, modernize flood management system, and improve forecasting, early warning and planning, and introduce liability and homeowner insurance among related agencies.

According to Karaca (2003), online/real-time rainfall and water level, meteorological precipitation and temperature statistics with previous years, and numerical weather prediction results are to be combined for data inputs in MIKE 11 or HecRAS computer programs to prepare flood models, hazard and risk maps for various return periods.

Hence, today there is a collection of 10 year data for hydraulic models in order to prepare digital flood hazard maps. Although it can make accurate flood forecasts for pilot basins with online data from satellites, meteorological station and river gauging stations, it has not actively started to prepare flood hazard and risk maps. At the same time, there are technical and infrastructural investments on Geographical Information Systems (GIS) in order to make spatial analysis for flood hazards and risks that can regularly be updated.

To make a request about conditions of any area or property, either for central/local governmental bodies or private planning offices is a time-consuming bureaucratic activity. There is no digital database for archive files that can easily be accessible even in DSİ. This is a handicap for any request from the departments of DSİ and other interest groups; such as researchers, planning offices, etc.

Hence, GD-DSİ is responsible for delineating flood-prone areas that may be affected by specific discharges and for preparing protection projects for such areas if necessary (Figure 5.5). Nevertheless, there is no regular, comprehensive programme for the preparation of flood hazard maps for each major river basin in Turkey. As a sole responsible institution for the delineation of flood prone areas DSI fulfills this task in two cases. First of all, in case of an official request from local governments for their development plans DSİ delineates the flood prone areas. Second, the same task is performed in case of an actual flood event damaging any settlement.

5.1.2 The Use of Flood Hazard Maps in Urban Planning Process

Maps indicating either flood hazard boundaries or flood protection facilities are reviewed here with reference to their uses in preparation and implementation processes of urban development plans. Flood issue is considered as a ‘technical problem’ to be identified and solved by the related central and regional departments of DSİ.

At the beginning of a planning study, the flood hazard areas and/or planned or constructed protection projects are requested from DSİ, as other information requested from related institutions. Then with all data collected, a base map of the planning area is prepared based on the Law numbered as 3194 (Figure 5.6).

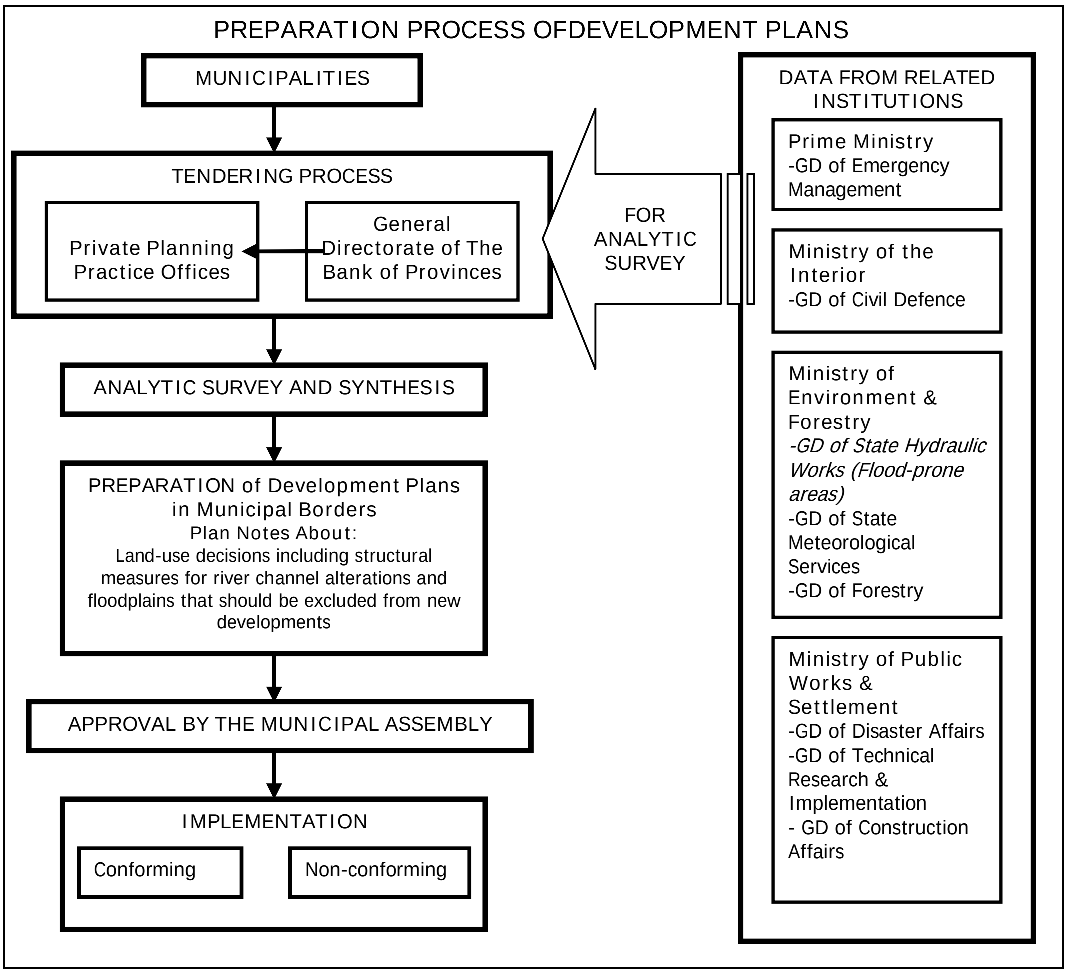


Figure 5.6: Simplified Diagram of Preparation Process of Development Plans in Turkey

Although a number of improvements in computer technologies and investments on GIS technologies used in GD-DSİ, such hazard maps currently are still prepared manually indicating 2-dimensional flood boundaries. These boundaries are determined by design discharges depending on area affected (for 500-year flood discharges in sub-provincial areas, and for 1000-year flood discharges in Metropolitan areas).

If considerable inhabitants exist in flood-prone areas, the river channel reclamation and/or the construction of embankments are proposed in order to increase river channel capacities to accommodate a 500-year/1000-year flood discharge volume. The boundary is declared by the development plan to identify areas 'restricted for settlement' until these protection facilities are constructed. After the completion of these structures such areas are declared as ‘safe locations for settlements’. Both of these decisions drawn on current base maps are used for the preparation of ‘development plans’ that also require other spatial data obtained from related governmental bodies (Figure 5.6).

Although ‘hazard maps’ of stream basins are used as base maps for development plans prepared by each local government to indicate areas to be avoided, such decisions are often overridden by unauthorized developments. Food-prone areas are either encroached by residential buildings, or used for streets, public buildings, residences, etc. This statement is also be substantiated by research findings in Chapter 4.

In other words, flood hazard boundaries of a basin determined as restricted for settlements by the central government institution (DSİ), unwillingly registered by the local administrations are usually ignored or bound to be ignored in practice.

It can be resulted from the determination of such vulnerable areas. Such areas are determined with respect to 500-year/1000-year discharges that affect broader areas but they are not frequent as 100-year floods. This is made for caution because it is particularly difficult to monitor and control the changing conditions of basins in Turkey.

Although such areas are taken into consideration in the preparation of Development Plans, it is not always possible to avoid developments on them particularly due to pressures of private interests, shortage of urban land supply, and the lack of appropriate development control instruments. Hence, it is not realistic to prohibit these areas from developments of unauthorized nature by denoting ‘prohibition zones’ on development plans without accompanying prohibitive tools of effect. This conclusion has been driven from the review of development histories of the cases examined in Chapter 4.

The second option is to provide flood protection facilities on rivers; such as river channel reclamations that are designed to carry ‘certain’ discharge volumes in order to protect the flood hazard area. The area delineated as flood-prone can then be allowed for developments after construction of the protection facilities. Then, same as in case areas, it is observed that these structural improvement investments encourage people to settle nearby reduced hazard areas where they feel safer and therefore, take less of cautionary measures. However, such engineering solutions do not eliminate the flood risks, as most of people believe, because they are designed regarding certain assumptions based on flood frequency-discharge data from the past. Moreover, after completion, these structural measures require a number of critical conditions to be fulfilled. It necessitates **first** to retain the water channel free from solid wastes. **Secondly**, service roads on both sides ought to be provided for maintenance and regular debris cleaning activities of the facility provided due to presumed sediment movement from the natural character of upper basin. **Third**, it is not the one and only solution for all times, rather it is designed for predetermined conditions. Therefore, there ought to be some room for the changing conditions; such as impacts of global warming and climate change.

As a result, there is no administration or control mechanism regarding flood risk mitigation of even the major river basins in Turkey. Instead, flood protection measures like engineering solutions for specific area of concern are proposed and somehow implemented by DSİ.

5.2. CONTEMPORARY APPROACHES, LEGISLATIVE STRUCTURES AND IMPLEMENTATIONS ON FLOOD RISK MANAGEMENT

Contemporary approaches, legislative structures and practices based on some international experiences are examined in this section. The international experiences cover the contemporary progress at EU level as well as the experiences of three European Countries, namely France, Netherlands and Germany. Flood management frameworks of these countries are evaluated in terms of their administrative and legislative provisions and country-specific mitigation methods. Although each country is evaluated in their own context, the intention here is to derive some lessons to establish alternative ways of dealing with floods.

5.2.1 Contemporary Approaches and Legislation on Flood Risk Management at European Union Level

Europe suffered over 100 major floods recently between 1998 and 2003. Floods along Danube and Elbe Rivers in 2002 were the most catastrophic floods in Central Europe, which caused a total damage of 21.1 billion Euros and 37 fatalities[23]. In that period (1998-2003) floods have lead to 700 fatalities, displacement of about half a million people and at least € 25 billion in insured economic losses[24].

It is proved in this process that assets at the risk of flooding could be enormous especially in case of trans-boundary rivers. More than 10 million people live in the areas vulnerable to risk of extreme floods along the Rhine. The potential damage of floods in these areas is estimated as approximately 165 Billion Euros[25].

Floods of 2002 had serious effects on three countries; namely Germany, Czech Republic, Austria and caused minor losses in Slovakia and Hungary (depicted in Figure 5.7). Table presented below provides a comparison of the impacts of floods that occurred in trans-boundary basins.

Table 5.1: Comparison of 1997 and 2002 Floods

	Odra Flood 1997	Flood August 2002
Countries affected	Czech Republic, Germany, Poland and Slovakia	Austria, Czech Republic, Germany and Slovakia
Casualties	100	112
People evacuated	300 000	400 000
Economic losses	EUR 5.0 billion	EUR 14.4 billion
Insured losses	EUR 0.8 billion	EUR 3.4 billion

(Source: EEA 2003)

[23] Munich RE, updated in 2003
[24] European Environmental Agency (EEA), Environmental issue report no.35, 2003
[25] EUrosion: http://www.eurosion.org

Figure 5.7: Areas Affected in 2002 Flooding *(Source: EEA 2003)*

After 2002 floods, once again it was understood that flood issues of streams shared with many European countries can not be solved by individual attempts of each country. As a part of the same hydro-meteorological system any intervention in one part of such a system could affect other parts in adversely or vice versa. Hence, flood mitigation activities in a river basin system ought to be considered in a 'concerted and coordinated action' at the level of the European Union[26]. For this reason, the Commission of The European Communities has launched joint projects and research, in order to set common guidelines for the assessment and management of flood risk regulated by the documents; such as Communication (2004) and Directive (2007) explained in following pages.

[26] (COM(2004)472 FINAL; 2)

According to the European research policy, described in Communication Document (2004) on Flood Risk Management, research on floods has already been supported through its successive Framework Programmes since early 1980's. For example, *FLOODsite*[27] research project launched in 2004 with its high budget contributes in developing methodologies for integrated flood risk analysis and management in nine pilot countries. In addition, Joint Research Center promotes and organizes the studies about flood forecasting, flood risk mapping and scenario modeling for the benefit of all member states. Future research is declared to focus on climate change impact analysis, mitigation and adaptation strategies. The prevailing idea is that flood management in stream basins cannot be achieved by individual actions; rather individual actions ought to be considered as a part of integrated and comprehensive basin approach. In this respect, a number of basin wide projects[28] originated for the establishment of international research and prevention programmes are financially supported and promoted by European Regional Development Fund and the Cohesion Fund.

European Commission explained the basis of EU Action Programme for flood protection in this Commission Document (2004), and defined the requirements in each level in order to provide collaboration of all stakeholders including Member States and Commission to develop and implement a coordinated flood prevention, protection and mitigation programme. Main requirements of the Action Programme are:

- Developing & implementing **flood risk maps** as a tool for planning and communication,
- Improving cooperation and coordination through the development and implementation of **flood risk management plans** for each river basin and coastal zones,

[27] http://www.floodsite.net

[28] INTERREG Initiative's IRMA Project (Ren-Meuse Activities) between the Netherlands, Belgium, France, Luxembourg, Germany and Switzerland. SCALDIT Project launched in 2003 for Scheldt and Escaut Basins works for basin planning and flood protection in France, Netherlands. (Source: COM(2004)472FINAL, p. 5)

- Increasing **awareness of flood risks** through wider **stakeholder participation** and more effective communication

Before that Communication (2004, 7) “flood protection was addressed largely at a local level, without upstream-downstream coordination, frequently just shifting the problem from one area to another”. However, the countries bordering common rivers have established joint bodies to ensure a coordinated approach to such shared river basins management through Europe. In many of river basins, therefore, flood protection plans have been already established, or are in the process of being developed.

In three years after that Communication document with which the principles, objectives, key outputs and particularly the main elements of flood risk maps as one of key outputs are defined, the “European Commission Directive on the Assessment and Management of Flood Risks” has been prepared. The Directive (2007)[29] defines the content and determines submission deadlines of

- Preliminary Flood Risk Assessment,
- Flood Hazard and Risk Maps,
- Flood Risk Management Plans.

It also defines the major rules about coordination, public information and consultation, as well as transitional measures, implementing measures and amendments. The regular submission deadlines of final provisions, reviews and reports are also determined in that directive. It is expected that member states ought to enforce the laws; regulations and administrative provisions necessary to comply with that Directive before 26.11.2009.

Concluding, the directive adopted by the EU Parliament on flood risk management requires that national governments of Member States take three steps. The chairman of the EU Environment Council also stated[30] in 2007 that these steps are:

[29] DIRECTIVE2007/60/EC comes into force on 12.11.2007
[30] Source: http://www.ens-newswire.com/ens/apr2007/2007-04-28-03.asp

1. A preliminary evaluation of flood risks and the identification of risk areas by the end of 2011,
2. The mapping of hazards and risks in these areas by the end of 2013 and,
3. Based on this, the elaboration of plans of measures for reducing flood risks by the end of 2015."

Since Thracian cities of Turkey have shared river basins Turkey is going to depend on current legislative provisions of the European Union, irrespective of its membership status. For this reason, three examples from European Countries are selected for further research about flood risk management.

One of them is France. France is examined due to the similarity between the structure and judiciary system of both Turkish and French systems. For instance, French parliament is a bicameral legislature comprising a National Assembly (Assemblée Nationale) with 577 members and a Senate.

The second country is the Netherlands, who has long-term experiences in dealing with water and flood issues since ancient times. It is also critical to examine the Netherlands, as the country has learned from past experiences and regularly renews its administrative and legislative structures. At the same time, the Netherlands is a leading country with its research and development departments about new technologies and solutions in this respect.

The third country examined in the following sections is Germany. The statements mentioned above for Netherlands are also valid for Germany. It has long-term and essential experiences in flood management and protection. Similar to Netherlands, Germany is also a leading country within the fields of its research and development and engineering.

5.2.2 France

In this section France as a case country is examined with respect to its administrative and legislative structures that govern flood issues and urban planning. This review is conducted in a historical manner so as to see the shifts in prevailing approaches and policies. Therefore, through a historical analysis the critical events that made significant changes in the system are attempted to be identified.

5.2.2.1. Flood Losses and History

Since the very beginning of the 19th century, floodplain mitigation has been a continuous concern in France, where every year more than 2 million people and 2 million hectares are likely to be under the risks of floods (Tonelli & Sironneau 1996, 55).

France is exposed to both river and flash floods, and is also subject to drought events. As indicated in the following figure and table, floods are the most effective meteorological hazards in the country.

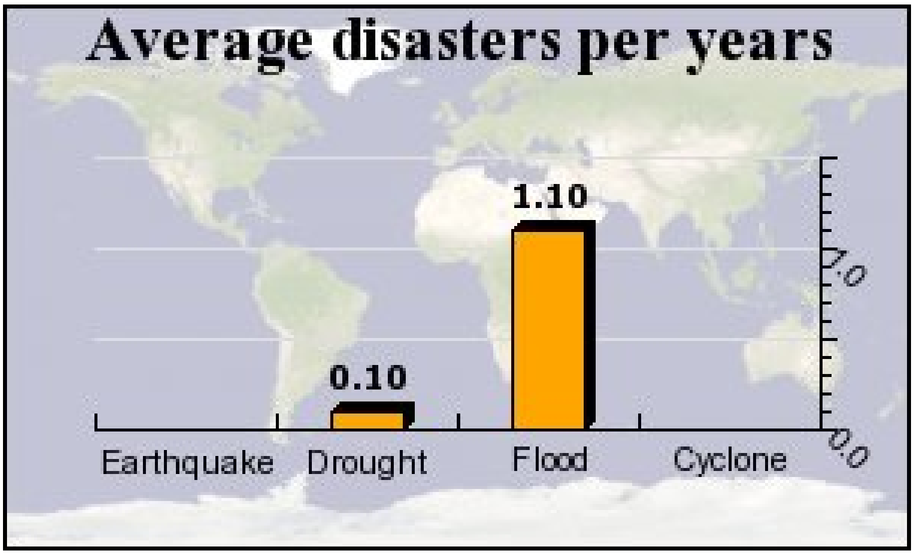


Chart 5.1: Average Disasters per years in France (1980-2000)
(http://gridca.grid.unep.ch/undp/cntry_profile.php)

Table 5.2: Descriptive Figures per Disaster Types in France between 1980 and 2000

	Disasters per year [nb/year]	Casualties [killed/year]	Physical exposure [nb/year]	Relative vulnerability [killed/mio. exp.]
Droughts	0.10	0	1’815’002	0
Earthquakes	x	x	x	x
Floods	1.10	5.3	1’821'024	2.9
Tropical Cyclones	x	x	x	x

Source: http://gridca.grid.unep.ch/undp/cntry_profile.php)

In France since 18th century the law concerning floodplains forbids every kind of works likely to cause or make floods worse along every navigable water course with the power of Royal Edict dated 1669. Since then, numerous laws and executive orders based on the trilogy principle of ‘Prevent-Foresee-Alert’ have been passed (Tonelli & Sironeneau 1996, 55).

After disastrous flooding along Loire River in 1846, 1856 and 1866, to protect nearby towns and villages, a program of dykes and levees was developed, as well as a mountain soil restoration plan was implemented due to the deforestation and the soil erosion. 1910 and 1924 floods resulted in broader measures, like the Seine river bed calibration, the canalization of upstream river sections, the construction of dykes and embankments, and the implementation of a reservoir-dam programme (Tonelli & Sironeneau 1996, 55).

Although France already had a river basin management system since 1964 there was no real integrated and participative management due to the neglect of wetlands (Wenger 2004, 1).

After the ‘great drought’ of 1976 during the last twenty years, the French system of managing water related risks has made great progress. Particularly in the late 80’s, several heavy flood disasters have resulted in the improvement of the floodplain mitigation system in France (Tonelli & Sironeneau 1996, 55).

In particular after the flood disasters in 1987, 1988, 1992, a very extensive flood event has taken place at the end of 1993 and at beginning of 1994. This event has been defined as a ‘detonator’ by the French Government affecting 40 ‘départements’, and 2750 municipalities. This major event led to ‘National Disaster Mitigation Programme’ launched in 1994 by a Decree for 10 years. It was financed by the State (40%), the decentralized local authorities, the water agencies and riverside residents (Tonelli & Sironeneau 1996, 57-58). This programme consists of measures in four fields as Chastan (1996, 35-36) listed:

1. Land-use control in flood-prone areas

    - Protecting already inhabited areas by avoiding new constructions,
    - Ensuring that land use in flood-prone areas does not decrease the capacity of water beds,
    - Avoiding the construction of dykes and bridges that reduce the river flow capacity or modifying, strengthening them to increase this capacity,
    - Providing new loans to finance the mapping of areas prone to flooding in France,
    - Update and simplify the legal system having a single document like ‘risk prevention plan’ replacing all existing plans.

2. Monitoring floods (the improvement of the flood forecasting and warning system) and evacuation of the population to safer areas

    - Updating remote monitoring stations, forecasting models, radar rainfall measurements in areas subject to intense precipitation in order to inform (warn) Mayors responsible for the safety of local population

3. Restoring and maintaining river and riverbeds with combination of efforts of the riverside owners, the local authorities, and the State.

This programme was supported by the Law of 1995, which aims to reform the natural hazards mitigation policy including financial, technical and legal measures (Tonelli & Sironeneau 1996, 57-58).

5.2.2.2. Current Institutional and Legislative System about Water Issues in France

In France the surface and ground water management is considered to be a "national common heritage". And one fundamental principle is "the geographic reality of large river basins must be taken into account as: -water knows no administrative boundary-"[31]

The French national territory is divided into six large river basins, each of which have own Watershed Agency (Figure 5.8). These agencies are referred to as 'water parliament' involving all stakeholders; elected officials, consumers, representatives of federal, regional and local governments (Parisi 2002, 3).

There is always **dialogue** that is institutionalized at National Level, River Basin Level and the level of Tributaries and Sub-Basins in France about water issues as shown in Figure 5.9 and Table 5.3 (http://oieau.org).

The government of France has a statutory responsibility to evaluate flood hazards, gather upstream information and ensure that it is passed down the line. The Ministry for Ecology and Sustainable Development like Turkey's State Hydraulic Works is the principal institution concerned with risk evaluation. Analyzing historical data on floods and gathering scientific data input from the hydrology and geology disciplines is another responsibility of this body. It is also responsible for encouraging research into flood risks; the impact of climate change, for example. It also assesses existing flood defenses (OECD Studies 2006, 20).

Water Management has conducted in accordance with the main strategies of Master Plans generated in each river basin and Schemes in each sub-basin of related major river basin. The participation of the stakeholder and consultation

[31] http://oieau.org/anglais/gest_eau/part_a.htm

of the citizen are the core features of the French Water Management Framework (MEDD 2006).

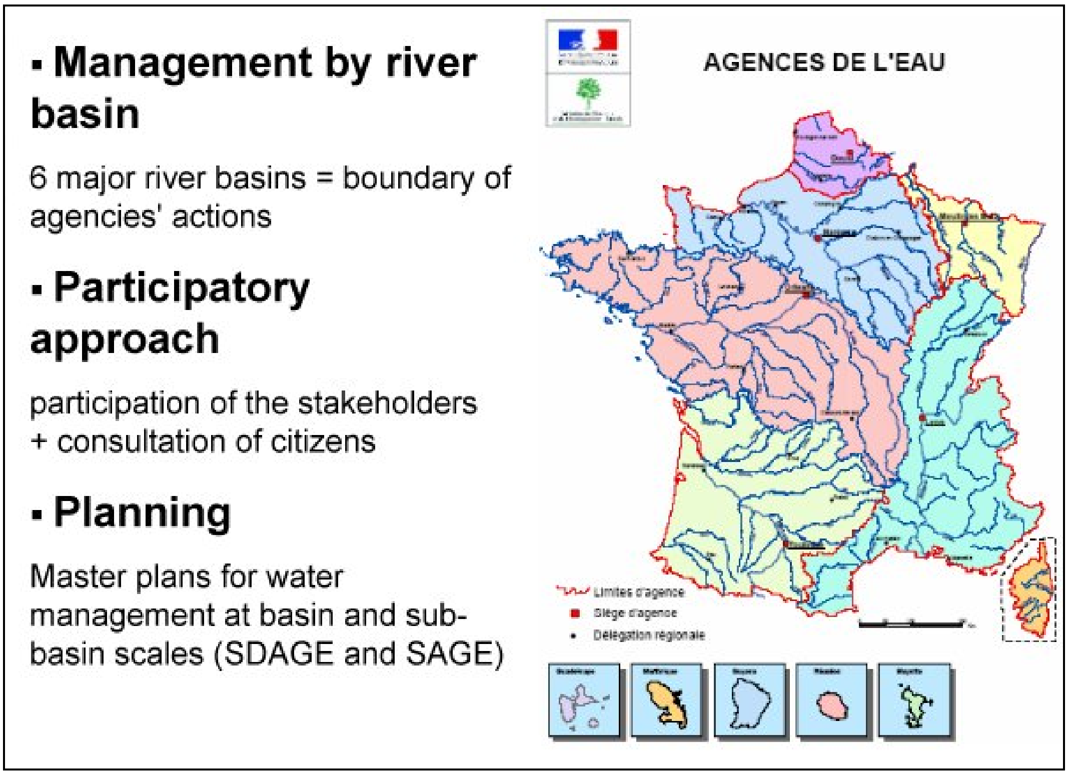


Figure 5.8: Management of River Basins of France by Water Agencies
(Source: MEDD[32] 2006)

[32] Minister of Ecology and Sustainable Development

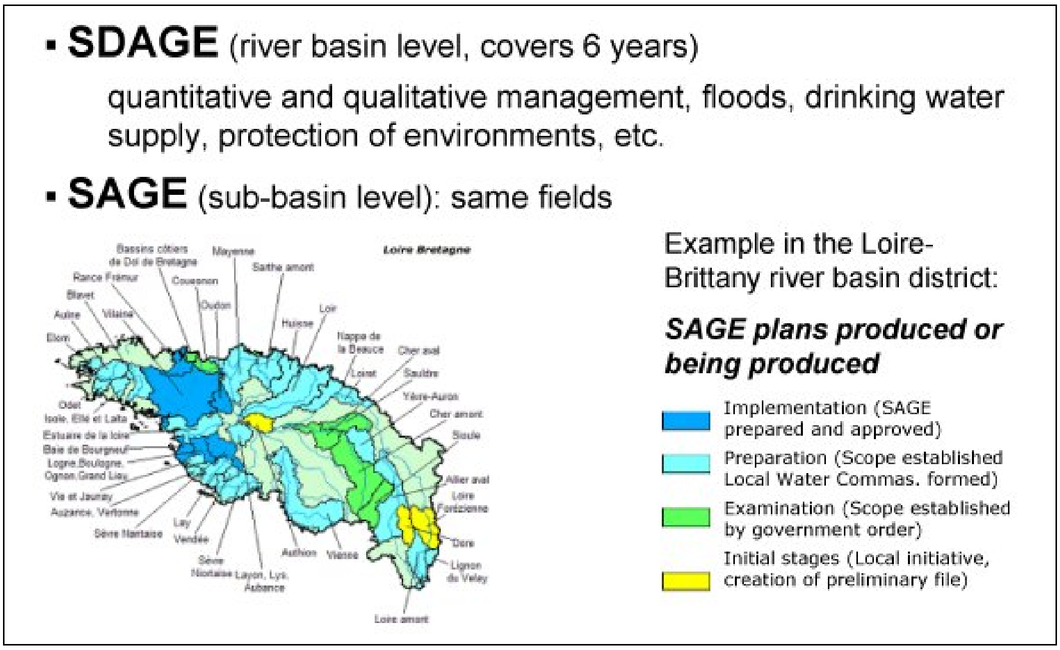
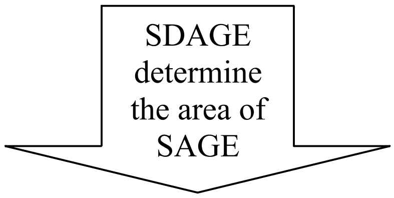


Figure 5.9: SDAGE covers SAGE plans *(Source: MEDD 2006)*

Main purpose of Master Plans and Schemes (SDAGE and SAGE) is to establish partnerships and coordinate actions of Public Authorities and developers for Water Development and Management.

Table 5.3: Master Plans and Schemes for Water Development and Management

	MUSTS	TASKS
SDAGE (Master Plan)	Main programmes decided by public communities	defining in a general and harmonious manner, the objectives for water quantity and quality as well as the developments and improvements to be undertaken to attain them
		defining the limits of the sub-basins corresponding to hydrographic units



SAGE (Water Development and Management Scheme)		fixing the general objectives for the utilization, development and quantitative and qualitative protection of surface and groundwater resources, and aquatic ecosystems, as well as for the preservation of wetlands, in a manner which complies with the principles defined by law

(Sources: http://oieau.org/anglais/gest_eau/part_a.htm)

Table 5.4: Water Management Hierarchy in France

	Administration	Members	Tasks
National Level	**National Water Committee**	chaired by a member of Parliament, representatives of the National Assembly and the Senate, and of important institutions and national federations involved	consulted on the trends of the national water policy and on drafts of legislative and regulatory texts
River Basin Level (6 Large Basins)	**River Basin Committee** consulted by **Water Agency** of River basins - on the rates and bases of water charges levied for water withdrawals and discharges - the priorities for the Agency's 5-year action programmes and on the methods to aid investments	chaired by a local elected official, plays a fundamental role as regards trends and incentives composed by one half of representatives of local communities, by one quarter of representatives of users and by one quarter of State representatives	Preparation and adoption of Master plans for Water Development and Management (SDAGE) which fixes for each basin or group of basins
The level of Tributaries and Sub-Basins	**Local Water Commission**	composed by one half of representatives of local communities, by one quarter of representatives of users and by one quarter of State representatives	to prepare and follow up the implementation of the Water Development and Management Scheme (SAGE)
	Local Water Community	composed by local communities	to help attain the objectives determined by SAGE

(Based on Sources: http://oieau.org/anglais/gest_eau/part_a.htm and http://www.enpc.fr)

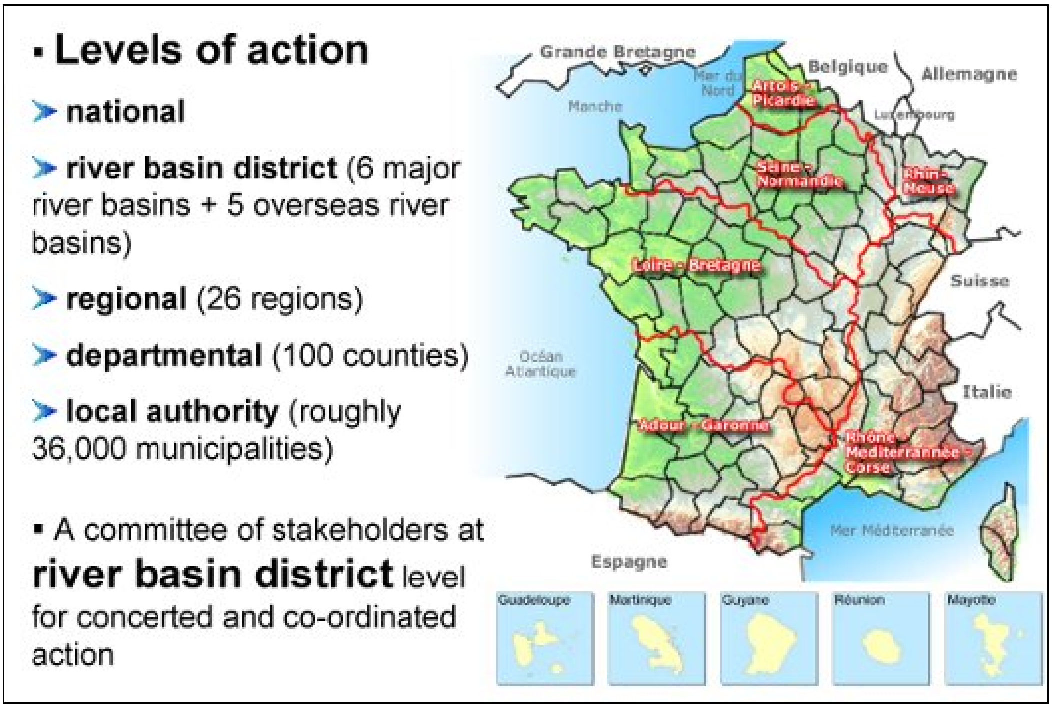


Figure 5.10: Levels of Action in French Government *(Source: MEDD 2006)*

Main objectives of the "Local Water Community" that can be entrusted with the study, the completion and operation of all constructions, installations or equipment of an urgent or general character[33], are:

- developing a basin or part of a hydrographic basin,
- developing and maintaining a watercourse that is not managed by the State, including accesses,
- controlling storm-water and run-off,
- protecting against floods and the sea,
- developing hydraulic works for civil defence,
- water supply, controlling pollution,
- protecting and preserving surface and groundwater,
- protecting and restoring sites, aquatic ecosystems and wetlands as well as bordering woodlands,

[33] http://oieau.org/anglais/gest_eau/part_a.htm

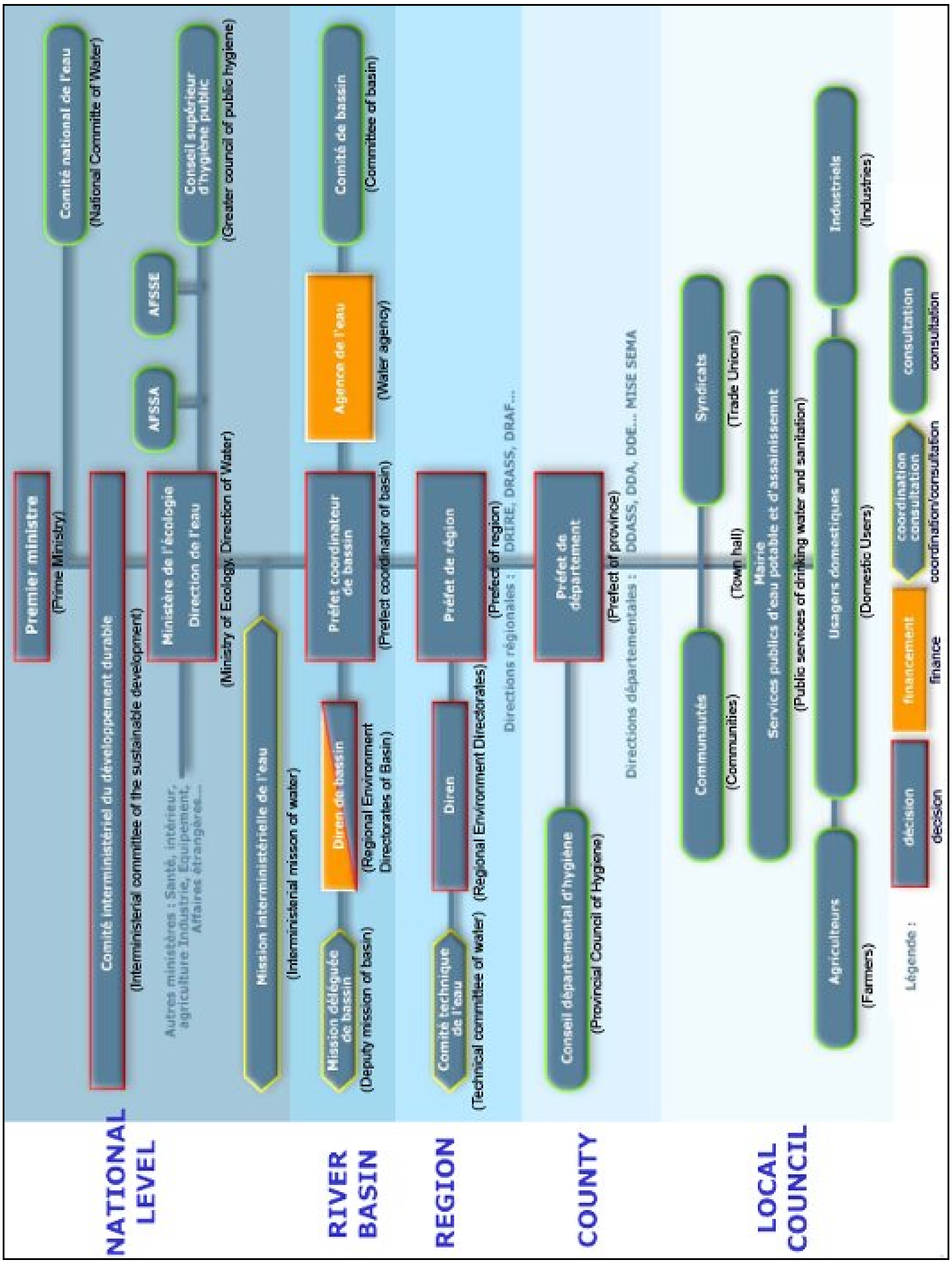


Figure 5.11: Levels of Action and Institutional Framework on Water Management in France *(www.enpc.fr/cereve/HomePages/thevenot/MEDD-Water-Policy-2006.pdf)*

Table 5.5: Several Laws and Regulations on Flood Management in France

Date	Event	Explanation
1964	Water Law	- Creation of **6 water agencies**, one for each river basin district - National Fund by State for agricultural calamities
1976	The Great Drought	
1982	Law on Compensation System	- Insurance coverage extended over the natural hazard damages when declared as natural disaster by State - Preparation **of Risk Exposure Maps** and **Plans (P.E.R**[34]**)**
1984	Fishing Law	Creation of fishing regulation
1987	Law on Public Information about Hazards	'**Departmental Hazard Book**' prepared by the Prefect to inform citizens and municipals about their exposure to natural and technological hazards
03.01.1992	Water Law	'Water= common heritage of the Nation' - Preparation of **SDAGE** and **SAGE**
22.09.1992	Floods	41 victims, 67 communes, 9000 people affected
24.09.1992	Decree	Prefects competent to prescribe measures against floods and droughts
15.10.1992	Circular	- Re-appraisal of all authorizations about measures before the implementation - Crisis control unit with representatives from various water users by the prefects
January 1994	Floods	
24.01.1994	Circular	Approval of '**National Disaster Mitigation Programme**'
January- February 1995	Floods	
02.02.1995	Law	- A special fund for the prevention of natural hazards - Preparation of Flood **Risk Prevention Plans (P.P.R.I.**
05.10.1995	Decree	Prefects with local authorities responsible to draw up a **PPRI**
17.10.1995	Decree	Expropriate order procedure of Prefects on goods exposed to certain major natural risks
1999	Floods	
30.06.2003	Law on Technological and **Natural Risk Prevention and Reparation of Damages**	- More proactive communication on flood risks using **PPRI**s - Risk management measures coordinated within the perimeters of each basin by the catchment area coordinator, a Prefect
2004	Law for transposing European Water Framework Directive (WFD)	Guiding French water policy acc. to European objectives
2005	Decree on Public Information	Mayors obliged to organized public meetings about all matters concerning flood risks

Sources: NOFDP 2008; OECD Studies 2006; MEED 2006; Tonelli & Sirenau 1996; Chastan 1996 [35]

[34] Plan 3 d'exposition aux risques (P.E.R) (Tonelli & Sironneau 1996, 57)

[35] (http://nofdp.bafg.de/servlet/is/14508/?lang=en last access in 2008, Spatial Planning System of France by NOFDP); 2006, OECD Studies in Risk Management, France; 2006, Presentation of Water Department of Ministry of Ecology and Sustainable Development (www.enpc.fr/cereve/HomePages/thevenot/MEDD-Water-Policy-2006.pdf); 1996, Tonelli & Sironneau 1996, Chastan)

By the ‘Risks’ Law of 2003 significant progress for flood mitigation has been taken;

- Inform, warn, develop awareness of the risk by renewing flood forecasting
- Develop new prevention tools; such as expansion areas, actions against soil erosion
- Assist local communities
- Reduce the vulnerability of areas liable to flooding and repair the damage

Particularly after this Law 2003, main objectives for mitigating flood risks in France has included better anticipation of floods, continuous information and better understanding of data by users (Table 5.5). In order to achieve these objectives at national and river basin level knowledge and information distribution networks are established. Water information system based on data networks, data banks, data processing & information distribution software are installed at national level, while water data master plans are actively used for monitoring at river basin level (MEDD 2006).

5.2.2.3. Specific Examples for Recent Measures and Spatial Planning Concepts

Since property or personal damages caused by natural disasters were not covered by any insurance in France, after a catastrophic flood the government has to give assistance in order to decrease the costs of damages for the owners of public and private properties. For example, in 1964 a national fund supplied with State budget was established to cover agricultural calamities. A new compensation system as regards to natural disaster risks has been enforced by the Law 1982 (Tonelli & Sironeneau 1996, 56).

According to this insurance system every contract covering personal or property damages is extended automatically over damages of the natural hazards like landslide, avalanche, earthquake, and flood. Thus, a 9%

additional premium is taken by the insurance company. When Government has declared that the event constitutes a ‘natural disaster’, the insurance company offers compensation for the damaged and insured properties defined by the 1982 Law. The Central Reinsurance Fund has reached to a very low level due to the destructive floods for the previous three years sequentially. So as to manage and sustain the insurance system, it has been reformed since late 90’s (Tonelli & Sironeneau 1996, 56).

The Law of 1995, therefore, aimed to improve the insurance system so that it orders a compulsory purchase by the State if human lives are under serious threat due to a foreseeable flood risk. However it could be reduced or suppressed when it appears that the real estate has been purchased with an intention of speculation. This law instituted a special fund for the prevention of natural hazards to finance the compulsory purchase. ‘This fund collects 2,5% out of the takings brought by the 9% additional premium received by the insurance companies over every contract covering personal or property damage’ as Tonelli and Sironneau indicate (1996, 58).

Another measure as a counterpart of the indemnification system is to produce major hazards exposure maps (*plan 3 d’exposition aux risques, P.E.R.*) by the 1982 Law. Three categories of areas were determined as follows (Tonelli & Sironeneau 1996, 57);

- white area (no foreseeable hazard – no specific restriction),
- blue area (quite hazardous – construction is allowed according to certain conditions),
- red area (particularly hazardous – no more construction is allowed).

1982 Law foresaw a new application of ‘eminent domain’ to protect public safety while dealing with major natural risks. In accordance with this law property owners subject to eminent domain are then indemnified by a fund provided by appropriating 2% of contributions financing the natural disaster system (Parisi 2002, 4).

However, this P.E.R. procedure has not been successful. Some mayors and local lobbies had been reluctant about the building restrictions without any compensation from the State as Tonelli and Sironneau admit (1996, 57).

Flood Risk Prevention Plans (P.P.R.I.), which are approved by the Prefect of the department after a public enquiry, are defined to complement the previous exposure maps (P.E.R.s) by the Law of 1995. Their provisions are considered as variations to be annexed to the land development and land-use plans. Financial penalties are pronounced by the courts, in case of breach of these plans' provisions (Tonelli & Sironeneau 1996, 59).

The main objectives of P.P.R.I.s are to map hazard zones and to prescribe measures of prevention according to risk levels. As shown in the following Figure 5.12, three types of zones had been determined namely (Parisi 2002, 4);

- a yellow zone (minimal risk),
- orange zone (moderate risk – requiring an hazard mitigation plan),
- a red zone (high risk – prohibiting all constructions).

If a building had been constructed in the red zone before the adoption of the hazard maps, the demolition of it was not required by the law except in case of imminent risk (Parisi 2002, 4).

Figure 5.12: Floodplain Map for the Village of Mende in south France Showing Different Risk Zones *(Parisi 2002, 5)*

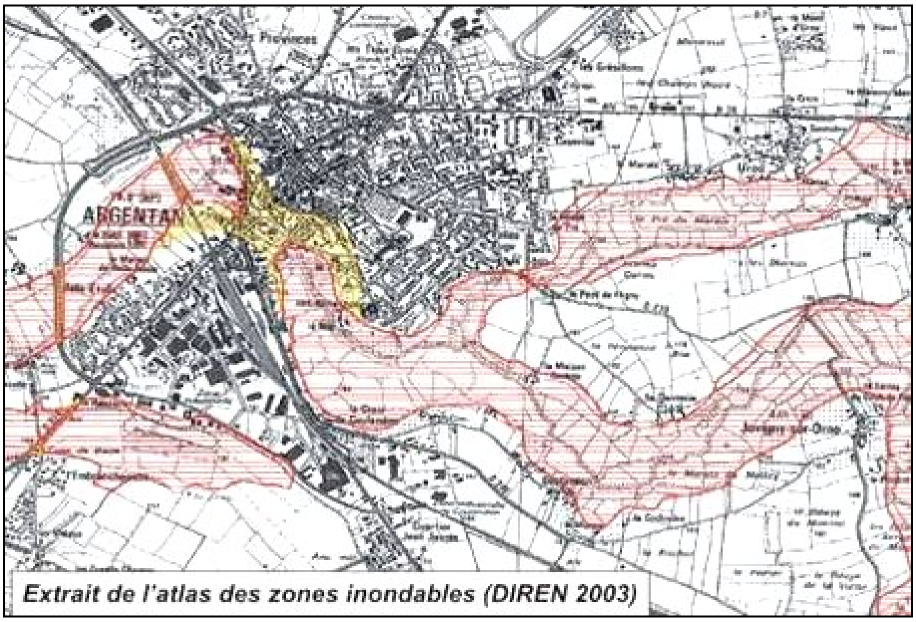


Figure 5.13: Maps Indicating Inundation Zones
(Source: http://nofdp.bafg.de/servlet/is/14508/?lang=en)

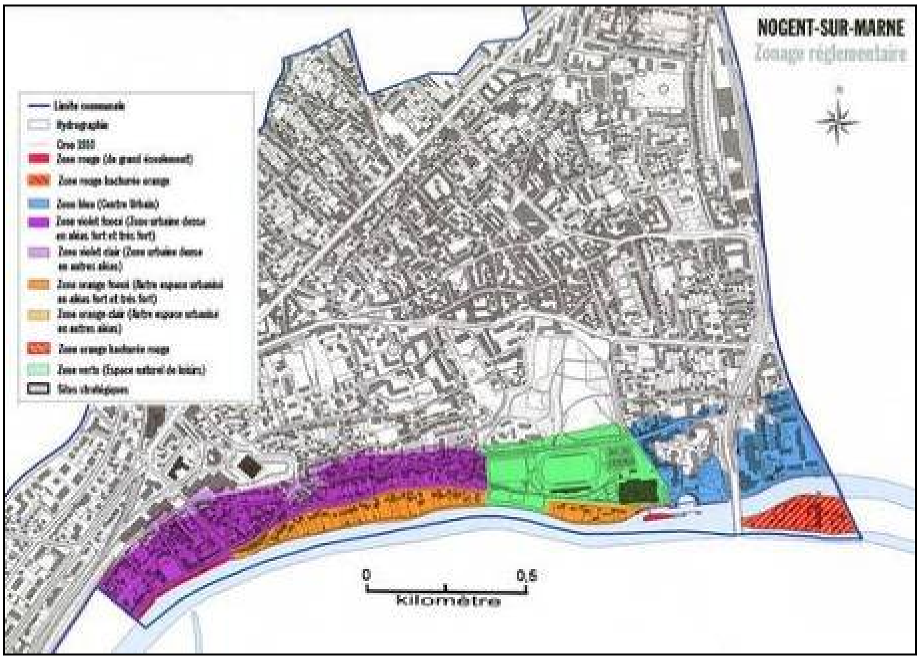


Figure 5.14: Risk Zones According to Assets on Land *(Source: http://nofdp.bafg.de/servlet/is/14508/?lang=en)*

According to the Act of 30.07.2003 on Technological and Natural Risk Prevention and Reparation of Damages commenced new provisions aimed at more proactive communication on flood risks. By this way it is compulsory for the mayors of any *commun*e subject to a Risk Prevention Plan (RPP) to keep citizens informed, requiring the situation of property regarding natural risks be stated 'for any transactions or rental contracts, even for seasonal rentals'. (OECD Studies 2006, 21)

One of regulatory measure for water protection, on the other hand, is penalty mechanism that requires 2 years imprisonment or fine of 76'000 Euros against originators of works or installations on watercourses without permits.

5.2.3 The Netherlands

In this section Netherlands is examined as a case country with respect to its administrative and legislative structures managing flood issues together with urban development planning. This examination is conducted in a historical manner in order to see the shifts in the existing approaches and policies, and to define the critical events that made significant changes in the system.

5.2.3.1. Flood Losses and History

As a low lying and developed country the Netherlands always face potential flood disasters because large parts of the country lie below water levels.[36] Since the construction, management and maintenance of flood protection structures are vital for the inhabitants and further development of the country, most of the country is protected by flood protection structures such as coastal dunes, sea/river dikes and storm surge barriers (Jorissen 1998, 57).

It could be stated that flood protection and preservation of sound water systems predominate all other interests. These predominant interests define the conditions of living in this country (Huisman 2004, 47).

Floods cause the most disastrous damages on life and property in the Netherlands. The ‘UN Development Program’ has observed that floods have been effective damages on settlements when compared with the yearly disaster averages as the following Chart 5.2 and Table 5.6 indicate.

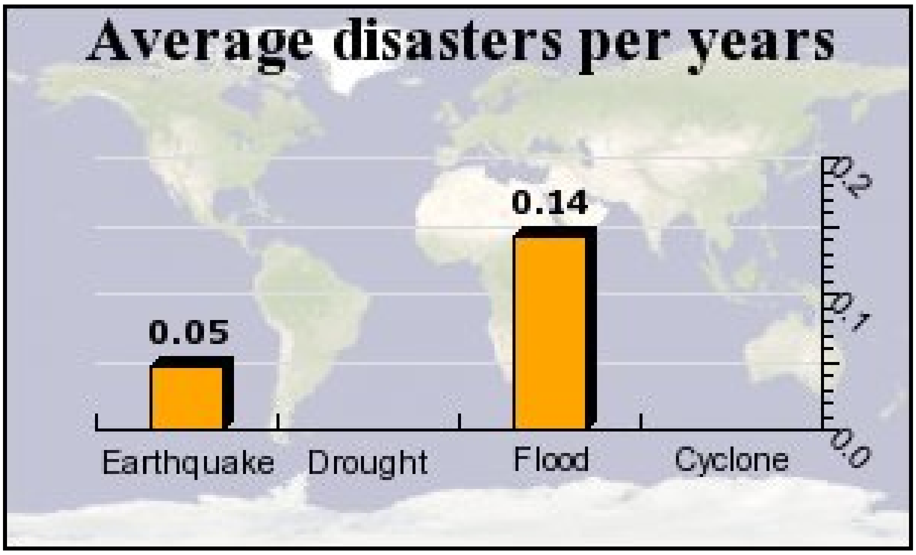


Chart 5.2: Average Disasters per years in the Netherlands (1980-2000)
(http://gridca.grid.unep.ch/undp/cntry_profile.php)

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[36] About 60% of the 16 million populations, live in these low lying areas, therefore an effective system of water control is needed to keep the land dry and habitable. *(http://www.holland.nl/uk/holland/sights/water_management.html)*

Table 5.6: Descriptive Figures per Disaster Types in Netherlands between 1980 and 2000

	Disasters per year [nb/year]	Casualties [killed/year]	Physical exposure [nb/year]	Relative vulnerability [killed/mio. exp.]
Droughts	x	x	x	x
Earthquakes	0.05	0	126'874	0
Floods	0.14	0	558'068	0

(Source: http://gridca.grid.unep.ch/undp/cntry_profile.php)

History of Netherlands shows that flood disasters mostly have led actions to improve the situation by raising/strengthening dikes or increasing the discharge capacity of the rivers. For instance, the disastrous flood of 1953 has been the milestone for the start of a national reinforcement of the flood protection structures (Jorissen 1998, 57). It was called '**Delta Works**' as a broad engineering program including building a system of dams, barriers and higher dikes, which traditionally aims to ensure safety and protect land by blocking out water (Woltjer and Al 2007, 214).

This conventional water management that focuses on constructing and raising dikes has a short-term reducing effect on the flooding risks. Moreover by constructing dikes an irreversible socio-economic process begins. That is, more people coupled with more investments result in a long-term dependency on the dikes (Jorissen 1998, 59).

Following the river floods of 1993 and 1995 additional flood protection measures to dike construction were investigated. They were made for a particular case, specifically for the upper part of river Meuse, where dikes are generally absent. One of the measures considered on this case was widening and deepening of the river bed. This kind of measure to be taken in river basin areas in general provides a decrease in water levels in peak periods by enlarging the area for the river itself and limiting the probability of damage.

Hence addition to the measure of building and reinforcement of dikes three more categories were considered (Jorissen 1998, 59):

- Planning; preventing any further development of the floodplain, which should be kept free the main functions of the river,
- Land use development; retaining rain and melt water in the soil as long as possible where upstream condition is suitable,
- River management; sustaining structural maintenance, improving water drainage, keep continuous recovery and development of the river's natural character,
- Building and reinforcement of dikes; like retention basins, dams, dikes, retaining walls supportive protection measures.

According to Jorissen (1998, 59) in addition to these categories, precautionary measures, public awareness and acceptance are key elements in integrated flood management. During the time of high water levels effective precautionary measures like forecast and warning systems may limit the possible damage. Building regulations and services, private insurance schemes for flooding damages could also be helpful to reduce the possible damage. As Jorissen claims (1998, 60) that absolute safety against flooding cannot be provided. While deciding the appropriate policy among various choices against flooding there is always a remaining flood risk that needs to be communicated to inform both inhabitants and policy-makers.

Therefore, in 1996 Flood Protection Act has been prepared to manage and maintain the safety provided by reinforcing the flood protection structures. According to this act, all flood prone areas of the Netherlands are described and for each area the safety standard[37] is set. To keep the actual safety of the dikes at the prescribed level a 5-yearly safety assessment of all the primary flood protection structures is prescribed in this Act. Local authorities are responsible for the management of these structures in their area assessing the prescribed safety standards of them. The guidelines for design and maintenance of the flood protection structures are prepared by the Technical Advisory Committee on Water Retaining Structures (TAW) (Jorissen 1998, 63).

[37] According to the present design practice the safety standard is defined by the frequency of exceedance of a water level to be withstood by the structure (Jorissen 1998, 63)

This safety standard that is the basis of reinforcement activities of the main flood protection structures of whole country were described by water level that is based on the highest recorded water level. However, it was not secure enough to deal with increasing potential risk of flood. For example; at water levels below the design water level failure or collapse of the flood protection structure is also possible because various failure mechanisms map play their role. In an another example even if the design water level is exceeded, the flood protection structure may not directly fail or collapse because additional structural requirements give the structure a safety margin the size of which is unknown (Jorissen 1998, 65).

These examples occurred in floods of 1993, 1995 and 1998 and gave rise to a series of new investigations in safety rules considering the possibility to develop a more powerful risk-based flood protection policy. In short, the reasons to include a flood risk concept are:

“Water defenses can also fail when conditions are not extreme;

It is necessary to look at probability as well as the consequences;

Other failure mechanisms need to be included in calculations apart from overflow/overtopping;

The present method looks at each dyke section separately to determine whether it meets the safety standard. Under the flood risk approach the entire dyke is looked at in terms of flood probability and what the consequences of this would be” (Fokkens 2005, 35)

Hence, the Flood Protection Act was needed to be improved in order to deal with the concept of risk against the floods because the scope of the risk assessment is wider than the scope of the earlier mentioned safety assessment like safe dike design, reinforcement. According to Jorissen (1998, 66) the risk concept in flood protection policy has various goals:

- “to monitor developments which affect flooding risks and risk perception,

- to compare between flooding risks and other sources of risk,
- to measure the effect of various flood protection strategies,
- to optimize the selected strategy and structural design of flood protection measures."

The new flood protection policy was the adaptation of risk concept to current one. Figure 5.15 indicates this new model including time scale for the assessments and proposals. The lower circle has a time-scale of 5 years while the upper one has a much longer scale ranging from 15 to 50 years as described in Jorissen (1998, 67).

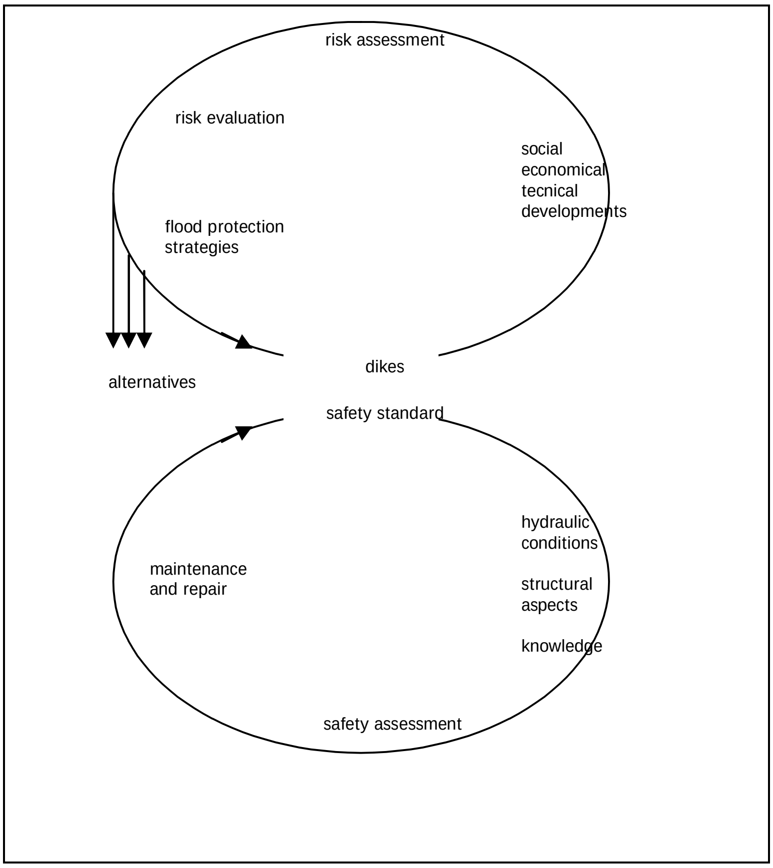

Figure 5.15: Adopting the Risk Concept to Current Flood Protection Policy
(Jorissen 1998, 67)

Within such current flood protection policy Dutch water management and the spatial planning system are interconnected in spite of weak or indirect links between them as shown in Figure 5.16 (Woltjer and Al 2007, 212).

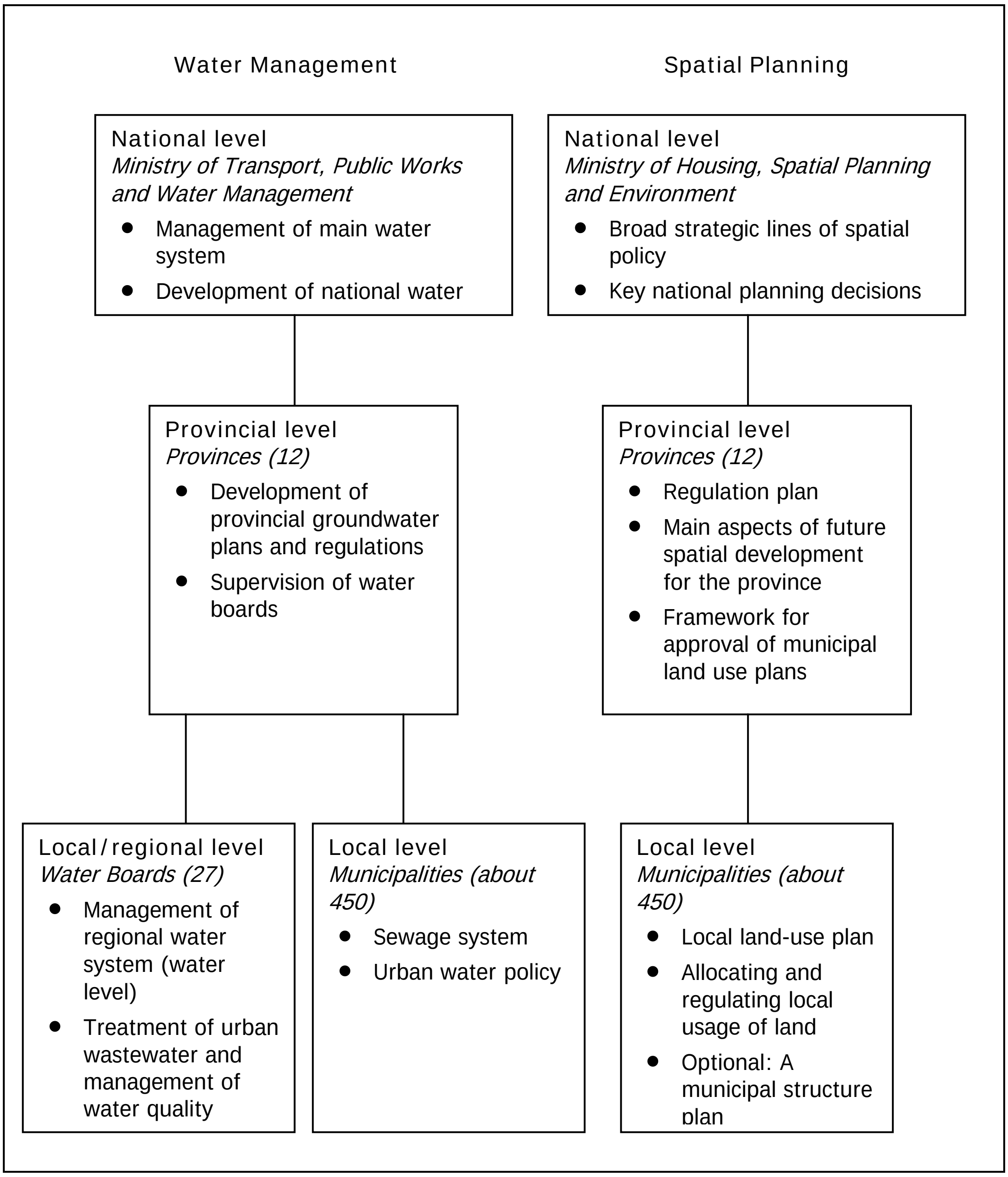

Figure 5.16: Responsibilities in the Current Dutch Water Management and Spatial Planning System *(Woltjer and Al 2007, 213)*

Most decisions regarding water, such as prevailing water levels, ground water depletion permits, water quality norms, strengthening sea water dikes, and river maintenance management, are made without reference to spatial planning. Vice versa, decisions about the location of new housing areas, business parks, or highways are also made with little consideration of their effects on water systems (Woltjer and Al 2007, 212-213).

Ministry of Transport, Public Works, and Water Management has controlling power on the coastal zone and the major rivers like Rhine and Meuse at national level. Provinces have the responsibility for groundwater, while municipalities are responsible for sanitary sewage and storm water facilities. Ministries and provinces determine strategic water policy. However drinking water supply is provided by private companies indirectly controlled by municipalities and provinces. The regional water system, such as water in polders[38] and surrounding outlet and drainage waters, is controlled by water boards responsible for flood defense, water quantity and quality management (Woltjer and Al 2007, 213-214).

For spatial planning the broad strategy is set by the national government with the so-called key planning decisions. Provinces translate these into regional plans and municipalities prepare detailed land-use plans that decide where housing, industry, roads, canals, railway lines, and parks are located in accordance with regional plans. These regional plans are supposed to integrate policies at the different government levels and across various policy fields.

Flooding in 1998 and 2002 in the Netherlands left people feeling the conventional water management would no longer be adequate to deal with issues such as climate change, rising sea levels, local land subsidence, and urbanization pressures. These recent floods affecting many countries of Europe also led the European Union to develop a new strategy for promoting coordination at the scale of the river basin. Hence, climate change and calls for greater coordination within Europe have resulted in Dutch water managers

[38] Polder: Land enclosed by dikes, and often reclaimed from lakes, rivers, or the sea (Woltjer and Al 2007, 213).

and planners alike to seek ways to connect water management and spatial planning (Woltjer and Al 2007, 211-212, 214).

Hence, in recent years two major developments; new national policy in the Netherlands and emergence of European Water Policy set the stage for new strategies that integrate water management and spatial planning. In Netherlands conventional water management that aims to ensure safety and protect land by blocking out flood-water with a vast engineering program is currently transforming into new strategy called 'dynamic coastal management' and 'room for the river' allowing water to occupy more space on land in order to be more resistant towards consequences of climate change, rising sea levels etc (Woltjer and Al 2007, 214).

Due to an enormous scarcity of space in the Netherlands land will have to serve multiple functions; such as for the combination of nature and water on space: wetlands, the combination of housing and water: floating homes, infrastructure and water: floating roads, public transport over water, economy and water: recreation (Woltjer and Al 2007, 214).

According to dynamic coastal management approach some space is set aside in natural areas for coastal flooding during high tides rather than preventing this with fortified dunes or dikes. This is a more appropriate response to rising sea levels than building traditional coastal-defense structures enhancing the resilience of coastal systems. Another approach is about river management for a large river like the Rhine Project enlarging the area available to accommodate Rhine waters during the floods by converting land from urban and agriculture uses to a land-use called 'water' or by constructing ecological channels. Another way to enlarge the available area is to identify some zones adjacent to large rivers that could be flooded in an emergency (Woltjer and Al 2007, 214-215).

In urban areas some zones are reserved for temporary water retention during times of extreme rainfall so that surplus water would flow into these ponds, parks, or separate reservoirs to alleviate the immediate threat of local flooding. 10% of the area in urban land is commonly set aside for such measures including ponds, streams for emergency conveyance and storage of rain water, and permeable surfaces and grass-covered roofs to hold rain and allow soil to infiltrate (Woltjer and Al 2007, 215).

5.2.3.2. Current Institutional and Legislative System about Water Issues in Netherlands

Water management in Netherlands is given to the responsibility of public authorities rather than private individuals or institutions. These authorities have to coordinate the possibilities of the water system to the demands of the socio-economic system. As seen on the following figure these authorities attempt to create harmonious relations between nature and society by governing-administrative structure about water systems in order to manage optimal benefit for all parties.

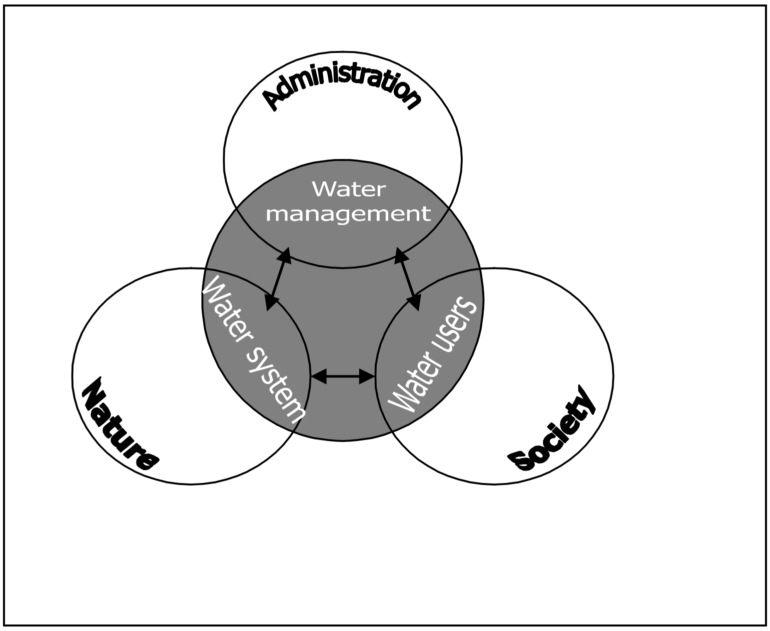

Figure 5.17: Harmonization of Water-Related Functions with the Water System by the Administration *(Huisman 2004, 77)*

Netherlands is a decentralized unitary state with three main hierarchical administrative levels of water resources management: national, provincial and regional as shown in Figure 5.18. At each level, bodies have both legislative and executive responsibilities (Huisman 2004, 87).

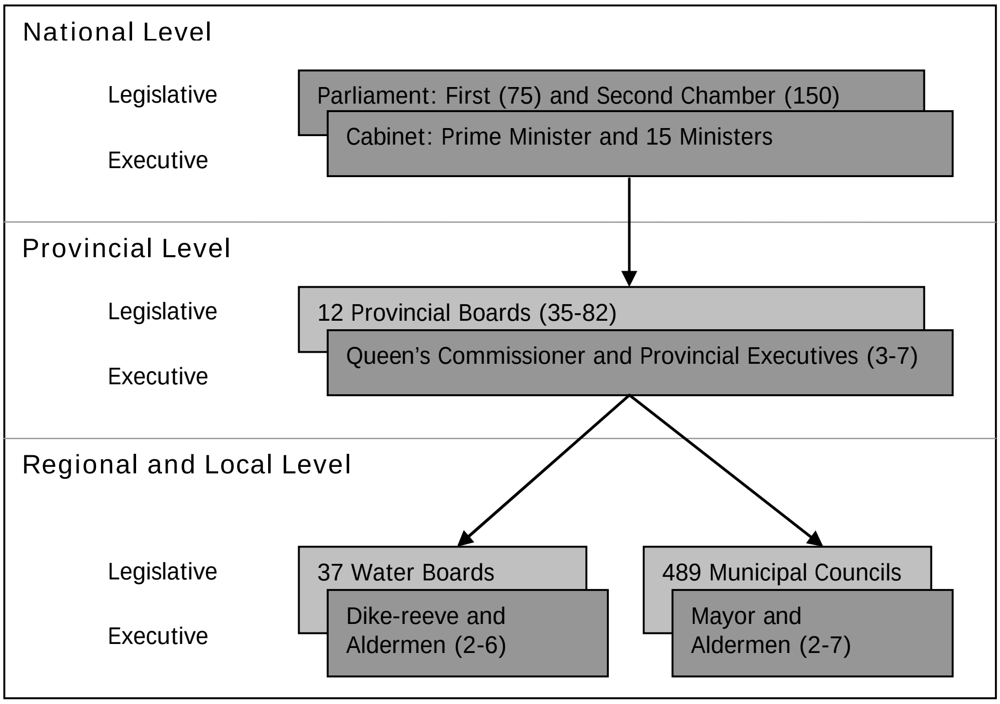

Figure 5.18: The Institutional Structure of Netherlands
(Huisman 2004, 87)

The central government formulates the main lines for the strategic policy about water issues at the national level as well as the operational management of the state-managed waters and some major flood protection works. Within the national policy framework, the provincial government, on the other hand, defines the strategic policy for the non-state managed waters and regional framework for flood protection. At the third level, both the water boards and municipalities are responsible for the operational management and actual enforcement of the policy issues. While the water boards are dealing with the overall drainage in urban and rural areas, water quantity and quality including wastewater treatment, as well as flood protection, the municipalities are responsible for waste water collection by sewerage system and drainage in urban areas (Huisman 2004, 77).

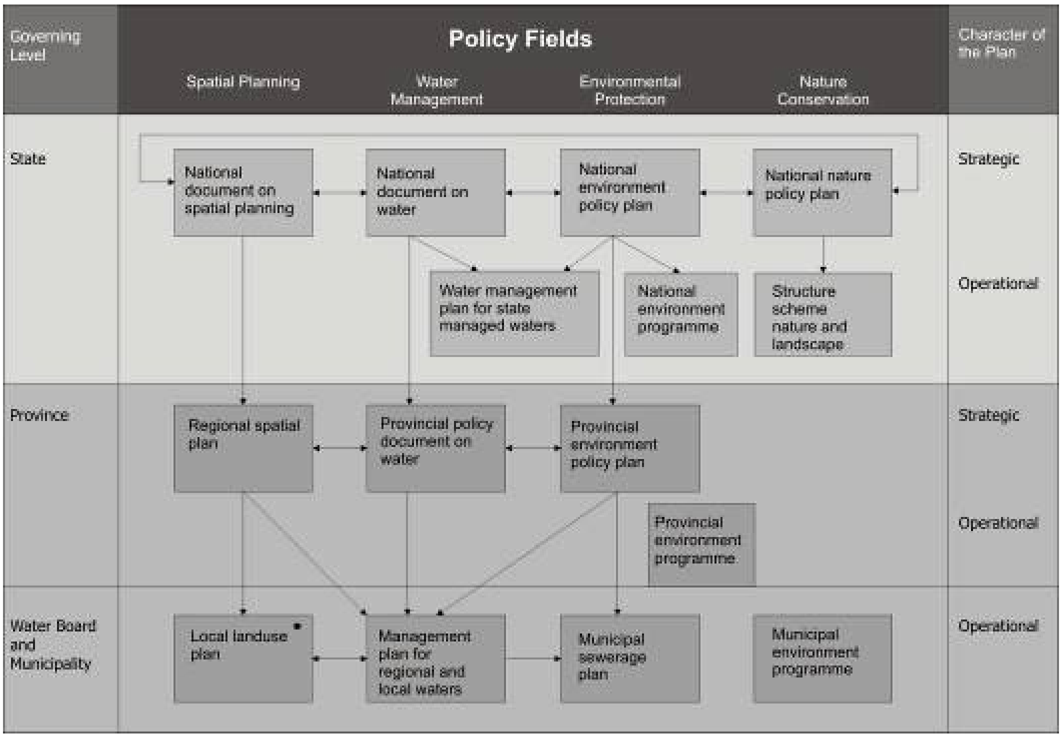

Figure 5.19: The Water Related Planning Structure in the Netherlands[39]
(Huisman 2004, 82)

In water management three **Ministries** at the national level have essential tasks as listed by Huisman (2004, 88-89):

The Ministry of Transport, Public Works and Water Management is responsible for flood protection and water management. The Water Directorate of this Ministry, established in 2002, has the task of preparing the national policy on flood protection and management. The Rijkswaterstaat[40] (RIZA) of this Ministry has been supervising the implementation of water policy by provinces and

[39] Two-way arrows indicate harmonization obliged by law, one-way arrows show legal obligation to draft plan according to instructions of higher government, and the black dot shows the only plan binding citizens
[40] The Directorate-General for Public Works and Water Management

water boards. It also has the operational responsibility for the state managed waters and water retaining structures of national importance.

The Ministry of Housing, Spatial Planning and the Environment is responsible for general environmental policy; setting of water quality and emission standards; laws concerning air, soil and groundwater protection, waste, noise etc, environmental impact statements, drinking water and sewerage; and spatial planning (land use).

The Ministry of Agriculture, Nature Management and Food Quality is responsible for general policy on agriculture, nature management, food quality, fisheries, rural areas and outdoor recreation, and legislative policy concerning nature conservation with regard to species and areas.

Netherlands are composed of 12 Provinces ruled by the Province Act. Three administrative bodies are namely (Huisman 2004, 89):

- The elected Provincial Council composed of 45-85 members depending on the number of inhabitants.
- The appointed Provincial Executive by the Provincial Council
- The Provincial Governor as the chairman of the council and the executive board nominated by the Provincial Council and appointed by the national Government.

Water management at provincial level was formerly performed by the provincial water management departments which define and supervise the responsibilities and activities related to flood protection and water management. These departments have combined with the provincial environmental departments (Huisman 2004, 89).

The provinces can formulate policies about water management, environment, nature conversation, housing, physical planning, transport, economics, and welfare of their own but they must be devoted to the directives issued by the national government. Additionally, they have to ensure that the national and provincial policies are implemented by the municipalities and water boards (Huisman 2004, 89).

At local level **water boards** have been the competent regional water authorities since 13th century administering the dikes, local embankments and polders. They are financed by their stakeholders: inhabitants, owners of land, real estate and industry. Stakeholders elect their representatives in the Assembly every 4 years[41].

The general democratic elections the Central Government, provinces and municipalities is based on the principle 'one man – one vote', whereas a functional democracy like the water board is based on the rule 'interest-payment-say'. The distribution of the seats in the water board among landowners, residents and wastewater dischargers is defined by this rule. Under the approval of the national Government the provincial authorities define and supervise the task or water boards that are responsible for flood defense[42], and water quantity and quality management in their territory. Many provincial borders do not coincide with the hydrological/hydraulic borders of the water boards where the inter-provincial water boards are created. Common views about flood control, water management and water-related issues are shared in the Union of Water Boards by all water boards (Huisman 2004, 90).

The tasks and organization of the **municipalities** governed by the Municipal Act are composed of the Municipal Council elected body of councilors, and the Municipal Executive, a number of Aldermen appointed by the Council. And the Mayor, the chairman of the both councils, is nominated by the Municipal Council and appointed by the Crown. The water management task at municipal level is limited to the management of sewerage systems performed by the local public works department and storm water facilities (Huisman 2004, 90).

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[41] Source: http://www.euwma.org/index.php?id=13,0,0,1,0,0

[42] Flood defense involves ensuring that dikes, dams and dunes are in good condition (Woltjer and Al 2007, 213).

5.2.3.3. Specific Examples for Recent Measures and Spatial Planning Concepts

Different types of measures in different scales are implemented and evaluated in various locations of Netherlands with the new strategy called 'room for the rivers'. Riverbed dredging, lowering of groynes, removal of embankments, floodplain lowering by excavation and removal of obstacles are examples of small scale measures as shown on Figure 5.20. Large scale types of measures, on the other hand, could be retention, 'city bypasses' and 'green rivers', and inland relocation of dykes (Fokkens 2005, 37).

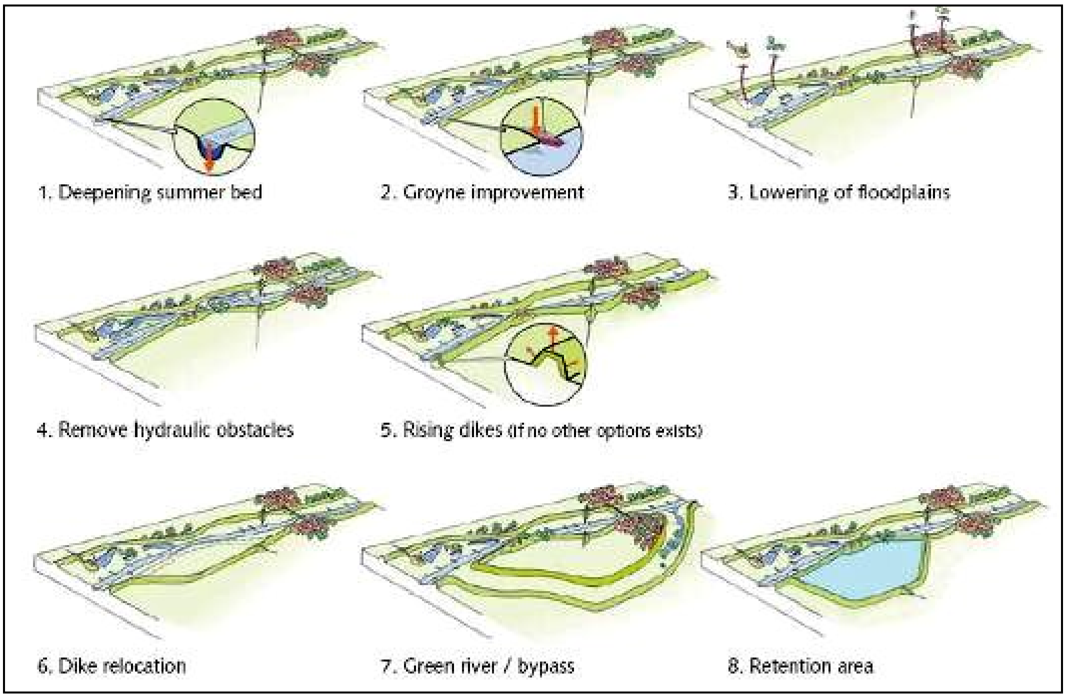

Figure 5.20: Overview of Possible Spatial Measures in the Riverine Area[43]
(Fokkens 2005, 38)

Measures, mainly based on the construction of new green rivers and 'city bypasses' are proposed **for robust and natural development** concept as shown on Figure 5.21.

[43] Between winter dykes, no. 1 to 5 and outside of winter dykes, no. 6 to 8

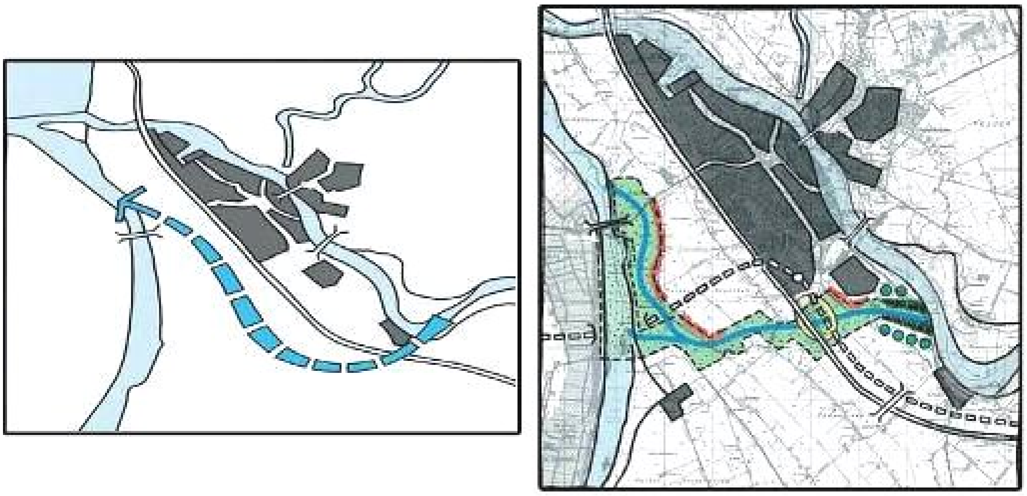

Figure 5.21: Construction of a Green river as a City Bypass Near the City Kampen *(Fokkens: 2005: 41)*

Figure 5.22: River Restoration by Construction of a Secondary Gully; Photos of 2000, May 2002 and August 2002 from left to right
(Fokkens 2005, 41)

5.2.4 Germany

Finally Germany as a case country is examined in this section. The examination is made with respect to the country's administrative and legislative structures managing flood issues as well as urban development and planning. The review presented here is conducted in a historical manner in order to determine the shifts in the current approaches and policies, and to find out the critical events that made significant changes in the system.

5.2.4.1. Flood Losses and History

Germany has experienced several disastrous floods in the last two decades. These are Rhine 1993 and 1995 Floods, Oder 1997 and 2001 Floods, Danube 1999 and 2001 Floods and Elbe 2002 Flood (Friescke 2004, 3). As shown on the following chart and table floods are the most effective disasters on life and property in Germany according to data between 1980 and 2000.

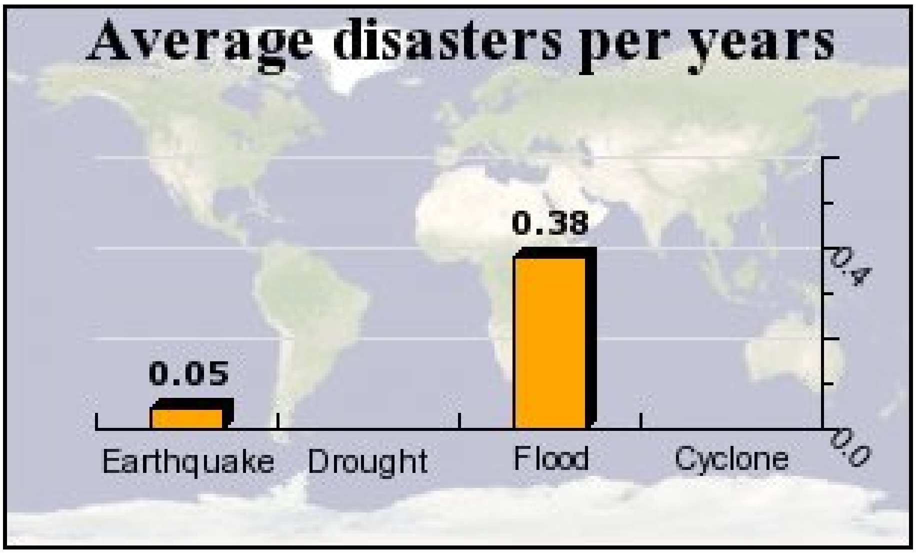

Chart 5.3: Average Disasters per years in Germany (1980-2000)
(http://gridca.grid.unep.ch/undp/cntry_profile.php)

Table 5.7: Descriptive Figures per Disaster Types in Germany between 1980 and 2000

	Disasters per year [nb/year]	Casualties [killed/year]	Physical exposure [nb/year]	Relative vulnerability [killed/mio. exp.]
Droughts	x	x	x	x
Earthquakes	0.05	0.0	357'730	0.1
Floods	0.38	1.0	3'976'284	0.3
Tropical Cyclones	x	x	x	x

(http://gridca.grid.unep.ch/undp/cntry_profile.php)

In April 2006 heavy rain with huge amount of snow melting caused high water levels in most of the rivers across Europe. Particularly Elbe and Danube Rivers flooded the surrounding areas in Germany without creating extensive damages as compared to that of 2002 (Figure 5.23). The reason is probably the measures that were implemented following 2002 flood. However, the water level of Elbe river was 13-centimeter higher than level in 2002 flood. In five communities a state of emergency was declared with the evacuation of 1000 people from Dresden and Meissen[44].

Germany has six main rivers creating noteworthy floods through history. These are Danube, Rhine, Elbe, Oder, Weser and Ems all of which are shared with bordering countries[45].

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[44] Sources: http://en.wikipedia.org/wiki/2006_European_floods, http://ec.europa.eu/environment/civil/floods_2006.htm

[45] http://www.icee.usm.edu/ICEE/conferences/asee2007/papers/1641_A_COMPARISON_OF_FLOOD_MANAGEMENT_PRACTIC.pdf

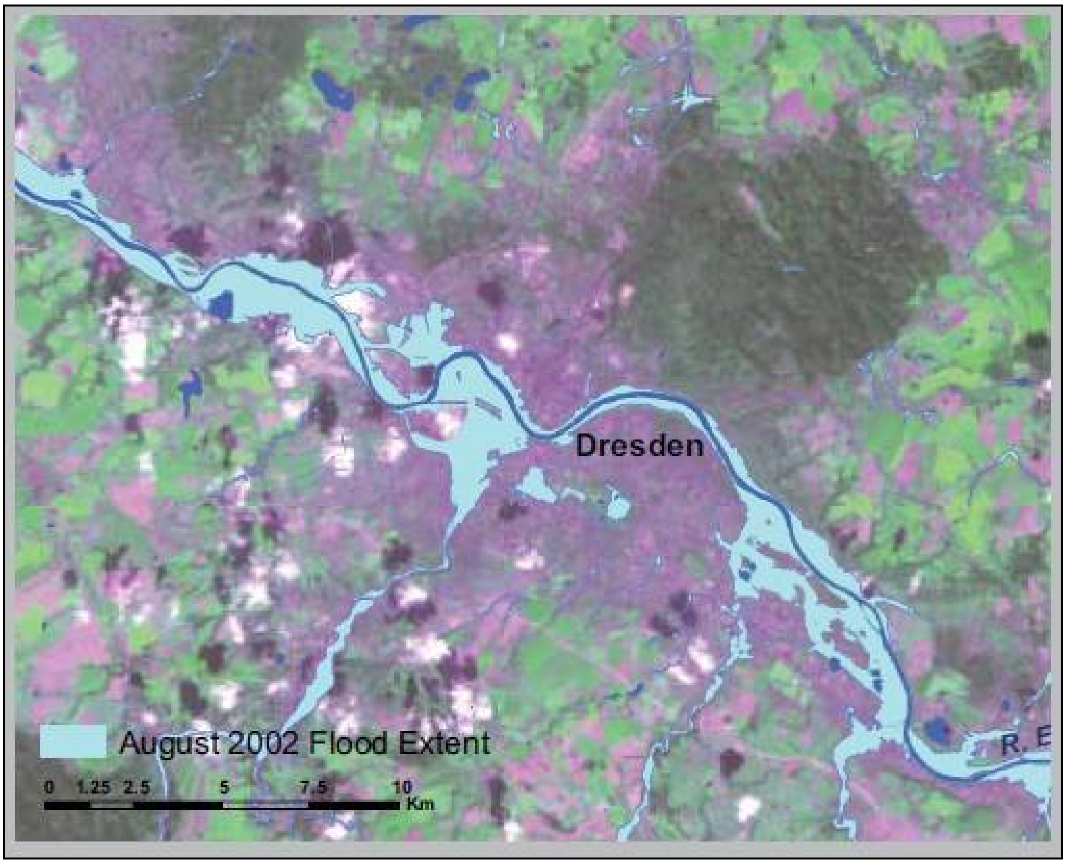

Figure 5.23: Extension of 2002 Flood
(Source: http://www.rms.com/Publications/Germany_Flood.pdf)

5.2.4.2. Current Institutional and Legislative System about Water Issues in Germany

Germany is a democratic parliamentary federal republic since 1949. The country is divided into 16 Federal States (Länder), three of which are the city states of Berlin, Hansestadt Hamburg and the Hansestadt Bremen[46].

Following the most devastative flood of 2002 German Ministerial Conference held in 4th September 2002 in order to find out immediate actions for reconstruction and refurbishment of flood protection structures, and for improvement of precautionary, emergency flood protection activities (Wilke 2004, 13). It has been the milestone for "**nationwide flood reduction policy**"

[46] Source: http://nofdp.bafg.de/servlet/is/13221/?lang=en

of German federal government. As summarized by a number of authors such as Friesecke (2004) and Wilke (2004) three basic objectives of such policy are

- To provide more space to the rivers, in other words to 'give the rivers more room'
- To restrain flooding decentralized
- To limit urban development and reduce damage potential

According to the final outputs of this conference German federal government declared a nationwide programme[47], that is called '5 points action programme' in 15th September 2002. In order to take "working steps towards the improvement of precautionary flood protection" for the whole country this new programme has to be adapted in each individual state and implemented cooperatively (Wilke 2004, 13).

As Friesecke (2004) pointed out, main regulations about flood protection are:

- Guidelines for Forward-Looking Integrated Flood Protection prepared by Laender Working Group on Water (1995),
- Recommendations "Preventive Flood Protection by Spatial Planning" by Standing Conference of Federal and State Ministers Responsible for Spatial Planning (2000),
- 5-Point Programme of the Federal Government (2002),
- Federal Government's Law on Improvement of Preventive Flood Protection (2004).

Based on that 5-point programme Federal Government established 'the Flood Control Act'. In accordance with the basic strategy of that programme relocating dikes further away from riverbanks and conserving/restoring floodplains are some of the measures in order to leave more room for rivers, particularly give their natural flood-plains back to them. Besides, in areas declared as 'at risk of flooding' certain restrictions are taken on building

[47] http://nofdp.bafg.de/servlet/is/13221/?lang=en

constructions and provisions like agricultural use particularly in high-risk areas are required (Friescke 2004, 8).

Flood Protection Act also immediately necessitates a number of amendments in related acts; like Water Management Act, Federal Building Code, Federal Regional Planning Act, Federal Waterways Act and in the law governing the German Weather Service as Friescke states (2004, 8).

5.2.4.3. Specific Examples for Recent Measures and Spatial Planning Concepts

German spatial planning is based on federalist and specialist cooperation instead of hierarchical and centralized decision-making process. The Federal Law contains coordination among various planning levels, such as the Federal Government, the Leander (state), the Municipalities, and different types of spatially effective sector planning (Friescke 2004, 6).

The Federal Government settles on the guidelines for spatial planning and water management. The planning competence and the legislative competence are under the responsibility of the 16 Federal States, the Leander working within the guidelines set by the Federal Government. In accordance to the decisions of the Federal State the regions and the municipalities have power to implement policies related[48].

The Republic of Germany is responsible for developing and implementing policies and legislation regarding the water resources management, spatial planning and building codes at Federal level. At that level spatial planning mainly contains a set of abstract requirements and guidelines which must be adopted by each state (Rehbach and Hinsberger 2008, 5).

'Federal Regional Planning Act' that requires extensive planning programs the Leander are responsible for defining concrete design for their territories on their own. Both the areas of supra-regional or federal interest and central areas, main development and transportation axes are determined within their regional plans (Friescke 2004, 6). The Act also obliges development plans to

[48] http://nofdp.bafg.de/servlet/is/13221/?lang=en

contain retention areas or ‘polders’ as a means to control the extent of floods as Rehbach and Hinsberger states (2008, 5).

In other words, areas that have certain goals of priority such as nature and landscape conversion, local recreation, agriculture and flood protection proposed are shown. As Friescke states (2004, 6) that “the statement of regional plans are primarily meant to be specified in sub-regional plans for parts of the Leander but serve at the same time as binding statements for municipal planning” (see Table 5.8).

Table 5.8: Spatial Planning System in Germany

State Structure and Responsible Bodies	Level of Planning	Legal Foundation	Decision making and Planning Instrument	Scale
Federation (Federal Ministry of Transport, Building and Urban Affairs)	Spatial Planning at Federal Level	Federal Regional Planning Act	Legislation for federal spatial planning and local planning: Spatial Organization Act, Federal Town Planning Act, Land Use Ordinances, Map sign Ordinances, Special Provisions for development and urban renewal	
Laender (Federal State: Ministries of State Parliament)	State planning (Spatial Planning at Land Level)	State Development Programme, State Planning Law (e.g. Spatial Planning Law of North Rhine-Westphalia)	Legislation for state spatial planning: Regional plan (for the territory of a land), State Planning Act, Design Guide Ordinance, State Building Code Approval of Local Planning	1:500.000 – 1:200.000
Region (Council Development Control Office)	Regional planning (for parts of the Laender)		Sub-regional Plan State Development Programme coordinating state and local development goals	1:50.000 – 1:25.000
Municipalities	Local planning (Urban land-use planning, area development planning)	Federal Building Code	Preparatory land-use plan (general) indicating the intended spatial development for the community	1:10.000 – 1:5.000
			Fixing in statue as legally binding local development plans for limited areas to be evolved from land-use plan	1:2.500 – 1:1.000

(Sources: Friescke 2004, 7, http://nofdp.bafg.de/servlet/is/13221/?lang=en)

According to the Decree of Federal Government framework legislation for all states may influence regional planning through two instruments; regional planning procedure and counseling (Rehbach and Hinsberger 2008, 5).

Provincial governments have to design and establish spatial planning guidelines within their jurisdiction concerning flood management in order to comply with Federal regulations. The accordance of such spatial planning guidelines of provincial governments with Federal policies is examined by the Federal Government. It also may advise to regional and local planning departments regarding spatial planning, water-resource management and land-use norms when required (Rehbach and Hinsberger 2008, 5).

As indicated in Figure 5.24 flood risks can only be reduced effectively by not only technical measures but also spatial planning regulations on land-uses in flood prone areas. The first and the most required policy in sustainable spatial planning is to promote building development outside flood prone area as much as possible. Secondly, in such areas it is critical to avoid or stop development via land-use control (called 'freeze' by Rehbach and Hinsberger 2008). Inside the floodplains 'freezing policy' is achieved by prohibiting new developments and restricting modifications to existing infrastructure.

And for the developments, which cannot be located elsewhere, appropriate building codes or zoning ordinances could be used to reduce flood damage potential. Then it is more suitable to use such flood prone areas as parks, natural and ecological reserves. By that way the developments beyond such areas may probably be flood-proofed in the future as well. For example, a variety of farming, cropping and cultivation techniques are crucial to maintain a prospective vegetative cover for more retention and increased infiltration capacity (Friescke 2004, 9).

According to Friescke (2004) the removal of flood-prone development and conversion of land to a conforming use may be more expensive way in the long-run than relocating flood-prone development regarding zoning flood-prone lands. However, sustainable planning efforts must focus on establishing a balance between urban development and flood water retention while providing space for them.

Although the federal building code is not legally binding for builders or property developers at individual level, it is legally binding for planning agency in charge of ‘Master Zone Mapping Plan’ as Rehbach and Hinsberger state (2008, 5). For example, Article 1, section 2, number 12 requires local planning agencies to consider flood protection while setting up land-use plans.

Ordinance used in the region of North Rheine-Westphalia includes a number of standards about the construction and modification of buildings in the floodplains of streams that are at risk during the floods. These standards applied to all buildings within legally defined floodplains. With the amendments and revisions in 2005 according to Federal Flood Protection Law “each person affected by a flood is obliged to take necessary precautions to protect his/her property and to reduce possible losses” (Rehbach and Hinsberger 2008, 11).

1	**Protection of existing retention areas** • declaration of flood areas	**Contribution of spatial planning and urban development**
2	**Extension of retention areas** • backward relocation of dikes • creating detention ponds • restoration of large streams • flood plain scrapes/deepening of retention areas	
3	**Retention in the catchment** • rainwater storage and greywater use • restriction of sealed surfaces • reduction of interflow on agricultural and forestry land • restoration of small streams	
4	**Minimisation of damage potential** • preventive land-use management • precautionary measures of construction • information of the public • improvement of public awareness • prediction of floods and warning • disaster prevention/control	
5	**Technical flood protection measures** • dikes • flood protection walls • retention ponds • river dams, barrages	

Figure 5.24: Contribution of Spatial Planning and Urban Development
(Friescke 2004, 9)

Preventive flood protection measures include securing or relocating meadows, water retention basins and flood-prone areas as the second section of Article 2 of the Federal Regional Planning Act stipulates (Friescke 2004, 10). This principle is to be implemented at state level by regional plans, at regional level by sub-regional plans and at a local authority level by local development plans as binding documents (see Table 5.9).

Table 5.9: Selective Instruments of Flood Protection in Germany

Fields of Action	**Legal Foundations**	**Supra-regional and Regional Instruments**
Spatial Planning	Federal Regional Planning Act	- Declaration of flood risk areas as priority areas - Declaration of flood risk areas as reserve areas
Water Management	Water Management Act	- Determination of flood areas - Installation of flood action plans - Installation of regional flood concepts
Risk Management		- Flood forecasting Implementation of early-warning systems - Development of flood hazard maps

(Source: Friesecke 2004, 10)

In regional plans Federal Laender designates flood risk areas as priority sites and as reserve areas by law (Federal Regional Planning Act § 7 Section No: 1 and 2). In local or regional plans particular functions such as recreation, nature/landscape, mining, urban expansion can be attributed to such **priority areas** designated in structural plans and any other actions must be compatible with this priority purpose (Friescke 2004, 10-11).

For instance, according to Article 35 (section 3, number 6) for some areas flood protection is denoted as ‘public concern’ that is not yet covered by a legally binding zoning map. Therefore, flood protection is considered to be more vital than the construction of new projects. In another example, Article 24 provides municipalities the right to deny building permits as first-refusal in geographical areas defined to serve as floodplains, as such areas should be kept free from buildings. By this Article municipal governments have right to deny requests in case of developments in flood-plains (Rehbach and Hinsberger 2008, 6).

Oppositely, **reserve areas** should be uses as a reserve for particular functions like nature/landscape, mining, flood risk area. And any planning action must be compatible with this purpose (Friescke 2004, 10-11).

The **flood areas** delineated by the Federal State have another requirement within the urban land-use planning. They are mainly considered as the most vital instrument for securing flood water retention areas defined by regulations of Water Resources Act amended. **Flood risk areas**, on the other hand, contain flood-prone areas that are defined by design event (generally 100-year-flood). Such areas that are not protected by dikes may include existing buildings as shown in Figure 5.25 (Friescke 2004, 11).

The mapping of flood risk areas is based on frequency of flood event and vulnerability analysis that is area specific. Since these maps are legally binding documents in terms of zoning and all kinds of measures they need to be accurate and credible. Based on such maps in order to reduce future flood damages urban development can be controlled by zoning and flood proofing measures. However, the effectiveness of such measures as Friescke claims (2004, 13) is highly reliant on enforcement and maintenance.

The definition of floodplains and restrictions regarding new developments within such floodplains, as well as modifications to existing infrastructure inside these floodplains are introduced by German Water Resources Act (hereafter WRA). By this Act the additional areas which are endangered by floods in case of failure of flood protection facilities are also determined (Rehbach and Hinsberger 2008, 6).

In urban land-use planning two instruments are effectively used in Germany. Based on the delineation of flood risk areas indirect or preventive measures like reforestation, avoidance of sealing are necessary to minimize flood hazards. When preparing (drawing up) legally binding land-use plans 'development freeze', 'postponement of applications for building permit', 'right of pre-emption' are several instruments local authorities applied as preventive flood management (Friescke 2004, 13).

Article 31b (section 4) of WRA enacted in 2005 obliges municipalities to completely interdict or at least severely restrict the construction of new buildings within legally-determined floodplains. 'It is now officially forbidden for municipal authorities to define new building areas within floodplains in the legally-binding zone-mapping plan'' (Rehbach and Hinsberger 2008, 6).

So for private individuals it is almost impossible to be granted a permit for construction within a floodplain. However, if criteria are met municipal authority may decide to a new building area exceptionally. To fulfill all criteria expenses for the justification of a new building area are usually too high for individuals (Rehbach and Hinsberger 2008, 6).

Table 5.10: Criteria for Construction Permits within Floodplain Area

Prohibition/Restrictions within the floodplains	
New Buildings	**Existing Buildings**
No alternative location available	Retention of floods only be marginally impaired
Being adjacent to an existing building location	Loss of retention areas be replaced within a short period of time
No anticipated danger to life, health or property	Runoff of floods and water level during floods not be worsened
Runoff of floods and water level during floods not be worsened	Existing flood protection not be impaired
Retention of floods not be impaired and lost retention areas be compensated regarding time, extent and function	Modifications of buildings be carried out in such a way that no structural damages occur during design flood
Existing flood protection not be impaired	
No disadvantageous consequences for people living upstream or downstream of proposed building location	
All concerns regarding flood protection must be considered	
Construction be flood-proof; i.e. no structural damages occur during design flood	

(Source: Rehbach and Hinsberger 2008, 6-7)

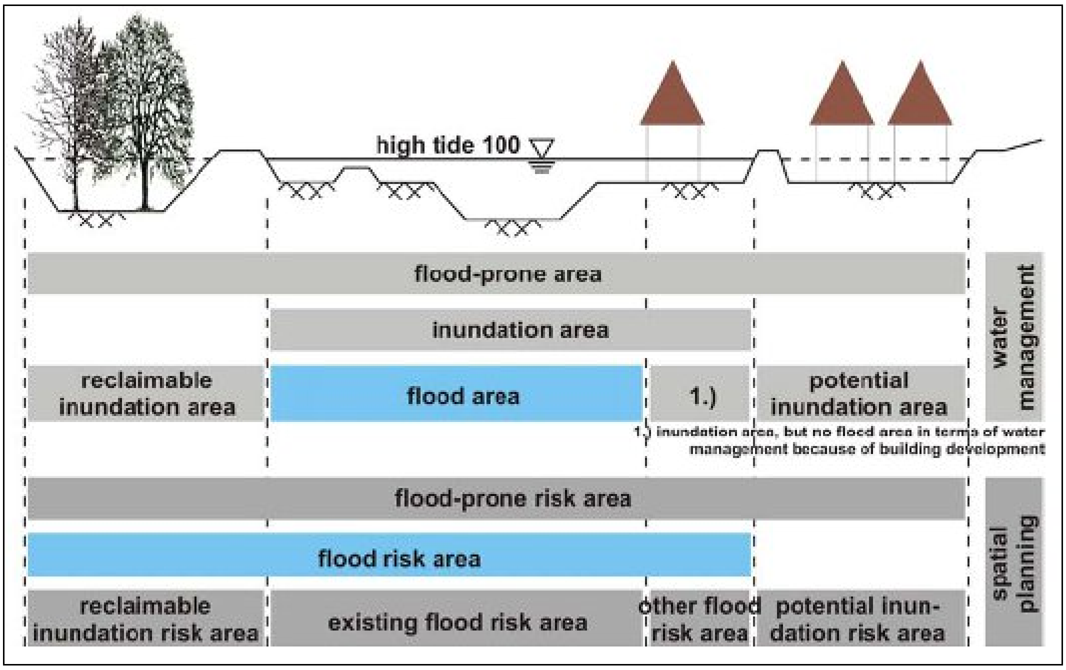

Figure 5.25: Overview Regarding Flood, Inundation and Flood-Prone Areas
(Friescke 2004, 11)

Table 5.11: International Experiences on Flood Risk Management and Urban Planning

FRANCE	NETHERLANDS	GERMANY
GENERAL POLICY SHIFT TOWARDS FLOOD DISASTERS		
A more proactive communication on flood risks was obtained by new provisions after the commence of Technological and Natural Risk Prevention and Reparation of Damages (2003)	'**A more powerful risk-based flood protection policy**' was developed in order to be more resistant towards consequences of climate change after 1998 and 2002 floods.	The strategy of averting dangers was replaced by a new "**risk culture**" strategy based on the comprehension that absolute flood control is impossible due to technical and economic limitations. '**Residual risks**' to be prepared and reduced always exist.
ADMINISTRATIVE ORGANIZATION OF WATER MANAGEMENT		
Ministry of Ecology and Sustainable Development is the main institution concerned with risk evaluation. Major responsibilities are: • evaluation of flood hazards and risks, • gathering and processing of the necessary information, • assessment of the current situation and progress, • spreading of info through the network of Regional Environment Directorates (communication) Each river basin has own **Watershed Agency** involving all stakeholders; elected officials, consumers, representatives of federal, regional and local governments. System is based on **dialogue** institutionalized at National Level, River Basin Level and the Levels of Tributaries and Sub-Basins. **Participation** is a top-priority goal attempted to be achieved through French Water Management Framework. Below is the **hierarchy of management**:	**Ministry of Transport, Public Works and Water Management** determines the strategic water policy. However **Ministry of Housing, Spatial Planning and the Environment** is responsible for general environmental policy; setting of water quality and emission standards; laws concerning air, soil and groundwater protection, waste, noise etc, environmental impact statements, drinking water and sewerage; and spatial planning (land use). At all levels of water resources management (national, provincial and regional) legislative and executive responsibilities exist. The operational management and actual enforcement of the policy issues are executed by water boards and the municipalities. The regional water system (water in polders and surrounding outlet and drainage waters) controlled by **Water Boards** responsible for basin-wide flood defense, water quantity and quality management. Provinces are responsible for groundwater while municipalities responsible for sanitary sewage and storm water facilities.	**Federal Ministry of Transport, Building and Urban Affairs** is responsible in spatial planning and navigation of waterways. For the protection of water bodies the responsible body is the **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety**. The hierarchical structure is subdivided into the upper authority at **national level**, in the middle at **Federal State level** or **sub-regional level** (executive boards or regional authorities) and the lowest at local level (lower water authorities). The Federation establishes a general framework with its **Federal Water Management Law**. Federal States have to set up its own water law to legitimize the national framework and to add their own regulations and orders. One of the tasks of Federal States is the execution of water policies. The Federation is the owner of the waterways and holds the administrative responsibility for them. The river banks, dykes, dams and retention areas are management tasks of the Federal States. Water management plans should integrate national principles and own strategies and aims

Sources: OECD Studies 2006, MEED 2006, http://nofdp.bafg.de/servlet/is/14508/?lang=en, Woltjer and Al 2007, Fokkens 2005, Huissman 2004, Rehbach and Hinsberger 2008, Kolf 2005, Friesecke 2004, http://nofdp.bafg.de/servlet/is/13221/?lang=en

Table 5.11 (continued): International Experiences on Flood Risk Management and Urban Planning

ADMINISTRATIVE ORGANIZATION OF WATER MANAGEMENT		
• **National Water Committee** consulted on national water policy and on drafts of legislative and regulatory texts, • **River Basin Committee** responsible from the preparation and adoption of Master Plans for Water Development and Management, • **Local Water Commission responsible from the** preparation and monitoring of the implementation of Water Development and Management Scheme, • **Local Water Community** help to attain the objectives determined by SAGE **The Advisory Council** for the Prevention of Large-Scale Natural Risks in order to "give opinions and make proposals in the field of natural risk prevention" Members: all ministries concerned, insurance companies, local governments, the National Assembly and the Senate.		regarding water affairs at Federal States level. The ministries have at their disposal **Advisory Authorities**, such as the Federal Environmental Agency and the Federal Institute of Hydrology.
INTEGRATION TO PLANNING		
Hazard and Risk Maps and **Compulsory Risk Prevention Plan (RPP)** based on these maps are the essential tools. It is compulsory for mayors of any commune under a Risk Prevention Plan (RPP) to keep citizens informed, requiring the situation of property regarding natural risks be stated 'for any transactions or rental contracts, even for seasonal rentals'. RPP evaluates the hazard, identifies the exposed areas and specifies town planning, construction and management requirements for new and existing buildings.	For spatial planning the broad strategy is set by the national government with the so-called key planning decisions. Provinces translate these into regional plans and municipalities prepare detailed land-use plans that decide where housing, industry, roads, canals, railway lines, and parks are located in accordance with regional plans. These regional plans are supposed to integrate policies at the different government levels and across various policy fields.	At National level spatial planning is in the responsibility of Federal State. The sub-regional level are responsible for regional water management planning's and partly for the execution. The planning bases are formed by State Regional Development Plan or by the regional plans which can assign interest of flood prevention and of other water matters. The main tasks of local authorities are sewage treatment and drinking water supply. Main planning guidelines are regulated in the preparatory land use plan drawn up in the light of all the relevant departments. The interest of the water management are integrated and considered.

Sources: OECD Studies 2006, MEED 2006, http://nofdp.bafg.de/servlet/is/14508/?lang=en, Woltjer and Al 2007, Fokkens 2005, Huissman 2004, Rehbach and Hinsberger 2008, Kolf 2005, Friesecke 2004, http://nofdp.bafg.de/servlet/is/13221/?lang=en

Table 5.11 (continued): International Experiences on Flood Risk Management and Urban Planning

MITIGATION MEASURES AND MEANS OF IMPLEMENTATION		
To promote an **integrated basin-wide approach** prevention and mitigation activities are launched by nation-wide programme focusing simultaneously on the upstream regulation, protection of housing, reduction of vulnerability and the provision of prevention information. Water Management has conducted in accordance with the main strategies of **Master Plans** generated in each river basin and **Schemes** in each sub-basin of related major river basin. River and riverbeds are restored and maintained by joint efforts of riverside owners, local authorities, and the State. Measures: • prohibition of new construction of any kind and imposition of building use, • operating requirements, • implementation of general preventive and defense measures, • requiring alterations to existing buildings up to a cost ceiling of 10% of the value of the property By the '**Risks' Law of 2003,** following significant progress in flood mitigation is achieved. • Awareness of risk is developed by renewing flood forecasting, • New prevention tools; such as expansion areas, actions against soil erosion are developed, • Local communities are assisted, • Vulnerability of areas liable to flooding is reduced, and damages are repaired.	Strategy called '**dynamic coastal management**' and '**room for the river**' is implemented. The strategy aims at allowing water to occupy more space on land in order to be more resistant towards consequences of climate change, rising sea levels etc. by use of the following; • some space is set in natural areas for coastal flooding rather than just relying on fortified dunes or dikes (*inland relocation of dykes*), • the scarcity of space to serve multiple functions is eliminated by provision of wetlands (combination of nature and water on space), floating homes (combination of housing and water), floating roads, public transport over water (combination of infrastructure and water), recreation (economy and water), • the area available to accommodate river flood waters is enlarged by converting urban land-use to agricultural uses (*green rivers*), • some adjacent zones to large rivers is identified and reserved for an emergency conveyance In urban areas 10% of total area is reserved for temporary water retention during times of extreme rainfall so that surplus water would flow into these ponds, parks, permeable spaces like grass-covered roofs or separate reservoirs to alleviate the immediate threat of local flooding in urban areas (*city bypasses*).	Main Mitigation Measures, • In Spatial Planning are the declaration of flood risk areas as priority areas and as reserve areas; • In Water Management are the determination of flood areas, installation of flood action plans and of regional flood concepts; • In Risk Management are the flood forecasting, implementation of early-warning systems and development of flood hazard maps. Within the areas where flooding can be expected in every 100 years or less, planning of new settlements is prohibited. In such areas, the possibilities of recovering retention areas and of restoring rivers to their natural environment have to be used. If flooding areas are used for physical structures such as infrastructure, the retention ability is secured by compensational measures such as reforestation, erosion control or restoring rivers to nature. Within Regional Development Plans reservoirs for technical flood protection may be built as compensational measures. As their realization is accompanied by a considerable intervention into nature and landscape, safeguarding the natural retention areas is a priority.

Sources: OECD Studies 2006, MEED 2006, http://nofdp.bafg.de/servlet/is/14508/?lang=en, Woltjer and Al 2007, Fokkens 2005, Huissman 2004, Rehbach and Hinsberger 2008, Kolf 2005, Friesecke 2004, http://nofdp.bafg.de/servlet/is/13221/?lang=en

Table 5.11 (continued): International Experiences on Flood Risk Management and Urban Planning

CONTROL MECHANISMS		
'**National Disaster Mitigation Programme**' (1994) in four fields: land-use control in flood-prone areas, monitoring flood by early-warnings and population, restoring/maintaining river and riverbeds by all stakeholders. This programme was supported by the **Law of 1995**, aiming to reform the natural hazards mitigation policy including financial, technical and legal measures enabling the various services of the central government and local authorities to co-operate on comprehensive basin-wide projects. Land-use control in flood prone areas: • Avoiding the construction of dykes and bridges that reduce the river flow capacity or modifying, strengthening them to increase this capacity, • Ensuring that land use in flood-prone areas does not decrease the capacity, • Protecting already inhabited areas by avoiding new constructions, • Providing new loans to finance the mapping of areas prone to flooding in France, • Update and simplify the legal system having a single document like 'risk prevention plan' replaced all existing plans In order to achieve the objectives of '**Risks' Law of 2003** at national and river basin level knowledge and information distribution networks are established. Water information system based on data networks, data banks, data processing & information distribution software are installed at national level, while water data master plans are actively used for monitoring at river basin level.	The provinces can formulate policies about water management, environment, nature conversation, housing, physical planning, transport, economics, and welfare of their own but they must be devoted to the directives issued by the national government. Additionally, they have to ensure that the national and provincial policies are implemented by the municipalities and water boards. Under the approval of the national Government the provincial authorities define and supervise the task or water boards that are responsible for flood defense, and water quantity and quality management in their territory. Many provincial borders do not coincide with the hydrological/hydraulic borders of the water boards where the inter-provincial water boards are created. Common views about flood control, water management and water-related issues are shared in the Union of Water Boards by all water boards.	'**Nationwide Flood Reduction Policy**' and '**5 Points Action Programme**' of German federal government set the main objectives as; • To provide more space to the rivers, in other words 'to give the rivers more room' • To restrain flooding decentralized • To limit urban development and reduce damage potential To achieve such goals in flood-plains • building development outside the flood prone area is promoted as much as possible, • in such areas, development via land use control (freezing policy by prohibiting new developments and restricting modifications to existing infrastructure) is avoided or stopped, • for the developments which cannot be located elsewhere appropriate building codes or zoning ordinances are used to reduce flood damage potential, • such flood prone areas are used as parks, natural and ecological reserves. '**Development Freeze**', '**Postponement of Applications for Building Permit**', '**Right of Pre-Emption**' are the several instruments applied by local authorities within the preparation of the legally binding land use plans.

Sources: OECD Studies 2006, MEED 2006, http://nofdp.bafg.de/servlet/is/14508/?lang=en, Woltjer and Al 2007, Fokkens 2005, Huissman 2004, Rehbach and Hinsberger 2008, Kolf 2005, Friesecke 2004, http://nofdp.bafg.de/servlet/is/13221/?lang=en

5.3. CRITICAL EVALUATION OF TURKEY'S FLOOD 'PROTECTION' STRUCTURE AND POSSIBLE SOLUTIONS FOR THE IMPROVEMENT

In previous parts of this chapter flood management systems of three EU member countries, namely France, Netherlands and Germany are examined by considering the key points of flood mitigation. This examination intends to find out the common policies and strategies in each country's experience, and to derive some instructive and innovative lessons for the case of Turkey.

Adverse effects of climate change, which have become evident in recent decades, are now paid great attention and placed on the agenda of most countries. Particularly in Europe many of the rivers and river basins are shared by several countries. Recent floods occurred in 1998, 2002 and 2006 extensively affected many countries at the same time. Therefore in Europe it has become inevitable to establish a concerted and coordinated action regarding flood risk management at the level of major river basins.

Hence, most of the EU countries accept the idea that **integrated basin management** and **flood mitigation programme** are totally vital to govern and to protect urban settlements, which have (in)direct impacts on hydrology of river basin system. Such a general policy that is embraced at the international level requires also the cooperation and coordination between institutions at the national level. Flood Risk Management Directive of EU set a number of guidelines to be adopted by each member state. Until the enactment of this directive it was mostly the individual protection activities executed within national boundaries. However, in recent years interventions that are compatible with the Flood Directive are started to be implemented. For the establishment of coordinated and concerted actions defined in the directive a number of actions are accepted as the key requirements. These requirements are stated as follows.

- Flood risk maps should be prepared and implemented in order to govern urban planning activities,

- Cooperation and coordination through the development and implementation of flood risk management plans for each basin should be improved,

- Awareness should be increased and active participation of all stakeholders should be facilitated by provision of flood risk maps and plans.

5.3.1 Key Points of Flood Risk Management in Selected Countries and Implications for Turkey

The findings of the examination on case countries highlight a number of key points to be considered in flood risk management and mitigation. In the following parts these points and evaluated with reference to the current system in Turkey.

5.3.1.1. Policy Shift: From Flood Protection to 'Risk-Based' Approaches or Risk Culture'

Many examples in history proved that <u>no absolute flood control</u> is possible, and there is always '<u>residual risks</u>' to be proactively prevented, reduced and shared. After the recognition of this reality, risk-based approaches were adopted in the national territories and shared basins of some countries. According to this approach three main principles of integrated basin risk management have to be implemented effectively. These principles could be defined as follows.

- Risks should be clearly identified and classified,

- Risks should be assessed and analysed,

- Risks should be effectively mitigated (avoided, reduced, shared)

The new approach has superseded the previous one, which intends just to keep flood waters away from the possible flood-prone areas. Flood prone areas have dynamically changed over time due to the impacts of global warming and climate change on hydro-meteorological system. A more powerful risk-based flood mitigation policy is needed in order to be more resistant towards changing effects of hydro-meteorological standards.

This new policy is implemented by various new strategies adopted in some certain fields in each county. These fields are;

- The organization of administrative bodies related water management,
- The integration to spatial planning, which is one of the vital instruments to take preventive measures, and to reduce flood risks as much as possible,
- Mitigation measures and means of implementation of such measures,
- Control mechanisms that govern and supervise proper implementation of such measures.

This new approach is theoretically accepted In Turkey, especially by DSi, the major central institution concerned about flood mitigation. However no progress is achieved in practical means. The case study research on selected provinces and the examination of the current legal and administrative structure regarding flood risk management in Turkey revealed that a risk-based flood management integrated to spatial planning system still lack in Turkey. Higher dependency on structural measures is still encouraging urban settlements to develop over risky areas. Apart from this, people are unaware of the safety capacity and standards of structural measures based on several assumptions and pre-determined extremes derived from previous events. All in all, despite the policy shift and the emergence of contemporary approach in flood risk management at the international level, structural measures and conventional approach are prevailing in Turkey.

5.3.1.2. Organizational Structure Regarding Water Management

All the issues about 'water' are administered by a single related Ministry in each country. Different aspects of water management such as quality and quantity of fresh water supply, sustainable use of water resources, water pollution, preservation and treatment, flood risk management and navigation of waterways are intended to be performed by one main coordinating body. However establishment of close relations and cooperation with other ministries or other leading organizations regarding spatial planning are also observed in each country. For instance, French system is based on dialogue institutionalized at national level, and participation is a core feature of this system.

One of the common points of water management organization in each case country is that river basins are accepted as the major scale of organization and administration. The Watershed Agencies in France, Water Boards in Netherlands and Water Authorities in Germany are all similar kinds of administrative bodies organized at river basin levels. Among the hierarchical levels of organization, specifically from national to local community levels there are usually two-way relations between each level. Policies and decisions determined at national level are not dictated to the lower levels. Instead these decisions are supervised at regional, provincial and local levels in order to control the accuracy and relevance of the decision.

In French system, different than the other two cases, there is also a well-defined hierarchy (and 'dialog') of water management bodies structured on committees and commissions at various levels; such as National Water Committee, River Basin Committee, Local Water Commission and Community. However, in the other two countries Water Authorities or Boards govern basin level, regional, provincial level and local level issues and execute water related works in accordance with National/Federal State policies.

Autonomous Advisory Council or Authorities at State and National levels are also essential for their opinions and proposals in the field of natural risk prevention based on scientific researches and studies. In France, for instance, members are selected from National Assembly, Senate, Insurance Companies and Local Governments. In Germany, in a different way, the Ministries have at their disposal Advisory Authorities, namely Federal Institute of Hydrology, Federal Environmental Agency.

In Turkey a central institution namely General Directorate of State Hydraulic Works (DSİ) is assigned as responsible for water related works. In the current situation DSİ is operating under the Ministry of Environment and Forestry. This institution has Regional Directorates (RDs), which were originally organized at major river basin levels just after the foundation of DSİ. However, this organizational scheme was changed in time. Institutional jurisdictions of Regional Directorates of DSİ were reorganized and provincial borders were determined as the jurisdictions of RDs. The reason for this reorganization has been the problems of management and conflicts originated between Regional Directorates and Municipal Governments. The reorganization ended up with a lack of basin-wide administrative structure to manage particularly river flood risks.

5.3.1.3. Integration of Flood Risk Management to Spatial Planning

Based on the review of selected countries it is possible to mention that water-related issues including flood risk management seem to have highest priority among other issues at national level. Therefore, decisions concerning spatial planning and urban development are not taken in isolation from mitigation strategies at national level as well as appropriate implementations at local levels.

Hazard and Risk Maps (as indicating high, moderate and minimal risks) based on a well-designed (regularly updated) spatial database management are the fundamental means of the close relation between spatial planning and mitigation strategies. These maps are used to inform society, and to develop awareness for being prepared for early warnings. These maps are also used for preparation of Risk Prevention Plans (RPP) that include several mitigation measures considered as main determinant of actions of Spatial Planning as like in France.

The strategies and decisions of such RPPs particularly based on stream basins and sub-basins are actively taken into account at each authorization level from international relations to local community.

The policy implications differ depending on the scale of responsibilities of administrative bodies, such as National level, (Federal State), Basin Level, Regional/Subregional level, Provincial Level and Local Municipal Level.

For example, in France Central Government identifies hazards, determines the exposed areas and proposes mitigation strategies in RPPs. RPPs specify strategies regarding town plans, construction and management requirements of new and existing buildings and settlements. Similarly, for spatial planning the broad strategy is set by the national government with the so-called key planning decisions. Provinces translate these into regional plans and municipalities prepare detailed land-use plans, which decide where housing, industry, roads, canals, railway lines, and parks are located in accordance with regional plans. These regional plans are supposed to integrate policies at the different government levels and across various policy fields.

In Germany, however, Federal States have their autonomous power to set regulations about areas that are determined as high-risk flood-prone areas, areas behind the dykes in accordance with National strategies. Then provincial governments are responsible to design and establish spatial planning guidelines within their jurisdiction concerning flood management in order to comply with Federal regulations.

Nevertheless, Turkey has no such kind of integrated flood risk maps. Instead it has current ‘flood plans’ regarding river basins prepared by the Regional Directorates of DSİ and the category, called ‘flood emergency plans’ prepared by GD-DA which have different outcomes than expected. Although they are necessary and useful maps none of them is functional to govern urban plans and direct urban developments that are exposed to floods.

In the current situation in Turkey there are a number of tools; such as delineation of flood hazard areas (with respect to Q_{500} in province/sub-provinces, Q_{1000} in metropolitan areas) and engineering solutions for protection of flood prone areas. However it should be mentioned that determination of flood-prone areas of all rivers is not a common application. This task is being performed on the basis of a request coming from local governments or other related institutions. Moreover, flood-prone areas with respect to 500-year flood discharges are not determined for rivers that were subjected to reclamation works. Therefore these tools should be provided a systematic organization and should be incorporated with the processes of urban development and local government issues. Nevertheless, such an organization and incorporation have not been actually and effectively realized in Turkey.

With the emergence of rapid urbanization in 1950s flood prone areas and risky zones, especially most of the riverbeds have been occupied by unauthorized housing developments deprived of adequate infrastructure. With the provision of amnesties and public services by local governments ignoring flood hazards, many settlements in Turkey have become more vulnerable today than in the past.

Today, although current ‘flood hazard maps’ in Turkey indicate the extent of a certain flood frequency in a limited and standardized manner; they do not determine the actual flood risks. In turn, they do not guide decisions concerning new developments in relatively flood-proof sites, and develop measures to combat the impacts of the climate change. These boundaries are drawn onto the base maps prior to the preparation of development plans. It is expected that these areas indicated on these maps are to be prohibited to any development until appropriate protection facilities are constructed. Any location outside this particular hazard boundary is considered as ‘absolute safe’ against floods at any time. As previous experiences in Turkey and other countries indicate, there is always ‘a risk factor’ affected by the combination of vulnerable uses and various probabilities that may be come up due to change in hydro-meteorological assumptions.

Although new investments in Geographical Information System (GIS) technologies and supportive software for flood hazard mapping were made, DSİ still continues to follow the already adopted manual processes that aim to provide the flood hazard boundary for urban areas. Hence, without having a basin-wide flood prevention plan preparation and implementation of hazard boundary or protection facilities based on particular requests of local institutions or investors does not solve the problem. Rather it contributes to create vulnerable settlements.

5.3.1.4. Mitigation Measures and Means of Implementation

As reviewed in the second chapter flood risk management can only be achieved by an integrated implementation of structural and non-structural measures. However, such a simplified categorization of flood risk management needs to be clarified. It is now possible to make this clarification by employing the findings of the examination on case countries. To this aim, a number of measures in flood risk management observed in case countries are to be mentioned.

1) Measures on Riverbeds and River Basins:

- Flood forecasting system to monitor rainfall and river-flow regularly should be improved.
- Integrated basin-wide approach focusing simultaneously on the upstream regulation and cooperation among local authorities should be promoted.
- River and riverbeds should be restored and maintained with the participation of riverside owners, local authorities and the state.
- The construction of dykes and bridges that reduce the river-flow capacity should be avoided and/or they should be modified and strengthened in order to increase river-flow capacities.

2) Measures on Settlement Developments and Communities at Risk:

- Hazard and risk maps should be prepared to identify areas at risk and prevention and mitigation plans should be prepared, and premiums of compulsory insurance should be determined.
- Preventive information and decisions with land-use control to reduce vulnerability should be promoted and protection should be increased.
- Participation of stakeholders and consultation of the citizens should be satisfied.

3) Measures on Legislative Structure:

- Nation-Wide Flood Risk Reduction Programme should be launched, and laws aiming to reform the natural hazard risks mitigation policy should be enacted

- Guidelines, regulations and instruments that facilitate the implementation process should be established.

- Insurance system should be strengthened.

The real challenge is to implement such measures properly. There are a number of country specific examples which are explained above in detail. For instance, in Netherlands the most vital tool for implementation is the active use of flood hazard and risk maps and integrated mitigation plans at river basin level in order to control development on safer locations, proposing preventive land-use decisions such as;

- Promoting multiple (mix) use of space in terms of combination of water and other urban uses,

- Converting land to agricultural uses to enlarge area available to accommodate river flood waters,

- Reserving some adjacent zones to large rivers for emergency conveyance (‘green rivers’),

- Setting aside 10% of total urban area such as ponds, parks, or grass covered roofs for temporary water retention during extreme rainfall then the stored water would flow into soil gradually,

- ‘Bypassing channels’ when immediate threat of local flooding occurs in urban areas.

In order to decrease the absolute dependency on flood protection facilities that are not safe anymore due to the climate change, new ways to ‘allow water to occupy more space on land’, and to ‘give the rivers their space back’ are investigated in case countries. ‘Inland relocation of dykes’ in Netherlands gives the opportunity to set aside some space as natural areas particularly along the coasts.

Based on the identification of flood hazard areas and determination of risks in Germany, Regional Flood Concepts are determined and Flood Action Plans declare flood (floodplains) areas, flood risk areas and flood-prone risk areas each of which has to be mitigated with particular measures attributed. These are;

- Flood (floodplain) areas (area including riverbed and adjacent banks under the extent of a 100-year flood of more frequent) used only for river retention activities and natural plantation and 'restricted for any development' called as 'priority' areas.
- Flood risk areas (behind the structural protection like levee) used as 'reserve' areas with particular functions like nature/landscape, mining, etc.
- In some flood-prone risk areas the notation 'public concern' is used to show the vitality of flood protection than any other projects.

Turkey, on the other hand, has still higher dependency on structural measures. Residential developments on flood-prone areas and riverbeds occupied by unauthorized houses require flood protection (reclamation) facilities. However, most of the consecutive flood disasters proved that solely reliance on these structural measures could backfire. Today structural measures are encouraging urban developments on nearby areas that always inhibit some risks of breach or collapse. Besides, unawareness of the society about safety capacity and standards of structural measures contribute this problem.

There are some non-structural measures proposed by DSI; such as delineation of flood hazard boundaries (Q500/Q1000) for development plan preparation requests, forestation and erosion protection and the notation as 'restricted for settlements until designed flood protection facility constructed'. However, such measures are incremental and not based on any systematic guidelines. Hence, most of the riverine cities of Turkey mainly depend on flood protection activities based on solely structural measures. When compared to those of case countries Turkish cities are suffering from the lack of comprehensive mitigation plans based on flood risk maps considering basin-wide hydro-meteorological, physical and social features.

5.3.1.5. Control Mechanisms

Integrated flood management or mitigation programmes in all case countries were initiated by specific laws on flood risk mitigation or reduction in order to govern the related sectors under one main comprehensive policy. Nation-wide mechanisms and policies on flood risk management are fundamental to create great impetus on all sectors and all communities in a country. Besides, these mechanisms and policies are also functional to achieve the following fundamental objectives.

- To provide more space to rivers by maintaining and/or restoring river and riverbeds by all stakeholders,
- To restrain flooding decentralized,
- To limit urban development and to reduce damage potential via land-use control particularly in flood-prone areas and early-warning systems,
- To share the risk burden via appropriate insurance system.

To achieve the above-mentioned goals several control instruments are being used. Following are the ones currently used in Germany.

- Land-use control instruments promoting building construction outside flood-prone areas.
- Land-use control instruments avoiding developments in flood-prone areas, such as ‘<u>development freeze zones</u>’, ‘the right to <u>postponement of applications for building permit</u>’, etc.
- Land-use codes or zoning ordinances used to reduce damage potential of developments which cannot be located elsewhere.

According to the Federal Flood Protection Law of Germany “each person affected by a flood is obliged to take necessary precautions in order to protect his/her property and to reduce possible losses” since 2005. In France, for example, on high risk areas the prohibition of new construction of any kind and imposition of building use are embraced as means of implementation.

Hence, such control mechanisms are supervised by well-defined and well-coordinated hierarchical administrative bodies. Proposals at municipal level are supervised, approved and controlled by the provincial level before and after the implementation processes.

The situation is quite adverse in Turkey. Despite the structural measures taken for years most of the riverine cities in Turkey are still highly vulnerable to flood hazards. The lack of an effective control and supervision mechanisms among the related institutions and their activities contribute to the prevailing vulnerabilities. As there is not a comprehensive and an integrated basin management approach implementations realized by a municipality mostly affect and increase the vulnerability of another municipality in a shared stream basin. Besides, one-way relationship between DSI and local governments create some problems as well. Implementation processes of protection facilities based on DSI permission at local levels are not monitored and supervised.

Moreover flood management issues in Turkey are governed by the Flood Protection Law enacted in 1943. The most recent document in use is the Circular (2006) declared by the Prime Ministry, which is about the restrictions on uncontrolled intervention in rivers, riverbeds and flood protection facilities by individuals and municipal governments. Therefore the old legislation in Turkey is not effective and functional to deal with the contemporary problems. Besides, it does not include contemporary control mechanisms and supervision tools, etc.

5.3.2 Prospects and Policy Implications for Turkish Case

Based on the findings of the examination on case countries several proposals and policy implications could be derived to restructure the legislative and administrative aspects of flood risk management in Turkey.

First of all, it is now clear that the current process of hazard boundary delineation process needs to be improved immediately. Hazard boundaries require to be identified for various flood probabilities rather than one probable hazard boundary. This would be functional to reveal almost all possibilities based on the river basin investigation. Besides, contemporary technologies, such as satellite mapping, GPS and GIS systems, etc should be used to determine the flood hazard boundaries, and the current land-uses and land assets in flood-prone areas.

After determination of the risk zones along a river basin, risk maps, which cover various degrees of probabilities and vulnerabilities, could be used for defining several mitigation measures. Such a spectrum of risks helps professionals and decision-makers to define different alternative planning decisions rather than solely prohibiting the flood hazard area for any sort of urban use. In other words, risk maps are effective tools to protect existing settlements, to direct new developments onto the safer locations and to implement various mitigation measures. Risk maps also create awareness about the vulnerable locations and help local population to choose the most suitable locations. However, in some cases identification of hazards and delineation of risk zones end up with the transfer of existing properties within a risky area. Such an intervention requires the existence of the necessary and appropriate urban planning instruments. Different examples of such instruments are available and in effect in spatial planning processes of the case country examples.

Nevertheless, such an approach equipped with the necessary instruments lacks in the Turkish case. Current mitigation strategies and urban planning tools are not only sufficient to manage flood issue in existing built-up areas in Turkey. Batman is a good example of this situation. In Batman, DSİ and GD-DA have prepared a collective project to transfer a number of houses that are located over the areas frequently flooded. Today, although some of the property owners were convinced to move into their new houses constructed by Housing Development Administration, the flood-prone area is still occupied by many houses and the expropriation process has not yet completed.

For this reason, DSİ proposes and prefers to implement structural measures and protection facilities that are costly but easy to manage. However such structural measures including improvements on river embankments and channels to keep water away from the inhabitants have been insufficient to mitigate the flood risk in Turkey. Moreover, it is observed that these sort of structural improvements and investments encourage people to settle on the nearby hazard areas, which are considered to be safer.

Determination of risk zones also provides a number of options, which could solve the problem within the built-up areas. For example, an option that proposes upper basin forestation and terraces with the combination of detention ponds can be preferred since it would reduce the need for construction of protection facilities on lower basin areas. Another option could be the review of the current uses of the areas frequently flooded. Relocation options could seriously be considered and instruments to make this option possible should be provided.

Such a study, which considers an array of policies and land-use options, was prepared for Bartın Basin by the author of this thesis based on the consents of DSİ and METU (Appendix J). In this project study more than one flood hazard and risk areas are determined according to the basin-wide hydro-meteorological data considering the terminology of European Atlas of Flood Risk Maps. The mitigation plan decisions are theoretically proposed in order to show alternative combinations of structural and non-structural measures. However, this project basically aims to show the minimum requirements for the preparation of GIS-based flood risk maps and its extensive use in mitigation plans (Figure 5.18). One further step could be the simulation of the alternative scenarios and the implementation process of mitigation decisions that are negotiated by all stakeholders.

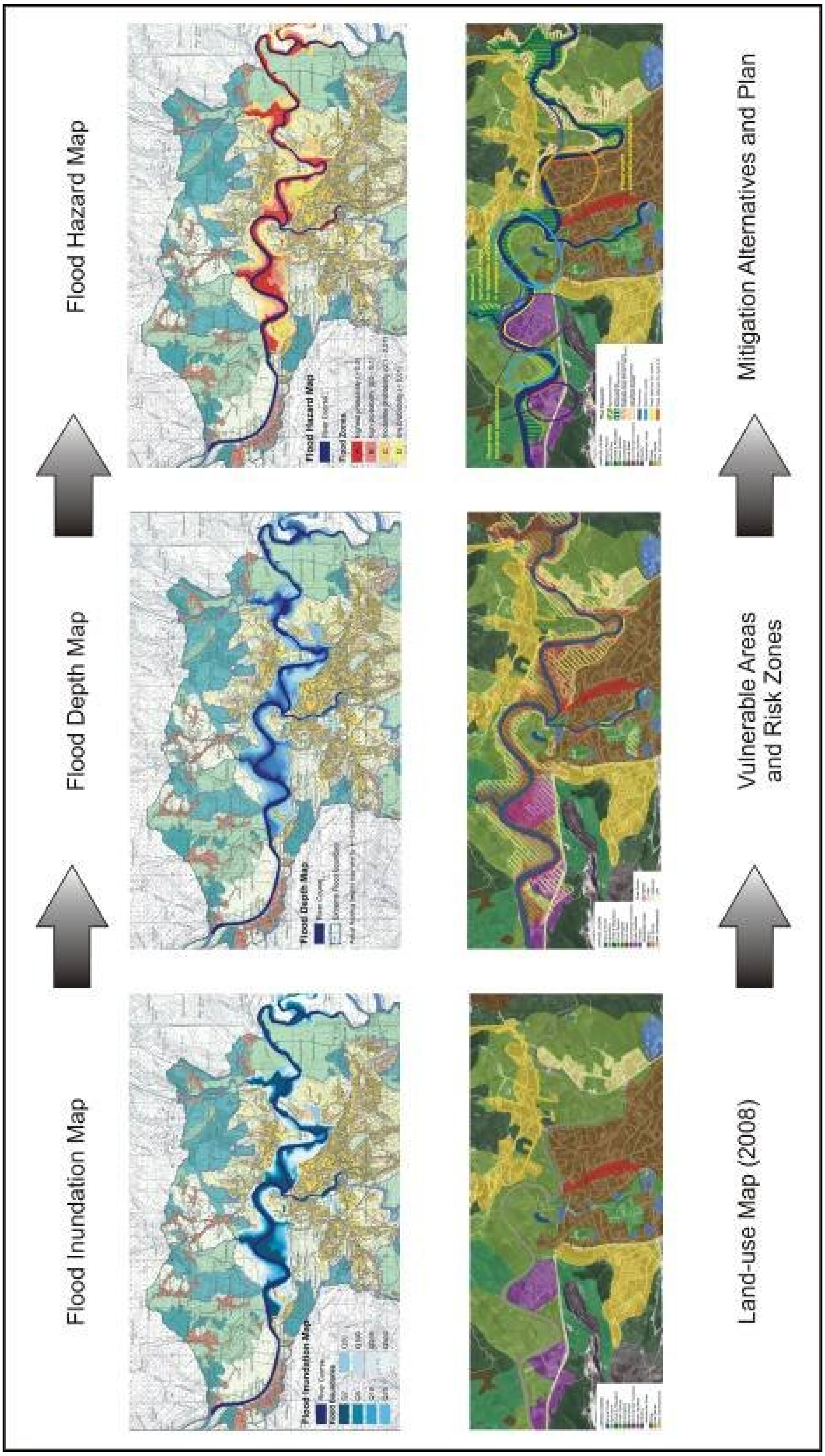

Figure 5.26: Flood Hazard, Vulnerability, Risk Maps and Mitigation Plan
(Outputs of the Project supported by Provention Consortium)

The real challenge in Turkey is how to implement comprehensive basin-wide flood measures with the active participation of all stakeholders. Although flood prone areas of stream basins are considered in the preparation of development plans, in actual situations these areas and even riverbeds are not only occupied by unauthorized developments but also used for some urban services like streets, public buildings etc. Tendencies of developing unauthorized low cost housing on public land, lack of public awareness and even ignorance of public officials, absence of regulations, pressures from local interest groups etc. all contribute to the problem.

Only the measures provided by DSİ are not sufficient and effective to reduce flood risks in urban areas in Turkey. On the contrary, such measures encourage investments and developments in the vicinity of flood-prone areas based on the trust in DSİ measures. This however creates irreversible outcomes and increases the vulnerability and risks in the area.

Hence, the 'comprehensive risk mitigation' approach adopted by most of the developed countries ought to be emphasized in reduction of all disasters in Turkey. Therefore, it is urgent to establish an effective nation-wide flood management strategy in Turkey by a new 'Flood Mitigation Law'. For this purpose, the current administrative and legal framework should be improved to achieve the three specific results. These results and their details are discussed in the following section.

- **Tasks and responsibilities of each stakeholder should clearly be defined.**

  Stakeholders of a flood management system are usually the central governmental institutions, their local representatives like regional and provincial directorates, local governments, NGOs, Professional Chambers and local communities. Coordination and cooperation of these stakeholders are necessary to assess and analyze the risks, and to mitigate them effectively.

  It seems rational and functional to start with the reorganization of central government institutions responsible for hydro-meteorological issues. These institutions have extensive knowledge, broad capacity, established infrastructure, qualified staff and budget, which should be used to strengthen the ability of flood risk identification, assessment and analysis. For instance, as the leading institution for producing flood hazard and risk maps DSİ should be streamlined (as shown in Figure 5.19). In this respect, DSİ requires a restructuring. First of all, the related division that has already initiated TEFER project should get the highest share in institutional budget in order to execute the works about flood risk identification, assessment and analysis. Furthermore, there is a need for a R&D Department under DSİ. This department should specialize on the (re)production of flood risk maps considering the effects of climate change. Data-base and GIS software set-up, training of personnel about active and extensive use of the software, digitizing previous data from archive files, regular updates about impacts of actual flood events are main steps to be established and completed. As a result, production and publication of flood hazard and risk maps for each river basin appear to an appropriate step for preparation development plans and implementing mitigation measures.

The relationships between DSİ and other Central Institutions such as DMİ (General Directorate of Turkish State Meteorological Service) and EİE (General Directorate of Electrical Power Resources Survey and Development Administration) should be re-organized as well. Both institutions together with DSİ should establish and share the same centralized database, particularly about meteorology, river discharges, river basin hydrology, riverbed profiles etc. this database has to be regularly monitored and updated.

As mentioned before, the lack of a river basin level administration in Turkey is a vital issue in the flood risk management. Therefore, the foundation of 'basin-wide commissions', which meet regularly, is crucial to review local and basin-wide activities and their effects, and to cooperate in the implementation of protective measures by each local authority sharing a common river basin. Stakeholders apart from the central institutions should be represented in these commissions. In Figure 5.19 a proposal on the position of these commissions with respect to other institutions and urban planning system is indicated.

On the other hand, it is necessary for local governments (mainly municipalities) to develop an understanding to integrate flood risk maps with urban development plans. The employment of technical experts, who are specialized in flood management such as hydraulic, agricultural, forest engineers and planners, are critical to this aim. It is also necessary to keep up the regular training activities for these staff. However, it is also fundamental to prepare and publish ‘guidelines’ for the land-use decision options regarding various flood risk levels. These guidelines should also define building codes at plot level and development codes for existing and proposed settlements.

- **Flood mitigation measures should be considered in a participatory manner.**

All settlements sharing a river basin should be governed as a whole within a concerted and cooperatively prepared and negotiated flood mitigation plan as shown in Figure 5.19. Individual and separate implementations in the different locations of a basin should be avoided.

Participation is vital for the protection and survival of the basin and its inhabitants including nature, human environments and man-made structures in a hydro-meteorological system to sustain. Participation is also instrumental in increasing public awareness, which is necessary to mitigate flood risks.

- **Implementations should be carried out according to the effective supervision system.**

As proposed in Figure 5.19 flood risk maps are necessary tools for flood risk mitigation and management. However these maps have to be used in spatial planning and urban development processes appropriately. For this reason, an organization is needed at the local level. In this respect, river basin commissions could play essential roles in the preparation and implementation of flood risk mitigation plans and decisions by using urban development plans. Local governments particularly municipalities should be given a critical position as well in this process. They should prepare and implement the basin-wide flood risk mitigation plans and decisions in close cooperation with DSİ and their Regional Directorates

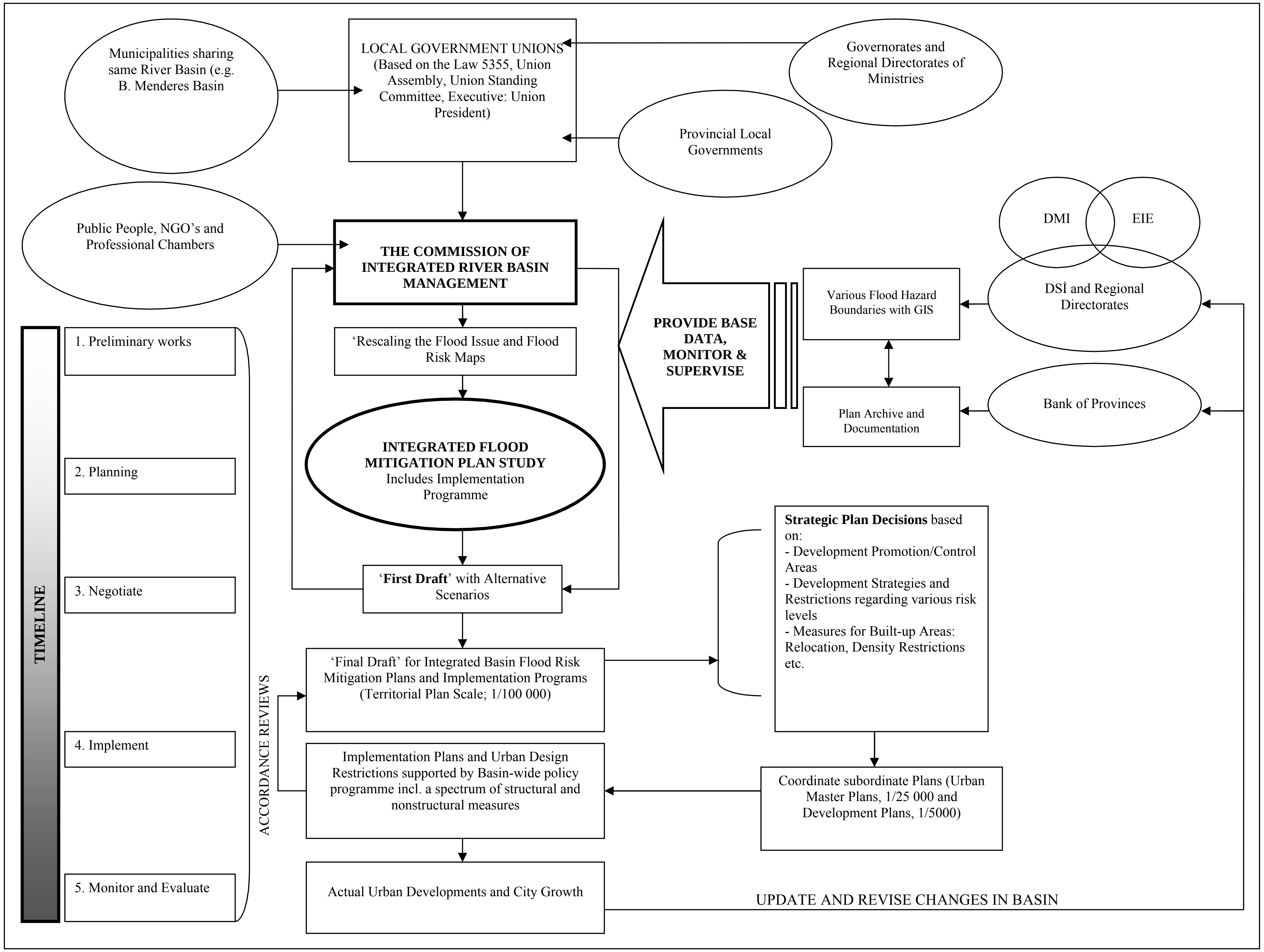

Figure 5.27: Proposal on River Basin Organization Regarding Flood Risks

CHAPTER 6

PROSPECTS FOR THE PLANNING OF FLOOD RISK MANAGEMENT

In this chapter, after a summary of findings the viability of improvements in the Turkish system is explored taking into consideration the international experience. Recommendations and avenues for further studies are given at the end of the chapter.

6.1. SUMMARY AND FINDINGS OF THE RESEARCH

Despite a number of protective efforts; such as dams, reservoirs and other protection structures are accomplished since the establishment of a central administration of hydraulic works (SHW) in 1954, flood losses in Turkey are in the increase today.

Instead of considering the management of flood risks at the overall basin level, only short-term palliative solutions are achieved by the application of discrete engineering measures. These measures not only fail to mitigate flood risks but also promote hazardous way of settling. This in turn, brings in more severe flood losses in the urban areas. Four riverine settlements as case study areas are examined to this claim. Hence, the intention of the thesis is to probe into new methods in urban planning effective to mitigate river flood risks and to prevent human and property losses in urban areas.

In the **second chapter** common policy changes and contemporary tendencies towards political restructuring at the international level in order to resist the destructive outcomes of recent global disasters as impacts of global climate change are intended to be emphasized. Besides, an introduction of the principles and the general framework of flood risk management by referring to the contemporary literature, and to the factors causing floods and flood losses are made. To these aims, main determinants of destructive flood events are examined by investigating the basic mechanisms of river flood events and inundations with reference to the contemporary literature. Since all the variables of a hydro-meteorological system such as climate, geomorphology and land-use interact with each other, ‘an integrated basin risk management system’ is accepted as vital to combat flood disasters. Hence, based on the prevailing discussions about flood risks in the current world literature and practices reduction of river flood risks by basin-wide mitigation strategies is highlighted.

The aim of the **third chapter** is to identify the current flood profile in Turkey by considering the flood losses on basin and urban levels, and the vulnerabilities originating from the physical and geomorphologic conditions and from the urban experience in Turkey. In the first part of this chapter the adverse impacts of the rapid urbanization process is reviewed, while a general picture of flood vulnerabilities is drawn in the second part. The conclusions of each part are provided below.

- The experience of urbanization after 1950’s in Turkey ended up with uncontrolled development in vulnerable areas of settlements, which were already established on unsuitable locations historically.

- Based on long-term statistics concerning flood events and losses recorded by DSİ and AİGM a number of basins and provinces of Turkey are identified as vulnerable. For instance, Basins in Black Sea Region have unique geomorphology and precipitation intensity. Settlements located in these basins are frequently exposed to floods with the highest number of people killed according to DSİ records. On the other hand, according to records of AİGM, the highest number of flood victims (killed/injured/affected) is observed in Yeşilırmak, Kızılırmak, Fırat and Dicle Basins since 1955. Hatay, Trabzon, Bartın and İzmir emerge as the provinces that are exposed to the most frequent flood events.

Based on these findings, four provinces, which have experienced heavy and continual flood losses, are selected as case study areas. Population sizes of the settlements and discharge rates of main rivers in each basin are also considered as factors in determining the case study areas. Provinces selected as case study areas are <u>Bartın from West-Black Sea Basin</u>, <u>Aydın from Büyük Menderes Basin</u>, <u>Batman from Tigris (Dicle) Basin</u> and <u>Hatay from Asi Basin</u>. By selecting provinces from different basins, impacts of similar external factors such as climate and geomorphologic conditions are intended to be eliminated.

Fourth chapter includes the survey on four case provinces. By examining the measures applied and the planned or unplanned human interventions independent from these measures in each case, it was intended to identify the major causes of chronic flood damages. Findings of the case-study research lead us to classify these problems in two broad categories, namely problems at basin level and problems at urban level.

There is a lack of monitoring, control and coordination at the **basin level**. Local ad-hoc interventions may temporarily solve the flood problem at a specific location. However, this leads to the transfer of flood problem to another location. Any change in land-use or in the course of river generally has basin-wide impacts depending on the hydrological cycle.

At the **urban level,** many examples of implementations and developments that have caused greater losses of river floods and inundations are observed. Tolerant land-use decisions and loose development controls have created substantial vulnerabilities in urban areas. A list of these interventions is given below.

a. Capacities of infrastructure systems in urban areas are decreased, and become inefficient due to the decisions of density rise in built-up areas,

b. Permeable surfaces (forests, parks, green areas, valleys, recreation areas) are engulfed by expanding hard surfaces (concrete spaces, pavements, buildings),

c. Riverbeds, flood-prone lands and valley bottoms are not only occupied by unauthorized developments but also by some public facilities and services like streets, public buildings closing river tops. Also flow discharges of rivers are decreased by a number of inaccurate interventions (discharging direct sewage/rainwater system, damping solid-wastes and debris, and insufficient cleaning and maintenance services),

d. There are infrastructural deficiencies caused by inaccurate and discrete engineering interventions such as inaccurate design of transport bridges and concrete channel construction.

Furthermore, an analysis aimed at defining the inventory of vulnerabilities in two of the case provinces is made in **Chapter 4**. With the vulnerability analysis it is intended to determine, and to assess the probable volumes of losses together with their values within the flood-prone areas. Besides, the likely losses are compared with the costs of measures applied to curb flood risks. In Bartın it is calculated that current vulnerabilities in value terms are 5 times bigger than the structural investments made to mitigate flood risks. Besides, it is observed that 30% of the population in Bartın is living in residences vulnerable to flood hazards. Similar figures are obtained in the vulnerability analysis of Batman. 26% of the population in Batman is calculated as either living or working in a property vulnerable to flood hazard. Value of current vulnerabilities in Batman appears to be 3 times more than the value of previous structural investments.

Based on the findings of the vulnerability analysis it seems appropriate to conclude that the rational decision and strategy in riverine cities is to avoid urban developments on flood-prone areas. Once development is not controlled or permitted on such areas the volume of potential losses goes beyond the structural investments, which only bring some partial and temporary solutions rather than effective mitigation. Therefore, in case of a flood event there is the risk of loosing substantial amount of resources including the money spent on both existing urban developments and structural measures.

Almost all of the riverine cities in Turkey are suffering from the problems discussed above. Hence the reasons of the continual increase of flood problem in spite of the protective measures deserve further attention. For this reason, legal and administrative framework regarding flood management and urban development in Turkey are examined in **Chapter 5**. Besides, current approaches are examined in a sample of international cases. It is intended to derive some proposals and prospects for the improvement of flood management and urban planning systems to mitigate river flood risks in Turkey.

Based on the findings of **Chapter 5**, major inadequacies and problems that create conflicts and disputes among institutions operating in the fields of urban planning and 'flood protection approach' are highlighted. A list of these problems and inadequacies are given below.

<u>Problems Regarding the Delineation of Flood Hazard Boundaries and the Use of 'Flood Plans'</u>

1- In Turkey the main approach in flood issue is '<u>flood protection</u>', instead of '<u>flood risk management</u>'. In this respect, one of the major protection measures is the **delineation of the flood hazard boundaries** denoting 'restricted zones for settlements'. Another protection measure is the construction of some facilities to protect flood hazard zones. However, upper basin measures such as erosion control, terracing and reforestation, which are usually effective to decrease flood risks at the source, are not properly implemented in Turkey.

2- Current '**flood hazard maps**' that indicate the extent of a certain flood frequency in a limited and standardized manner, do not determine the actual and updated flood risks. They are deprived of the contribution of the risk concepts. Potential risks that could be occurred with respect to the various floods frequencies are be determined by these maps. Thus investments and developments in the areas that might have prone to floods with other frequencies are promoted.

3- There is a distinct sort of planning in Turkey, namely **'Flood Plans'**. These plans reveal a different content when compared to the international examples and the examples discussed in the literature. Flood Plans in Turkey are not equipped with necessary measures to reduce the risks prior to flood events, and instruments to determine land use decisions. Risk Zoning Maps identifying risks at different levels would be effective to provide the 'Flood

Plans' such contents. However development of these maps have not been realized and institutionalized yet.

Problems Regarding the Administrative Boundaries and Responsibilities

1- In the current situation, major river basins are not governed by any administrative authority in Turkey. In other words, river basin level is not organized as a special administrative level. **Regional Directorates of DSİ,** which were organized at river basin levels before, are today operating within provincial borders.

2- There is no regular and comprehensive programme to prepare flood hazard maps for each major river basin in Turkey. This responsibility of delineating borders of flood-prone areas by DSİ is set in, when there is an official request from local governments for their development plans or any other institution. It is also set in when any settlement unit is actually inundated by floods.

6.2. PROSPECTS FOR FLOOD RISK MITIGATION IN TURKEY

As the impacts and scope of global climate change are in the increase a nation-wide flood management campaign/programme could be launched. In this effort, a number of regional meetings by regional directorates of DSİ in Turkey could announce the impacts of climate change and possible flood losses. At the same time, it is urgent to improve the administrative and legal framework where the tasks and responsibilities of each stakeholder regarding flood issue are clearly defined and where flood risk mitigation planning and measures are considered in a participatory manner and implementations carried out in accordance with an effective supervision system. However, it is a challenging task to establish such an effective system, it requires, first of all, a general policy shift from flood protection to flood risk reduction (mitigation).

Hence, it is necessary to make a number of proposals regarding organization, legislation, and planning in accordance with the legislative structure of Turkey.

6.2.1 Administrative and Organizational Prospects and Proposals

According to the findings of this research, mitigating flood risks requires a basin-wide cooperation that governs ‘planning-monitoring-supervising’ activities. The stakeholders of this cooperation are local governments, governorates, regional directorates of central government institutions, NGOs, professional chambers and local people sharing a common river basin.

Although, there are ‘unions’ of municipalities regarding environmental protection in particular basins, they are not widely adopted by all municipalities. Such potential needs to be re-structured to promote the flood risk mitigation approach. Based on such administration structured on major river basins of Turkey, basin-wide commissions; probably called ‘**The commission of integrated river basin management**’ could be organized by all stakeholders (Figure 6.1).

As the leading central government institution for producing flood hazard maps DSİ, could be restructured. Having a broad capacity, knowledge, qualified staff and adequate budget, R&D department under the DSİ could produce the flood risk maps taking into consideration the effects of climate change. The Regional Directorates of SHW could be empowered as a steering body to monitor and supervise activities in major river basins. Besides, this body could regularly update the hazard maps. These maps could be published in order to share this information with local authorities, other stakeholders, and citizens in general.

This could be accompanied by revised maps of flood area for settlements to be prepared and delivered to related municipalities. Based on such hazard probability information, municipalities could then identify and declare the values at stake. This risk information could be locally announced and submitted to the Ministry of Public Works and Settlement. This could entitle the municipality involved for specific but partial financial support. Measures to reduce risks and revised plans could then be approved by the Ministry.

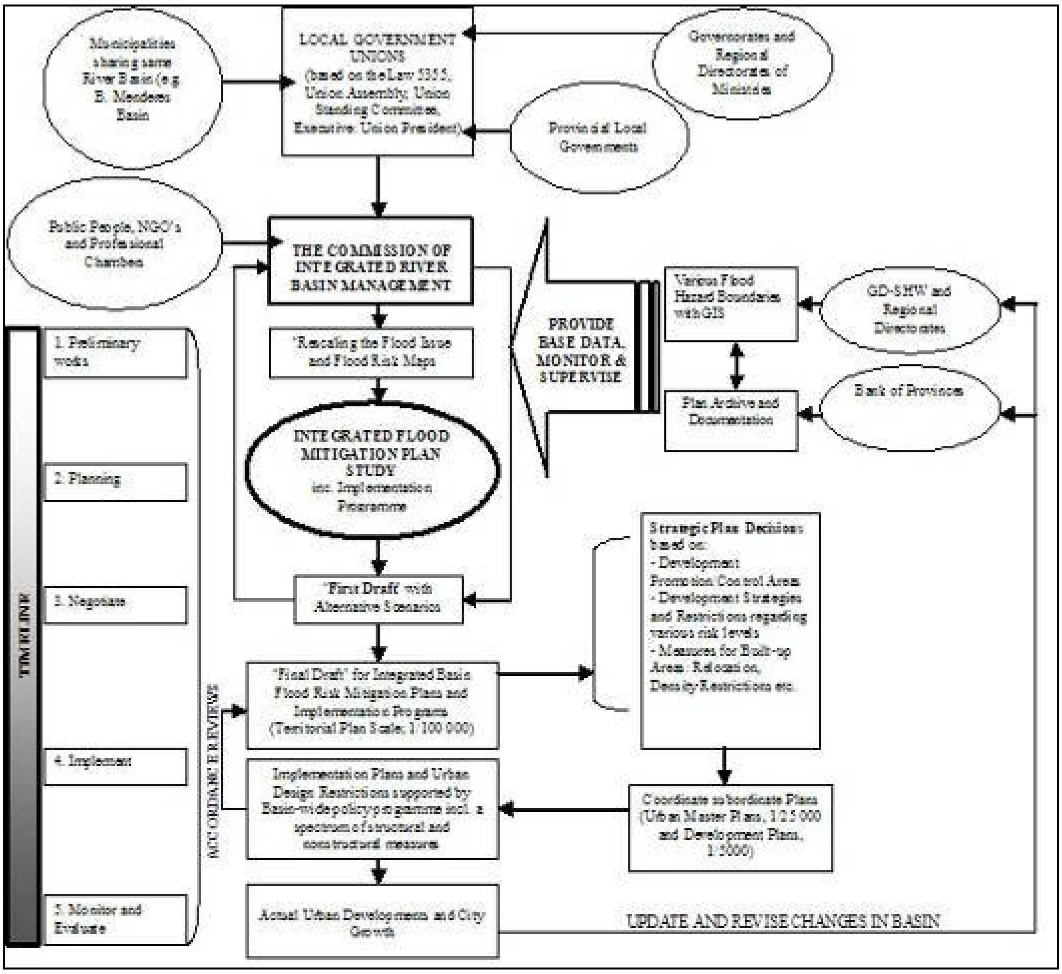

Figure 6.1: Proposal for River Basin Organization Regarding Integrated River Basin Management

On the other hand, at the local government level, integration of flood risk maps with urban development plans is necessary. The lack of professionals and technical experts specialized in flood management such as hydraulic, agricultural, forest engineers and planners is a major problem. Local governments should be supported to employ the necessary technical staff. Moreover it is also necessary to keep up regular training activities for the staff. These activities could be facilitated by Professional Chambers.

Most of the flood losses in Turkey are due to ignorance and indifference to vulnerabilities and to the magnitude of hazards. It is therefore necessary to raise public awareness on flood risks and mitigation measures. The proposed commission could operate in such a way to increase awareness. The commission could share main strategies and proposals collectively agreed in regular meetings with the public and related interest groups.

6.2.2 Legal Prospects and Proposals

Current laws and regulations are limited, outdated and dysfunctional to manage implementations about the identification, use of flood-prone areas, riverbeds, valleys as well as flood protection measures in Turkey. The Protection Law from River Floods and Inundations (dated 1943) needs to be renewed and prepared according to current needs. However, for the last 66 years only two Circulars were enacted (in 1994 and 2006) regarding the protection of rivers from adverse interventions of municipalities and unauthorized establishments. Hence, the system of legal provisions need to be redesigned to meet contemporary needs that prevails at both national and international levels.

To this aim, the first step could be the development of a law on the preparation of flood hazard maps and integrated basin flood risk maps. Initially, this law can be prepared on a pilot basin; for example West Black Sea Basin, to observe the consequences of the implementation. The results of ‘Flood Atlas’, which is one of the EU research projects made to identify flood-prone areas, and to determine potential damages in EU Countries, can be inspiring for the development of this legal provision.

6.2.3 Prospects and Proposals Concerning Planning

Since the monitoring and controlling of all natural events and human-induced activities that occur in any river basin ought to be considered as a whole in relation to its hydro-meteorological character, it is expected that major river basins of Turkey, can probably be monitored and controlled by Territorial Plan decisions approved by the Ministry of the Environment and Forestry.

The purpose of Territorial Plans (1/100.000 scale) is to maintain ‘sustainable development’ in the confines of the planning area. In order to achieve this goal, all sectoral developments, as well as urban and rural development ought to be assessed, and ‘conservation-use balance’ ought to be determined. Once the Territorial Plans (TPs) are prepared, they ought to provide the basis in the planning area for sub-ordinate plans, such as Urban Master Plans (1/25’000 scale) and Development Plans (1/5000 scale) determined by strategic decisions and land-use decisions.

However, it can be claimed that Territorial Plans investigated in the context of selected cases with their current uses do not have provisions to monitor the related activities impacting water management and flood disasters. The confines of the planning area are particularly based on NUTS Regions defined by the State Planning Organization.

Therefore, TPs ought to have strategic decisions and programs to organize activities of mitigating flood risks. During the preparation phase of TPs all stakeholders could be informed and contributions on draft plans requested. Alternative plans could be negotiated before finalizing the TP that also appoints the organizations and cooperations of responsible institutions and related tasks and responsibilities for the preparation of sub-ordinate plans; such as 1/25000 Urban Master Plans, 1/5000 Development Plans and 1/1000 Implementation Plans.

Flood hazard boundaries identified on 1/25000 and 1/5000 scales are used as base maps before urban development planning for each settlement. Although flood hazard areas of stream basins are included in the preparation of development plans, in actual situations such areas and even riverbeds are not only occupied by unauthorized developments but also used for urban services like streets, public buildings etc. Tendencies of developing unauthorized low cost housing on public land, lack of public awareness and even ignorance of public officials, absence of regulations, pressures from local interest groups etc. all contribute to this problem.

Hence, implementations ought to be monitored in accordance with basin and sub-basin mitigation strategies proposed in TPs and Urban Master Plans. This monitoring activity may be realized by supportive committee assigned by The Commission of integrated river basin management.

Implementations on areas already settled and planned for development require different policies and policy instruments based on flood risk zones.

1- New development areas may be determined according to safe locations based on the risk zones.

2- Agricultural areas, wetlands, natural flora on lower plains adjacent to riverbanks should be preserved, protected from new developments to make room for flood waters.

3- Existing residential sites, on the other hand, are under moderate and low risk. These could not be protected only by river reclamation activities and flood defenses with high costs. Upstream investments such as emergency flood-ways, forestation of slopes and retention ponds significantly may contribute to their protection. For built-up areas located on high flood risk zones, relocation decisions to lower risk areas can consider other instruments like transfer of development rights rather than simple 'expropriation'.

4- The highest risk (frequently flooded) zones ought to be declared as 'zones prohibited for development' and for any vulnerable land-use. On the other hand, these areas can actively be used for recreational activities; such as parks, outdoor sport fields, open public spaces, cycle tracks and pedestrian paths.

6.3. RECOMMENDATIONS FOR FURTHER STUDIES

This thesis admits that current process of hazard boundary delineation needs to be improved. Hazard boundaries could be identified for various flood probabilities rather than one probable hazard boundary, in order to reveal levels of possibilities. With the use of available technologies, such as satellite mapping, GPS systems, etc. the current uses and land assets can be used to determine vulnerable areas as well. Therefore, risk zones can be determined in detail. Risk maps that cover various degrees of probabilities and vulnerabilities could be used for several mitigation measures before taking any action, rather than using current hazard maps. In order to protect existing settlement, to direct new developments to the safer locations and to implement various mitigation measures, the risk maps help both decision-makers and potentially affected population while creating awareness about the vulnerable locations and choosing the most suitable decisions.

Establishment of effective Early Warning Systems and Insurance Programmes based on risk maps are topics that need further research in Turkey. After the 1998 floods, Emergency Flood and Earthquake Recovery Project (TEFER) for the Western Black Sea Region was launched to establish and modernize systems for monitoring, predicting, warning and responding to river floods. However it is not yet in fully operation. Similar basin-wide projects for other regions can be based on the experience and know-how acquired here.

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Afflux (Kabarma): Rise in water level immediately upstream of, and due to, an obstruction.

Backwater Effect: The rise in water surface elevation caused by some obstruction such as a narrow bridge opening, buildings or fill material that limits the area through which the water must flow. Also referred to as 'heading up'.

Base Flood: A term used in the National Flood Insurance Program in U.S. to indicate the minimum size flood to be used by a community as a basis for its floodplain management regulations; presently required by regulation to be that flood which has a on-percent chance of being equaled of exceeded in any given year. Also known as a 100-year flood or one-percent chance flood.

Bend (*Kurp*)*:* Change in the direction of a stream.

100-year storm: The storm that brings the precipitation projected for once in a 100-year period is often referred to as a '100-year storm'. This is a statement of the *probability* that a storm will occur which brings at least as much as the predicted precipitation once during that period; it does not mean that it predicted to occur regularly every 100 years. There may be two '100-year storms' within a 5-year period, or no '100-year storms' for 200 years, but the probability is that there will be one such storm on the average of once every 100 years.

Base flood elevation (BFE): The elevation for which there is a one-percent chance in any given year that generally based on statistical analysis of stream flow records for the watershed and rainfall and runoff characteristics in the general region of the watershed, and application of hydraulic backwater models. (a 100-year flood is used for BFE in U.S.)

Basin: The total area from which surface runoff is carried away by a drainage system. Other comparable terms are 'drainage area', 'catchments area' and 'watershed'.

Brook: A stream smaller than a *creek.*

Channel: A natural or artificial watercourse with definite bed and banks to confine and conduct flowing water.

Channel flow: The flow of runoff waters through an open channel (contrast with *sheet flow*).

Coefficient of runoff: Percentage of gross rainfall which appears as runoff.

Creek: A small to medium sized natural stream.

Design flood: Commonly used to mean the magnitude of flood used for design and operation of flood control structures or other protective measures. It is sometimes used to denote the magnitude of flood used in floodplain regulations.

Design storm: A particular storm that contributes runoff which the drainage facilities were designed to handle. This storm is selected for design on the basis of its probable recurrence (i.e. a 50-year design storm would be a storm for which its maximum runoff would occur on the average of once every 50 years).

Designated floodway: The channel of a stream and that portion of the adjoining floodplain designated by a regulatory agency to be kept free of further development to provide for unobstructed passage of flood flows.

Detention pond: a low lying area that is designed to temporarily hold a set amount of water while slowly draining to another location. They are more or less around for flood control when large amounts of rain could cause flash flooding if not dealt with properly.

Drainage basin (frequently known in the U.S. as *watershed):* that proportion of the earth's surface from which precipitation drains to an identified body of water such as a stream, river, lake, or ocean; its boundaries are defined by *drainage divides.*

Encroachment: Any physical object placed in a floodplain that hinders the passage of water of otherwise affects flood flows, e.g. landfills, buildings.

Erosion: The wearing away of a surface by some external force (water, wind, ice, or geological agents). In the case of drainage terminology, this term generally refers to the wearing away of the earth's surface by flowing water.

Evaporation:

Exceedence probability: The probability P that a certain value h (e.g. discharge, precipitation depth, wind speed) will be exceeded in a given period of time. (example: a hundred-year event has an exceedence probability of 1% in each year)

Flash flood: A flood that reaches its peak flow in a short length of time (hours or minutes) after the storm or other event causing it. Often characterized by high velocity flows.

Flood or flooding: Temporary inundation of normally dry land areas from the overflow of inland or tidal waters, or from the unusual and rapid accumulation or runoff of surface waters from any source. The rise in water may be caused by excessive rainfall, snowmelt, natural stream blockages, wind storms over a lake or any combination or such conditions.

Flood control: Keeping flood waters away from specific developments or populated areas by the construction of flood storage reservoirs, channel alterations, dikes and levees, bypass channels, or other engineering works.

Flood crest: The maximum stage or elevation reached or expected to be reached by the waters of a specific flood at a given location.

Flood duration: The length of time a stream is above flood stage or overflowing its banks.

Flood fringe: The portion of the floodplain outside of the floodway but still subject to flooding.

Flood plain: A strip of land adjacent to a river or channel which has a history of being inundated by flood waters.

Floodway: The channel of a watercourse and those portions of the adjoining floodplain required to provide for the passage of the selected flood with an insignificant increase in the flood levels above that of natural conditions.

Hyraulics: Branch of fluid mechanics dealing with the flow of water (or other liquids) in conduits and open channels.

Hydrograph: A graph that charts the passage of water as a function of time. It shows flood stages, depicted in feet above mean sea level or gage height, plotted against stated time intervals.

Hydrology: The science dealing with the occurrence and movement of water upon and beneath the land areas of the earth. It overlaps and includes portions of other sciences such as meteorology and geology.

Infiltration: The flow of fluid into a substance through pores or small openings. To denote the flow of water into the soil.

Inundation: the rising of a body of water and its overflowing onto normally dry land; "plains fertilized by annual inundations"

Levee: (syn. bund; dike; embankment; stop bank) Water-retaining earthwork used to confine streamflow within a specified area along the stream or to prevent flooding due to waves or tides.

Permeability: The property of soils which permits the passage of any fluid. Permeability depends on grain size, void ratio, shape, and arrangement of pores.

Precipitation: Rainfall, snow, sleet, fog, hail, dew, and frost.

Ponding: (1) Natural formation of a pond in a watercourse. (2) Creation of free, standing water on the soil surface.

Recurrence interval: (syn. Return period) A statistical expression of the average time between floods equaling or exceeding a given magnitude.

Reservoir: A natural or artificially created pond, lake or other space used for storage, regulation or control of water. May be either permanent or temporary.

Retention pond: Designed to hold a specific amount of water indefinitely. Usually the pond is designed to have drainage leading to another location when the water level gets above the pond capacity, but still maintains a certain capacity.

River: A large natural *stream*.

Riverine: Relating to, formed by, or resembling a river (including tributaries), stream, brook, etc.

Runoff: The portion of precipitation that is not intercepted by vegetation, absorbed by the land surface or evaporated appears as flow in streams; drainage or flood discharge which leaves an area as surface flow or pipeline flow, having reached a channel or pipeline by either surface or subsurface routes.

Sedimentation: Gravitational deposit of transported solid materials found in flowing or standing water.

Sheet flow: Any flow of water which is spread out and not confined; e.g. flow waters flowing across a flat, open field (contrast with *channel flow*).

Stream: A body of water flowing in a natural surface channel. Flow may be continuous or only during wet periods. Streams which flow only during wet periods are termed ‘intermittent streams’. Streams = *river>creek>brook*

Storm sewer: A sewer for carrying off precipitation.

Subsidence: Sinking of the land surface, usually due to withdrawals of underground water, oil, or minerals.

Surface runoff: The movement of water on the earth’s surface, whether flow is over surface of ground or in channels.

Time of concentration: The time required for storm runoff to flow from the most remote point of a drainage area to the measurement or collection point; it is usually associated with the design storm.

Watershed: A defined area drained by a stream or stream system. (Although this term is widely used in the U.S., professional hydrologists recommend that the term *drainage basin* be used instead.)

APPENDIX A

DATES OF MAJOR FLOOD EVENTS IN TURKEY

Table A.1: List of Major Flood Events (1900-2007)

Start	End	Location	Sub Type	Killed	Total Affected	Estimated Damage (US $ Million)
16.11.2007	21.11.2007	Thracian and Aegean region	General flood	1	2.250	0
03.08.2007	03.08.2007	Aliceyrek, Akkeran, Danis	General flood	2	186	0
27.05.2007	01.06.2007	Agri, Van, Bitlis, Gaziantep	General flood	13	750	0
27.10.2006	07.11.2006	Van, Diyarbakır, Şırnak, Urfa, Batman, Mersin	Flash flood	47	63.015	317
01.07.2006	03.07.2006	Bitis, Mus, Kirklareli	General flood	12	0	0
02.08.2005	03.08.2005	Trabzon-Çaykara	Flash flood	7	0	0
04.07.2005	04.07.2005	Istanbul, Duzce, Sakarya		0	3.000	0
16.08.2004	18.08.2004	İstanbul-Alibeykoy	Flash flood	2	100	0
14.05.2004	16.05.2004	Hatay region	General flood	6	0	0
05.03.2004	09.03.2004	Erzurum, Batman, Bitlis	General flood	15	50.000	0
24.12.2003	26.12.2003	Antalya region	General flood	8	0	0
23.07.2002	27.07.2002	Rize	General flood	34	3.000	0
02.12.2001	09.12.2001	Adana, Icel provinces	General flood	5	570	25
07.05.2001	08.05.2001	Antakya (Konya provinces)	General flood	3	1.500	0
08.03.2001	08.03.2001	Sanliurfa province	General flood	4	450	0
27.05.2000	27.05.2000	Samsun and Tokat	General flood	2	1.000	40

Table A.1 (continued): List of Major Flood Events (1900-2007)

Start	End	Location	Sub Type	Killed	Total Affected	Estimated Damage (US $ Million)
07.11.1998	08.11.1998	Trabzon-Beşköy	Flash flood	60	1.000	0
12.06.1998	12.06.1998	Diyarbakir	Flash flood	22	0	0
20.05.1998	23.05.1998	Zonguldak, Karabuk, Bartin	Flash flood	10	1.240.047	1000
04.11.1995	08.11.1995	Izmir, Antalya, Isparta	River and Flash Flood	135	306.617	50
02.05.1995	02.05.1995	Bitlis (Eastern Turkey)	General flood	0	201	23,5
11.12.1992	12.12.1992	Muğla-Marmaris	Flash flood			
16.05.1991	17.05.1991	Diyarbakir, Malatya, Adiyaman	Flash flood	42	500	25
18.02.1990	19.02.1990	Maras	General flood	18	0	0
18.06.1990	21.06.1990	Giresun, Gumushane, Trabzon	General flood	51	4.500	150
13.12.1990	13.12.1990	Muğla	Flash flood			
13.06.1988	13.06.1988	Ankara	Flash flood	13	1.500	0
May 1984	May 1984	SouthEast	Flash flood	0	200	0
17.12.1981	17.12.1981	Western		10	0	0
March 1980	March 1980	Anatolia		75	60.000	15
19.11.1974	19.11.1974	Silopi		33	0	0
28.12.1968	28.12.1968	Içel		147	0	0
10.03.1964	10.03.1964	Western-Eskisehir		0	3.000	0
11.09.1957	11.09.1957	Ankara-Hatip	River Flood	185	0	0
August1956	August1956			138	0	0
June 1948	June 1948	Amasya		155	0	0
February 1948	February 1948			200	0	0
July 1929	July 1929	Of-Sürmene		146		
1910	1910	Tokat		2.000		

(Source: Günay 1997; EM-DAT 2009, DSİ 2009)

APPENDIX B

CONTENTS OF DSI ARCHIVE FILES OF CASE PROVINCES

Table B.1: Contents of DSI Archive Files of Bartın

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
02.06.1975	Report on flood occurred at 01.05.1975	Calculations about flood discharges and damages as well as the proposed solutions	Bartın-Kozcağız-Arıt Drainage Areas shown on 1/200.000 map (1975)	5th Regional Directorate of DSİ	General Directorate of DSİ
06.05.1975	Report on flood occurred at 01.05.1975	Causes of the flood, damages occurred and requested measures		Governorate of Zonguldak	Ministry of Development and Settlement, General Directorate of DSİ, Ministry of Energy and Natural Resources, Ministry of Public Works
06.05.1975	Report on flood occurred at 01.05.1975	Damages of the flood and requested measures		Governorate of Zonguldak (Directorate of Road, Water and Electricity)	Ministry of Rural Affairs
22.05.1975	Report on flood occurred at 01.05.1975	General situation about the measures taken and works done following the flood event		District Governorate of Bartın	Governorate of Zonguldak, Special Provincial Administration
29.05.1975	Official Correspon-dence for information about the flood occurred at 01.05.1975	Damages in agricultural areas and requested works		Governorate of Zonguldak (Zonguldak Provincial Directorate of Ministry of Development and Settlement)	Ministry of Agriculture and Husbandry
29.05.1975	Official Correspon-dence for information about the flood occurred at 01.05.1975	General situation and requested works following the flood event		Governorate of Zonguldak (Zonguldak Provincial Directorate of Ministry of Development and Settlement)	Ministry of Public Works
29.05.1975	Official Correspon-dence for information about the flood occurred at 01.05.1975	General situation and requested works following the flood event		Governorate of Zonguldak (Zonguldak Provincial Directorate of Ministry of Development and Settlement)	Ministry of Energy and Natural Resources

Table B.1 (continued): Contents of DSI Archive Files of Bartın

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
29.05.1975	Official Correspon-dence for information about the flood occurred at 01.05.1975	Damages received and measures requested by the tradesmen and craftsmen as victims of the flood event		Governorate of Zonguldak (Zonguldak Provincial Directorate of Ministry of Development and Settlement)	Ministry of Trade
01.01.1978	Base map preparations for develop-ment plans	Q500 flood extension	4 units of 1/5000 scale map	General Directorate of DSİ	
01.01.1990	Base map preparations for develop-ment plans	Q500 flood extension	14 units of 1/5000 scale map	General Directorate of DSİ	
30.12.1991	Survey Report on floods occurred at 27.06.1991 and 07.07.1991	Causes of flood losses and solutions for both short-term and long-term	1/5000 scale layouts of flooded areas	General Directorate of DSİ, General Directorate of Technical Research and Implementation	
06.07.1993	Official Correspond ence	A request to check the location of industrial areas along Bartın River with respect to flood risks	Exact location drawn on 1/5000 scale map	Bartın Municipality	General Directorate of DSİ
13.09.1993	Letter of a Request from a citizen	A request to check the flood risks along Karaagac Brook with regard to proposed housing development on that area	Exact location drawn on 1/1000 and 1/5000 scale maps	Bartın Municipality	General Directorate of DSİ
08.02.1995	1/100.000 scale map displaying the flooded areas at 25.07.1995	Facilities damaged, and the flooded areas		5th Regional Directorate of DSİ	
17-18.02.1998	Report on flood occurred at 17-18.02.1998	Survey on precipitation, damages and the requested measures following the flood of February 1998	Bartın River and its tributaries layout including flood discharges comparing previous floods, 1/100.000 scale map of flooded area in Bartın Province, and photos from the flood event	5th Regional Directorate of DSİ	General Directorate of DSİ
21-22.05.1998	Hydro-Meteorolo-gical Evaluation Report	Survey on basins, precipitation patterns, discharge levels, flood damages, measures and proposals following West Black Sea Region Floods	1/100.000 scale map showing the flooded areas in Bartın, Zonguldak, Karabuk, Kastamonu and Bolu	General Directorate of DSİ (Investigation and Planning Division, Hydrology Branch)	5th Regional Directorate of DSİ

Table B.1 (continued): Contents of DSI Archive Files of Bartın

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
01.01.2004	Base map preparations for develop-ment plans	Q500 flood extension	16 units of 1/5000 scale map	General Directorate of DSİ	
02.05.2007	Irrigation Project	Bartın-Arit-Kozcagiz Project	Kozcağız Dam Irrigation Area Planning Drainage System, 1/25.000 Scale Map	23rd Regional Directorate of DSİ, Su Yapı Engineering Firm	General Directorate of DSİ
04.09.2007	Kirazlikopru Dam Project	Location of existing and proposed industrial zones	1/25.000 Scale Map showing dam, reservoir area and irrigation channels, 1/100.000 scale map for the location of industrial zones	Ministry of Commerce and Industry	General Directorate of DSİ

Table B.2: Contents of DSI Archive Files of Batman

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
04.11.1969	Official Correspon-dence	Discharge of flood waters into Batman River	1968 Survey Report to protect settlement from floods, Sketch of effected areas of 11.04.1969 flood and 1968 flood borders on 1/20.000 scale layout	Governorate of Siirt	General Directorate of DSİ
28.03.1970	Official Correspon-dence	Based on the results of economic feasibility report, 60 housing units were identified to be transferred to other locations by AIGM	1969 Survey Report to protect settlement from floods	General Directorate of DSİ	10th Regional Directorate of DSİ
20.05.1970	Official Correspon-dence	About the necessary precautions to protect Batman sub-provincial center from floods of İluh and its tributaries		Umumi Munasebetler Basmusavırlıgı	General Directorate of DSI (Investigation and Planning Division)
17.06.1970	Official Correspon-dence about the request to transfer 60 buildings on flood-prone area	To protect a number of buildings from İluh and Çay river floods		General Directorate of DSI (Investigation and Planning Division)	Ministry of Development and Housing (General Directorate of Disaster Affairs)
25.09.1970	Official Correspon-dence	For the protection of 60 dwelling units in Batman sub-provincial center transfer option was proposed due to higher reclamation costs of İluh River and Çay, Savaro Creeks (construction of protection facilities were not found economically feasible)	Survey Report (25.12.1970)	Umumi Munasebetler Basmusavırlıgı	General Directorate of DSI (Investigation and Planning Division)
27.07.1971	Survey report (25.12.1970)	Flood protection investigation and planning for İluh River and Çay Creek	Referring to the correspondence of Investigation and Planning Division of DSİ (04.08.1969)	10th Regional Directorate of DSİ	General Directorate of DSI (Investigation and Planning Division)
05.05.1972	Damage report of flood occurred at 30.04.1972	Identification of damages, and determination of possible solutions	List of property owners damaged	Batman Municipality	Sub-governorate of Batman

Table B.2 (continued): Contents of DSI Archive Files of Batman

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
16.06.1972	Official Correspon-dence for Information	Information about preparation of damage report of 1972 floods, proposals and protection measure such as Batman Dam, coastal erosion control and distribution table of daily maximum rainfalls causing 1972 floods	Referring to letter of DSİ (02.06.1972), Economic damage Report (15.07.1972) and based on costs of damages economic feasibility of alternative structural solutions of 30.04.1972 Floods	10th Regional Directorate of DSİ	General Directorate of DSI (Investigation and Planning Division)
25.09.1973	Official Correspon-dence for Information about Iluh River and Çay Creek flood protection	Approval of Reclamation Projects of İluh River and Çay Creek without giving permission for covered channel tops	Referring to letters of Investigation and Planning Division of DSİ (29.03.1971, 27.07.1973) and Batman Municipality (04.07.1973)	General Directorate of DSI (Investigation and Planning Division)	Project and Construction Division of DSİ
23.05.1977	Official Correspon-dence for Information about Batman River floods	Proposals of Batman Project; such as no feasible for reclamation activities so the planning activities of Batman Dam will be completed in 1977 to solve the flood problem	Referring to telegraph of Governorate of Siirt (27.04.1977)	General Directorate of DSİ	Governorate of Siirt
15.06.1978	Official Correspon-dence for Information about Batman flood protection and reclamation project	The request for the revision of derivation channel project from Çay creek into İluh river due to new establishments on selected site before the construction	Referring to letter of 10th RD of DSİ (31.05.1978)	General Directorate of DSİ	10th Regional Directorate of DSİ
31.05.1978	Official Correspon-dence for flood protection survey considered in annual program of DSİ	Derivation channel project is cancelled due to new establishments on selected site before the construction, to explore other solutions flood protection survey is requested		10th Regional Directorate of DSİ	General Directorate of DSİ
29.07.1985	Official Correspon-dence about the requests of Governorate of Siirt and Sub-governorate of Batman (12.07.1985, 11.07.1985)	Survey of İluh River history of reclamation projects before responding the request to cover the İluh River channel top	Correspondence from Governorate of Siirt and Sub-governorate of Batman (12.07.1985, 11.07.1985)	General Directorate of DSİ	10th Regional Directorate of DSİ

Table B.2 (continued): Contents of DSI Archive Files of Batman

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
27.09.1985	Official Correspon-dence about the requests of 10th Regional Directorate of DSİ (17.09.1985, 19.09.1985)	Denial of the request to cover the İluh River channel in order to use as a main sewerage channel of Batman city		General Directorate of DSİ	10th Regional Directorate of DSİ
16.10.1986	Official Correspon-dence about the request of private individual (18.6.1986)	Denial of the request to cover the İluh River channel top due to some adverse effects afterwards	Referring to the letter of request of a citizen living in Batman	General Directorate of DSİ	Ministry of Energy and Natural Resources
26.07.1989	Official Correspon-dence about the requests from Batman Municipality (14.05.1989 and 21.07.1988)	Official request of DSİ from the municipality regarding river cleaning activities for the construction debris and solid wastes dumped into river channel		General Directorate of DSİ	Batman Municipality
20.10.1989	Official Correspon-dence about the requests of 10th Regional Directorate of DSİ (19.07.1989 and 16.08.1989)	The survey results to provide current flood situation as a base for development plan and flood protection	Referring 1971 Survey Report on flood protection, construction of flood walls in 1980, 1/25.000 scale layout indicating drainage channels (BT27 and BT28) of tributaries into İluh River	General Directorate of DSİ	10th Regional Directorate of DSİ
27.07.1990	Official Correspon-dence about the requests of Batman Municipality (24.05.1990)	The protection of Batman Sub-Provincial Center from floods of İluh, which was reclaimed in 1975 according to the Survey Program of DSİ	Correspondence of Batman Municipality including mainly financial shortages to complete sewerage system, construction of required roads, new housing developments and required infrastructure, and reclamation of other part of İluh river (24.5.1990)	General Directorate of DSİ	Batman Municipality
16.10.1990	Official Correspon-dence	The investigation regarding upper basin measures by Erosion and Debris Control Division Program to protect Batman Sub-Provincial Center from floods and debris of İluh River		General Directorate of DSİ	10th Regional Directorate of DSİ

Table B.2 (continued): Contents of DSI Archive Files of Batman

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
11.06.1990	Meeting Record (22.10.1990)	Organize a Commission to make technical surveys, approximate costs and implement by the support of Municipality	Approved 2-year Project on Reclamation and Protection Facility for Batman-İluh River: GAP as financial supporter 6billion TL in 1991 prices, other partners are DSİ, Bank of Provinces, Batman Municipality	Presidency of GAP Administration	Ministry of Development and Housing
11.07.1991	Flood Survey Report	Floods, precipitation, losses, main causes and proposals	Technical survey report (25.05.1990) with existing and proposed elevations for river channel of İluh, Map showing Batman and its close neighbors (10.01.92)	10th Regional Directorate of DSİ	General Directorate of DSİ
27.12.1991	Report about protection of Batman from floods	The main causes of flood losses and required works for each flooded Iluh River and its tributaries	Summary Report on 04.11.1991 Iluh Flood (07.11.1991), 1/200.000 scale layout of İluh and its tributaries, 8 photos showing debris and cleaning works (December 1991)	10th Regional Directorate of DSİ	General Directorate of DSİ
24.03.1994	Official Correspon-dence for Information	Structural interventions (such as closing the top of the river channel) to flood Protection facilities of İluh River, and Batman Dam Construction Project		Prime Ministry Ministry of Development and Housing	To all the related Ministries including General Directorate of DSİ
05.04.1995	Official Correspon-dence	After destruction by floods Sewerage channel construction requested to be managed by DSİ through the reclamation project of İluh		Batman Municipality	10th Regional Directorate of DSİ and General Directorate of DSİ
29.05.1995	Report about prompted works for the reclamation of İluh River	Information about hydraulics, geological structure and soil, characteristics of protection facilities and bridges, prompted works about Iluh River Reclamation	A number of photos of Batman River		
30.05.1995	Official Correspon-dence	İluh River Reclamation	Report of Batman Provincial Representatives of TMMOB Construction Engineers' Chambers about their engineering proposal by covering river channel top to gain additional space	Governorate of Batman	General Directorate of DSİ

Table B.2 (continued): Contents of DSI Archive Files of Batman

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
29.06.1995	Official Correspon-dence about the application from Provincial Planning and Coordination Directorate of Governorate of Batman	Closure of İluh River was rejected on technical grounds. The closure was found to be technically infeasible		General Directorate of DSİ	Governorate of Batman
07.05.1995	Meeting Record on Batman City center Iluh River Reclamation	Problems due to Iluh River, possible solution options, Short-term and long-term measures, coordination need between institutions		Governorate of Batman	Related Institutions
22.08.1996	Meeting Record on Batman City center Iluh River Reclamation			Presidency of GAP Administration	General Directorate of DSİ
30.11.2006	Official Correspon-dence about the request of Batman Governorate Provincial Crisis Center (13.11.2006)	To conduct a survey to delineate the extension area of flood on 31.10.2006-2.11.2006 in order to declare "disaster prone area" by law	Survey Report prepared after the floods occurred at 31.10.2006-02.11.2006, 1/4000 scale map showing residential development on riverbed through plan decisions by Municipality, 1/25000 scale map showing undischarging tributaries	10th Regional Directorate of DSİ	Governorate of Batman (Provincial Crisis Center)
26.01.2007	Official Correspon-dence about the request of 10th Regional Directorate of DSİ (08.11.2006)	The request for evaluation of flood-prone areas regarding several topics; such as maintenance of reclamation facilities, investigation on upper-lower basin measures, on discharging alternatives of tributaries into İluh, determination of elevations of channels, identification of already effected properties in determined flood-prone zone before transferring safe locations	Flooded areas drawn on 1/5000 scale base map	General Directorate of DSİ	10th Regional Directorate of DSİ
01.08.2007	Official Correspon-dence about the request of Batman Governorate Provincial Crisis Center (13.11.2006)	Delineation of "disaster prone area" by flood water level on the walls	Flooded areas drawn on 1/5000 scale base map	10th Regional Directorate of DSİ	Governorate of Batman (Provincial Crisis Center)

Table B.2 (continued): Contents of DSI Archive Files of Batman

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
2007	Survey Report referring the letter of Batman Governorate Provincial Crisis Center (13.11.2006)	Delineation of the extension area and water level of flood on 31.10.2006-02.11.2006 in order to declare "disaster prone area" by law	1/25 000 Scale Map indicating structural measures proposed	General Directorate of DSİ, General Directorate of Disaster Affairs	Governorate of Batman (Provincial Crisis Center)

Table B.3: Contents of DSI Archive Files of Aydın

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
27.03.1958	Official Correspon-dence for Information about recent floods occurred at 13.03.1958	The forms, nature and causes of damages of floods occurred at 13.03.1958	Flood Survey Report about damages (5.7.1956 floods)	Governorate of Aydın	Ministry of Public Works
19.07.1962	Official Correspon-dence about urgent precautions to be taken	General description of the effects of B. Menderes Floods, the approximate cost of damages and possible solutions proposed	1.200.000 and 1.25.000 layouts about flooded area	2nd Regional Directorate of DSİ	Governorate of Aydın
15.02.1965	Official Correspon-dence on flood and debris survey report about B. Menderes and its tributaries	Proposals about debris controls of upper basins of tributaries	Quick Flood Survey Report (13.4.1964)	General Directorate of DSİ	2nd Regional Directorate of DSİ
03.03.1965	Official Correspon-dence about flood issue regarding Aydın city center and preparation of Development Plan	Flood Protection of Tabakhane, Çakırlar, Kemer Creeks	1.5000 scale base maps indicating designed riverbed widths	General Directorate of DSİ (Investigation and Planning Division)	Bank of Provinces
22.04.1965	Official Correspon-dence for Information about B. Menderes River and Aydın Center Plain Flood occurred at 20.04.1965	Identification of flooded area, possible causes and solutions considering whole B. Menderes plain and basin	1.25.000 Scale Layout	2nd Regional Directorate of DSİ	General Directorate of DSİ
07.03.1966	Official Correspon-dence about coordination meetings among related Ministries	Related Ministries such as Rural Affairs, Forest, Agriculture and State Planning Organization are coordinated and cooperated in order to control debris problem of upper sub-basins of B. Menderes and Gediz Valley Tributaries	Table indicating division of tasks regarding to subjects and area	Ministry of Energy and Natural Resources	General Directorate of DSİ (Investigation and Planning Division)

Table B.3 (continued): Contents of DSI Archive Files of Aydın

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
13.03.1975	Official Correspon-dence for Information about flood Issue regarding Aydın-Center Umurlu Town with reference to the correspon-dence of Bank of Provinces (22.10.1974)	Survey results of current situation regarding floods and protection works done. Such results should be considered in Development Plan Preparation	1.2000 scale map indicating river directions, flood-prone areas, section of reclamation facilities and precautions done before. will be done later (No map exists in the file)	General Directorate of DSİ (Investigation and Planning Division)	Bank of Provinces, 2nd Regional Directorate of DSİ
27.03.1976	Official Correspon-dence about institutional opinion of DSİ	About Tepecik Town Development Plan in macroform study of Metropolitan Area Territorial Plan in accordance with DSİ's irrigation projects and flood protection facilities	1.5000 scale map indicating reclamation facilities and a number of flood-prone areas (Q500) that should be restricted to establishments (No map exits in the file)	21st Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)
13.10.1977	Official Correspon-dence about the former correspon-dence of Ministry of Development and Public Works (4.7.1977)	In Aydın-Center between Nazilli and Çakırlar Bridges Aydın Municipality asks to cover the top of Tabakhane River and use them as commercial one-storey shops by revising the current development plan decision that is proposed to use as a green area in the referring letter. After investigation DSİ gives the permission under a number of conditions.		General Directorate of DSİ (Investigation and Planning Division)	Ministry of Development and Public Works
29.09.1977	Official Correspon-dence about the former correspon-dence of DSI (23.08.1977 and 02.09.1977)	Clarifying a number of topics about current situation of Tabakhane Creek regarding the proposal of Aydın Municipality. Such as Municipality neither contacted with Regional Directorate of DSİ nor requested any supervision about the proposed project. So the ongoing process about the proposal are monitored by Regional Directorate of DSİ		21st Regional Directorate of DSİ	General Directorate of DSİ

Table B.3 (continued): Contents of DSI Archive Files of Aydın

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
15.06.1978	Official Correspon-dence regarding the covering project of some segment of Tabakhane Creek with reference to the former correspon-dence of Aydın Municipality (20.04.1978)	Although the proposal of Municipality was accepted a number crucial statements about the possible adverse results of such kind of implementations are reminded by DSİ	1.5000 scale base maps of 03.03.1965 indicating riverbed widths defined by DSİ	General Directorate of DSİ	21st Regional Directorate of DSİ and Aydın Municipality
05.12.1978	Official Correspon-dence referring the former correspon-dence of DSİ (07.04.1978) and the former correspon-dence of Aydın Municipality (20.04.1978)	Tabakhane Creek in Aydın City Center was reclaimed in the past according to Q500 discharge, however southern parts towards B. Menderes River according to Q100 for agricultural uses. The proposal of Municipality about covering some segments of Tabakhane Creek must be approved by DSİ	1.25.000 Scale Map indicating typical sections (Q500 and Q100) of Tabakhane Creek	21st Regional Directorate of DSİ and Aydın Municipality	General Directorate of DSİ
26.10.1978	Official Correspon-dence referring the former correspon-dence of Ministry of Tourism (25.05.1978)	In order to prepare Tabakhane reclamation project that meets the requirements of recreation project of Ministry of Tourism in Pınarbaşı location	1.1000 scale reclamation project of Tabakhane Creek on base map, Survey summary according to 1998 costs	21st Regional Directorate of DSİ	General Directorate of DSİ (Project and Construction Division), Aydın Branch of DSİ, Aydın Municipality
30.12.1987	Application letter for yearly allowance	About a number of proposals to get the allowance for flood protection works; such as river flood and debris surveys, reclamation activities etc. from 1988 Financial Investment Program	Table indicating total costs of the proposed works for flood protection	21st Regional Directorate of DSİ	General Directorate of DSİ (Research, Planning and Coordination Division)
07.04.1988	Official Correspon-dence for Information about evaluation criteria for the *management license for* sand, pebble stone mines	To evaluate the facility before giving permission and regular controls, otherwise the structure of river beds could be spoiled	Evaluation Guidelines for Establishing Mines of Sand, Pebble Stones etc (1988)	General Directorate of DSİ (Investigation and Planning Division)	21st Regional Directorate of DSİ

Table B.3 (continued): Contents of DSI Archive Files of Aydın

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
17.11.1988	Official Correspon-dence for Information about approval of allowances for some proposals applied		Table indicating total amount of allowances for approved project survey proposals for flood protection	General Directorate of DSİ (Research, Planning and Coordination Division)	21st Regional Directorate of DSİ
12.01.1988	Official Correspon-dence referring the letter of General Directorate of Highways (31.10.1988)	Since a number of Creeks are crossed over by highway corridor, İkizdere, Alangüllü, Kızılçay, Yalkıdere and Çamurluılıca Creeks will be reclaimed by General Directorate of Highways. They required consultancy from DSİ	1.25.000 scale map indicating sections and latest calculated discharges of right bank tributaries of B. Menderes River regarding İzmir-Aydın Highway route planned	21st Regional Directorate of DSİ	General Directorate of Highways
28.12.1988	Official Correspon-dence about the results of works done in 1988	Summary report of current situation of projects in 1988 and draft program on 1989	Table prepared according to pre-defined titles; such as type of the project and name, project number, program (first application revision), implementation (completed/ongoi ng), % completed and explanations	21st Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)
11.03.1989	Application letter for yearly allowance	About a number of proposals to get the allowance for flood protection works; such as river flood and debris surveys, reclamation activities etc. from 1990 Financial Investment Program	Table indicating total costs of the proposed works for flood protection	21st Regional Directorate of DSİ	General Directorate of DSİ (Research, Planning and Coordination Division)
11.09.1989	Application letter for revision of yearly allowance		Table indicating revisions in costs of the proposed works for flood protection	21st Regional Directorate of DSİ	General Directorate of DSİ (Research, Planning and Coordination Division)
14.11.1989	Official Correspon-dence about approval of allowances for some proposals applied		Table indicating total amount of allowances for approved project, survey proposals for flood protection	General Directorate of DSİ (Research, Planning and Coordination Division)	21st Regional Directorate of DSİ
04.10.1990	Official Correspon-dence about quick survey for upper basin reclamation of Aydın-Kemer Dam	Detailed survey about debris control on upper basin area of Aydın-Kemer Dam defined in 1989's Survey Program of erosion and debris control will be done later	Quick Debris Survey Report (5-12.9.1989), 1.100 000 Scale Map showing debris-prone rivers and creeks	General Directorate of DSİ (Investigation and Planning Division)	General Directorate of DSİ (Branch of Minor Works on Water Issues)

Table B.3 (continued): Contents of DSI Archive Files of Aydın

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
11.09.1990	Application letter for yearly allowance for 1991 Investment Program and Implemen-tation Plan	About a number of proposals to get the allowance for flood protection works; such as river flood and debris surveys, reclamation activities etc. from 1991 Financial Investment Program	Table indicating total costs of the proposed works for flood protection	21st Regional Directorate of DSİ	General Directorate of DSİ (Research, Planning and Coordination Division)
31.01.1991	Official Correspon-dence about results of works done in 1990	Summary report of current situation of projects in 1990 and draft program on 1991	Table prepared according to pre-defined titles; such as type of the project and name, project number, program (first application/revi-sion), implementation (completed. ongoing), % completed and explanations	21st Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)
11.11.1991	Application letter for yearly allowance for 1992 Investment Program and Implemen-tation Plan	About a number of proposals to get the allowance for flood protection works; such as river flood and debris surveys, reclamation activities etc. from 1992 Financial Investment Program	Table indicating total costs of the proposed works for flood protection	21st Regional Directorate of DSİ	General Directorate of DSİ (Research, Planning and Coordination Division)
06.02.1992	Official Correspon-dence about flood situation of Aydın Koçarlı-Davutlar towns with reference to the former correspon-dence of Governorate of Aydın (9.12.1991)	For preparation of a development plan a number of necessary requirements mentioned by DSİ; such as 25 meter wide stripes on both sites of river channel to be restricted zone for developments until flood protection facility is constructed		General Directorate of DSİ (Investigation and Planning Division)	21st Regional Directorate of DSİ
11.09.1992	Application letter for yearly allowance for 1993 Investment Program and Implemen-tation Plan	About a number of proposals to get the allowance for flood protection works; such as river flood and debris surveys, reclamation activities etc. from 1993 Financial Investment Program	Table indicating total costs of the proposed works for flood protection	21st Regional Directorate of DSİ	General Directorate of DSİ (Research, Planning and Coordination Division)

Table B.3 (continued): Contents of DSI Archive Files of Aydın

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
07.11.1995	Official Correspon-dence	A request to check the conformity of irrigation sites and network system within development plan area indicated in macroform proposed	1.5000 scale Development Plan (No data found in the file)	21st Regional Directorate of DSİ on behalf of Municipality of Antakya	General Directorate of DSİ
20.10.1995	Official Correspon-dence about institutional opinion of DSİ	To check the conformity of irrigation sites, network system, flood-prone areas and facilities with development plan area indicated in macroform proposed	1.10.000 Scale Aydın Macroform Plan, Aydın Macroform Plan Report, Rainfall and Freshwater System Plans, Sections and Details	21st Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)
01.02.1996	Application letter for yearly allowance for 1996 Investment Program and Implementa-tion Plan	About a number of proposals to get the allowance for flood protection works; such as river flood and debris surveys, reclamation activities etc. from 1996 Financial Investment Program	Table indicating the total costs of the proposed works for flood protection	21st Regional Directorate of DSİ	General Directorate of DSİ (Research, Planning and Coordination Division)
31.07.1996	Official Correspon-dence referring to the former correspon-dences of 21st Regional Directorate of DSİ (20.10.1993), of General Directorate of DSİ (30.01.1995) and of Municipality of Aydın (15.03.1995)	Regarding irrigation sites, projects and river flood protection facilities Tabakhane, Kemer-Çakırlar, Kızılçay and Şevketiye Creeks are surveyed	1.5000 scale map indicating reclamation facilities and a number of flood-prone areas (Q500) that should be restricted to establishments	General Directorate of DSİ (Investigation and Planning Division)	Aydın Municipality
14.10.1996	Official Correspon-dence about the contribution of other related institutions with reference to correspon-dence of DSİ at 09.09.1996	After heavy rainfall and storm in 6-8.9.1996 the estimated damages of floods were not as effective as on public life defined in the Law 7269.		Governorate of Aydın	General Directorate of DSİ

Table B.3 (continued): Contents of DSI Archive Files of Aydın

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
07.11.1996	Official Correspon-dence about damages of floods occurred at 06-08.09.1996 with reference to the former correspon-dences of Governorate of Aydın (09.09.1996 and 14.10.1996)	Effects of flooding of Olucak Creek on Doğanköy, Yılmazköy, İmamköy in Aydın	Flood Survey Report, flooded areas on a non-scaled map and coastal erosion (10.09.1996)	General Directorate of DSİ (Operation and Maintenance Division)	General Directorate of DSİ (Investigation and Planning Division)
24.03.1997	Official Correspon-dence referring to the former correspon-dence of DSİ (18.03.1997)	Emergency works done after 06-08.09.1996 floods and long-term precautions proposed		21st Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)
27.05.1997	Official Correspon-dence referring to the former correspon-dence of 21st Regional Directorate of DSİ (14.10.1996)	The effects of heavy rains during 06-08.09.1996 in Aydın and the surrounding area		General Directorate of DSİ (Investigation and Planning Division)	21st Regional Directorate of DSİ
16.12.1997	Official Correspon-dence about heavy rains and inundation during 12-15.12.1997	No river floods occurred but inner city inundations observed		21st Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division), General Directorate of DSİ (Operation and Maintenance Division)
22.05.1998	Official Correspon-dence about flood at 17.05.1998		Flood Survey Report about 17.5.1998 floods	21st Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division), DSİ Brach Office, Governorate of Aydın, Sub-provincial Governorate of Aydın
24.05.1999	Application letter for yearly allowance for 1999 Investment Program and Implemen-tation Plan	About a number of proposals to get the allowance for flood protection works; such as river flood and debris surveys, reclamation activities etc. from 1999 Financial Investment Program	Table indicating total costs of the proposed works for flood protection	21st Regional Directorate of DSİ	General Directorate of DSİ (Research, Planning and Coordination Division)

Table B.3 (continued): Contents of DSI Archive Files of Aydın

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
02.02.1999	Official Correspon-dence about damages of heavy rainfall and floods occurred at 29-31.01.1999			21st Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)
03.08.1999	Informing and Official Correspon-dence to Davutlar Municipality referring Governorates' letter (22.02.99) and letter from local people from Söke (09.02.1999)	Flood-prone areas were allowed to residential uses without constructing flood protection facility determined by DSİ at 02.06.1992	Official Correspondence with flood-prone sites and project standards of reclamation facilities of Alaçay Creek sent to Davutlar Municipality for Development Plan Preparation (02.06.1992)	21st Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division), Governorate of Aydın, Sub-Provincial Governorate of Kuşadası, Davutlar Municipality
15.02.1999	Official Correspon-dence requesting aid for 6 dwelling units near to Alaçay Creek	Dwelling units near to banks of Alaçay Creek were flooded.		Sub-Provincial Governorate of Kuşadası	Governorate of Aydın, 21st Regional Directorate of DSİ
18.11.1999	Application letter for yearly allowance for 2000 Investment Program and Implemen-tation Plan	About a number of proposals to get the allowance for flood protection works; such as river flood and debris surveys, reclamation activities etc. from 2000 Financial Investment Program	Table indicating total costs of the proposed works for flood protection	21st Regional Directorate of DSİ	General Directorate of DSİ (Research, Planning and Coordination Division)
15.02.2000	Official Correspon-dence referring to the former correspon-dence of 21st Regional Directorate of DSİ (27.03.1996), of DSİ (31.07.1996, and of Municipality (15.11.1999)	For Yılmazköy location, a survey for an addition to the development plan to check its conformity with irrigation sites and facilities of DSİ were made	1.10.000 macroform layout including irrigation sites and network	21st Regional Directorate of DSİ	General Directorate of DSİ, Municipality of Aydın
03.09.2000	Circular declared by the Ministry of Development and Public Works (16.12.1985)	About the use of agricultural areas and riverbeds	Circular Text	21st Regional Directorate of DSİ	Governorates of Aydın, Denizli and Muğla

Table B.3 (continued): Contents of DSI Archive Files of Aydın

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
15.12.2000	Directive about closure of top of Aydın Tabakhane Brook with reference to the former correspondence of DSİ (04.07.1989), the Directive of Ministry of Internal Affairs (03.08.1994)	The process of closure is declared as unfavorable by General Directorate of DSİ	Yeni Asır Newspaper (05.12.2000), the Directive of Ministry of Internal Affairs (03.08.1994)	21st Regional Directorate of DSİ	Governorate of Aydın, Municipality of Aydın
19.01.2001	Directive about closure of top of river channels with reference to the former correspondence of 21st Regional Directorate of DSİ (12.02.1993)	A number of inaccurate interventions are declared as to avoid doing	The Directive of Ministry of Internal Affairs (03.08.1994)	21st Regional Directorate of DSİ	General Directorate of DSİ, Governorates of Aydın, Denizli and Muğla
19.12.2001	Official Correspondence about floods occurred at 17.12.2001 in some parts of Aydın Province due to continuous heavy rains during 16-18.12.2001	Floods occurred along Çakırbeylı and Boğaziçi Brooks in Koçarlı Sub-province, Sarıçay Brook in Söke, Çine Creek Dam basin		21st Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)
04.06.2004	Official Correspondence about floods occurred at 23.1.2004 due to heavy flood during January		B. Menderes Flood Survey Report, 1/100.000 scale maps showing flooded areas in Koçarlı, Söke and Yenipazar Sub-provinces	21st Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division), Governorate of Aydın

Table B.4: Contents of DSI Archive Files of Hatay

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
22.07.1957	Erosion and Debris Report	Erosion and debris control survey report on Asi and Karasu Drainage Basins	1/200.000 Land uses; such as dams, basin borders, debris agglomerations, agriculture, meadows etc	6th Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)
02.03.1962	Report on flood occurred at 25.02.1962 (after heavy and continuous rains during 03-09.02.1962 and 13-14.02.1962)	Data about rainfall and river flow during rainfall and flood with previous flood discharges, costs of damages, and proposed works	Flooded areas on 1/200.000 Scale map	6th Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)
24.01.1967	Official Correspon-dence for information about flood occurred at 19.04.1965 with reference to the correspon-dence of Hatay Governorate	Altınçay Creek flood affected Armutlu neighborhood due to the deficient hydraulic standard of Antakya-Samandağ bridge constructed by General Directorate of Highways		General Directorate of DSİ (Investigation and Planning Division)	General Directorate of Highways
17-18.04.1967	Official Correspon-dence for information about flood occurred during 17-18.04.1967	Physical features of Asi Basin and other creeks/brooks (Kavaslı, Büyükdere, Hacıkürüş, Antakya inner-city brooks, Altınçay, Sünberi, Dereboğazı, Miras, Bohşin), Rainfall-Flow values, Costs of flood damages and affected areas with respect to rivers and proposals made	Flooded areas on 1/200.000 Scale map, flood report and photos	6th Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)
25.04.1967	Summary Report on flood occurred at 25.4.1967	Altınçay, Sabunluk Brook and Miras Creek flooded, no damage other than traffic interruption	Photos	6th Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)
13-14.01.1968	Report on flood occurred during 13-14.01.1968	Physical features of Asi Basin and other creeks/brooks (Kavaslı, Büyükdere, Hacıkürüş, Antakya inner-city brooks, Altınçay, Sünberi, Dereboğazı, Miras, Bohşin, Karasu, Comba, Muratpaşa, Afrin, Harim, Kızılark, Sabunluk), Rainfall-Flow values, Costs of flood damages and affected areas with respect to rivers and proposals made	Flooded areas on 1/200.000 scale map, and photos	6th Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)

Table B.4 (continued): Contents of DSI Archive Files of Hatay

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
05.02.1968	Report on flood occurred at 05.02.1968		Flooded areas on 1/40.000 Scale map	6th Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)
02.10.1973	Official Correspon-dence about flood issue regarding Antakya city and preparation of Development Plan with reference to the correspon-dence of Bank of Provinces (19.7.1973)	Survey on flood-prone areas and reclamation facilities proposed/completed along Asi River, Hanna Creek and Hacıkürüş, Altınçay, Kavaslı Brooks	Survey Report: According to Law 4373, 100 meters wide stripes from the mid-axis of Asi river channel along both banks where no reclamation facility constructed should be kept as 'restricted to settlements'. Riverbed while passing through Antakya city was covered by concrete blocks and designed for Q500 flood discharge. For Hacıkürüş Brook 15 m. wide stripes along both banks restricted to settlements until the reclamation completed. For Hanna 30 m. wide stripes, for Altınçay 40 m. wide.	From 6th Regional Directorate of DSİ to General Directorate of DSİ (Investigation and Planning Division)	Bank of Provinces
22.09.1987	Official Correspon-dence about flood issue regarding Harbiye town	For the preparation of Development Plan with reference to the correspondence of Harbiye Municipality (09.04.1986)	Survey on flood-prone areas and reclamation facilities proposed or completed along Hatip Creek and one tributary brooks	From 6th Regional Directorate of DSİ to General Directorate of DSİ (Investigation and Planning Division)	Municipality of Harbiye
27.03.1987	Official Correspon-dence about flood issue regarding Antakya Sub-Province	For the preparation of Development Plan Addition with reference to the correspondence of Bank of Provinces (10.10.1985)		General Directorate of DSİ (Investigation and Planning Division)	Bank of Provinces
03.02.1993	Official Correspon-dence about flood protection regarding Antakya Sub-Province	For the protection of a number of neighborhoods in Antakya Sub-Province from floods due to water coming from western slopes of Habib Necar Mountain	According to survey results the reason is the deficient structure of road constructed by Municipality and General Directorate of Rural Affairs	6th Regional Directorate of DSİ	General Directorate of DSİ (Investigation and Planning Division)

Table B.4 (continued): Contents of DSI Archive Files of Hatay

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
20.06.1995	Official Correspondence about flood issue regarding Hatay-Center-Çekmece Town and preparation of Development Plan with reference to the correspondence of Çekmece Municipality through 6th of Regional Directorate of DSİ (18.3.1993)	Survey on flood-prone areas and reclamation facilities proposed/completed along Hanna Creek, Altınçay, Yağlı Brooks	Survey Report: Altınçay Brook ongoing reclamation activities since 1986, Hanna Creek buffer zone (25m. wide stripes along both banks) defined acc. to Law 4373, for Yağlı Brook flood-prone areas and sections of proposed flood protection facilities given. 5 m. service road required at least along one bank of each river for clearance and maintenance activities. (prepared by 6th Regional Directorate of DSİ, 29.5.1995)	General Directorate of DSİ (Investigation and Planning Division)	Municipality of Çekmece
09.01.1996	Official Correspondence about flood issue regarding Hatay-Center-Kuzeytepe Town and preparation of Development Plan with reference to the correspondence of Kuzeytepe Municipality through 6th of Regional Directorate of DSİ (25.9.1995)	Survey on flood-prone areas and reclamation facilities proposed/completed along Erferli and Sümberli Brooks	Survey Report: Eferli Brook requires 5m. Service road with a sufficient channel capacity. For Sümberi Brook flood-prone areas were declared as ' restricted to settlements' until reclamation facility completed in accordance with sections drawn. (prepared by 6th Regional Directorate of DSİ, 22.12.1995)	General Directorate of DSİ (Investigation and Planning Division)	Municipality of Kuzeytepe
08.05.1996	Official Correspondence about flood issue regarding Hatay-Center-Gümüşgöze Town and preparation of Development Plan with reference to the correspondence of Bank of Provinces (31.7.1995)	Survey on flood-prone areas and reclamation facilities proposed/completed along Ceviz and one dry Brooks	Survey Report: No flood event observed in historical survey. Rivers kept as they are. 5m. wide service road required along one bank at least (prepared by 6th Regional Directorate of DSİ, 19.4.1996)	General Directorate of DSİ (Investigation and Planning Division)	Bank of Provinces

Table B.4 (continued): Contents of DSI Archive Files of Hatay

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
06.07.1996	Official Correspondence about flood issue regarding Hatay-Center-Karasu Town and preparation of Development Plan with reference to the correspondence of Bank of Provinces (06.10.1995)	Survey on flood-prone areas and reclamation facilities proposed/completed along B. Çay and K. Çay Brooks	Survey Report: riverbed capacities sufficient. (prepared by 6th Regional Directorate of DSİ, 3.5.1996)	General Directorate of DSİ (Investigation and Planning Division)	Bank of Provinces
01.08.1997	Official Correspondence about flood issue regarding Hatay-Center-Küçükdalyan Town and preparation of Development Plan with reference to the correspondence of Kuzeytepe Municipality through 6th of Regional Directorate of DSİ (22.3.1997)	Survey on flood-prone areas and reclamation facilities proposed/completed along Asi River, Hacıkürüş river	Survey Report: riverbed capacities sufficient. The segment passing through Küçükdalyan of Hacıkürüş creek reclaimed (prepared by 6th Regional Directorate of DSİ, 24.3.1997)	General Directorate of DSİ (Investigation and Planning Division)	Küçükdalyan Municipality
15.06.1998	Official Correspondence for information about **floods in 21.5.1998** affecting Zonguldak, Karabük, Bartın, Bolu, Samsun, Kastamonu, Hatay and Ardahan	Requesting local flood damage survey reports from related Regional Directorates		General Directorate of Disaster Affairs	General Directorate of DSİ
02.07.1998	Official Correspondence	About the protection of Aknehir town with reference to the correspondence of General Directorate of Disaster Affairs (12.6.1998) after **21.5.1998 floods**		General Directorate of DSİ (Investigation and Planning Division)	6th Regional Directorate of DSİ
08-09.05.2001	Report on flood during 08-09.05.2001		Flooded areas on 1/100.000 Scale map, and photos		

Table B.4 (continued): Contents of DSI Archive Files of Hatay

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
13.07.2001	Official Correspon-dence for information about first evaluation draft of **floods in Hatay during 8-9.5.2001**	For the compensation of flood losses the evaluation of total damage cost required in order to provide this compensation from European Bank of Development and Reconstruction	Tables about damages in residential and business areas. Total cost of reconstruction works of damaged buildings were calculated as 7670 billion TL.	General Directorate of Disaster Affairs	General Directorate of DSİ, Prime Ministry Undersecretaiat of Treasury (International Relations Division)
15.02.2003	Report on **flood occurred at 15.02.2003**		1/500.000 Scale Site Plan including the areas of projects, surveys, constructions by DSİ Regional Directorate, Flooded areas on Amik Plain shown in 1/100.000 scale map, and photos		
12.03.2003	Official Correspon-dence for information about causes of **floods in Hatay at 04.06.2002 and at 15.02.2003** with reference to the correspondence of Hacıpaşa Municipality	Dam failure in Syria was the main reason of those floods.	The summary report including proposals like short and long-term measures submitted to Hatay Governorate	6th Regional Directorate of DSİ	Hacıpaşa Municipality
15-16.05.2004	Report on flood occurred **during 15-16.5.2004**	The report about Hatay Province-Altınözü, Harbiye, Bohşin floods includes description of the basin (agricultural, economic and social), flooded areas and damages, existing flood protection facilities, climate-water sources, rainfall - flow measured during flood, list of historical floods, causes of flood losses and inefficiencies of facilities, and proposals	Flood photos		

Table B.4 (continued): Contents of DSI Archive Files of Hatay

Date of Document	Type of Document	Contents	Annexes	Forwarding Authority	Receiving Authority
1995 - 2006	Official correspon-dences about flood issue regarding 11 different settlements; namely Narlıca, Turunçlu, Ekinci, Avsuyu, Subaşı, Ovakent, Şenköy, Odabaşı, Belen, Güzelburç towns and Bohşin Village for the preparation of Development Plans	Survey on flood-prone areas and reclamation facilities proposed/completed along related rivers, creeks and brooks		General Directorate of DSİ (Investigation and Planning Division)	Related Municipality or Bank of Provinces

APPENDIX C

AN EXAMPLE OF AN OFFICIAL CORRESPONDENCE

T.C.
BAYINDIRLIK VE İSKÂN BAKANLIĞI
DEVLET SU İŞLERİ GENEL MÜDÜRLÜĞÜ
Etüd ve Plan Dairesi Başkanlığı

[illegible] DSİ 0.10.12.00/
[illegible] 2420

Aydın-Kuşadası-Davutlar
kasabasının taşkın durumu.

2 HAZİRAN 1992

DSİ XXI.BÖLGE MÜDÜRLÜĞÜNE
AYDIN

İLGİ : Aydın Valiliği'nden intikal eden 9.12.1991 tarih ve 1529 sayılı yazınız.

İlgi yazıya konu Aydın-Kuşadası-Davutlar kasabasının taşkın durumu Devlet Su İşleri Genel Müdürlüğü'nce incelenmiş ve tespit edilen hususlar imar planı çalışmaları sırasında dikkate alınmak üzere aşağıda belirtilmiştir.

1- 28 M paftasında yer alan Yanaluk ve Bal derelerinin haritada Km: 1+050 olarak işaretlenen birleşim yerinin membasında kalan kesimleri yeterli olup, yerleşim planı çalışmaları sırasında aynen muhafaza edilmelidir.

Söz konusu iki derenin birleşmesi ile oluşan müşterek yatak ise Km:0+000-1+050 arasında işaretlenen kesimde yoğun yapılaşma nedeni ile daraltıldığından kapasite olarak yetersiz durumdadır. Anılan kesimde yatak güzergahı boyunca her iki sahilde takriben 25'er metre genişliğindeki şeritvari alanlar taşkına maruz durumda olup, haritada tip kesit detayı verilen taşkın tesisi Belediyenizce inşa edilmeden taşkın etkisinde olduğu belirtilen bu alanlarda iskan yapılmamalıdır.

2- 30 L ve 30 M paftalarında yer alan kuruderelerin şev üstlerinden itibaren işaretlenen mevcut yatakları yeterli olup, imar planı çalışmaları sırasında aynen muhafaza edilmelidir. Kuruderelerin birleşimi ile oluşan Alaçay deresinde ise, Km: 0+000-0+675 arasında işaretlenen kesimde mevcut yatak yetersiz ve yatak güzergahı boyunca her iki sahilde takriben 50'şer metre genişlikteki şeritvari alanlar taşkına maruz durumdadır. Harita üzerinde tip kesit detayı verilen taşkın tesisi Belediyenizce inşa edilmeden söz konusu taşkına maruz sahalarda iskan yapılmamalıdır.

Konu :

3- 29 L paftasında yer alan Kapuz deresinin yeterli ve yetersiz yatak kesimleri ile taşkın alanı harita üzerinde işaretlenmiştir. Yerleşim planı çalışmaları sırasında, dere yatağı yeterli bulunan kesimlerde aynen muhafaza edilmeli ve tip kesit detayı verilen taşkın tesisi Belediyenizce Km:0+260-1+250 arasında işaretlenen güzergah boyunca inşa edilmeden taşkına maruz alanlarda iskan yapılmamalıdır.

4- 28 K ve 28 L paftalarında daha önce DSİ Genel Müdürlüğü tarafından açılmış olan kurutma kanalları yer almaktadır. İmar planı çalışmaları sırasında, anılan paftalarda güzergahları işaretlenen her bir kurutma kanalı için 15 m genişlikte bir alan iskan dışı tutulmalıdır.

5- Gelecekte yapılabilecek temizlik ve bakım-onarım amaçlı çalışmalarda kullanılmak üzere, halihazır harita paftalarında yer alan her dere için uygun bir şekilde ve 5 m den az olmamak kaydıyla yeterli genişlikte yol şeritleri ayrılmalıdır.

Gereğini ve bilginizi rica ederim.

GENEL MÜDÜR ADINA

Süleyman BOZKURT
Etüd ve Plan Dairesi Başkanı

EK: 2 tk.(12 pafta)harita

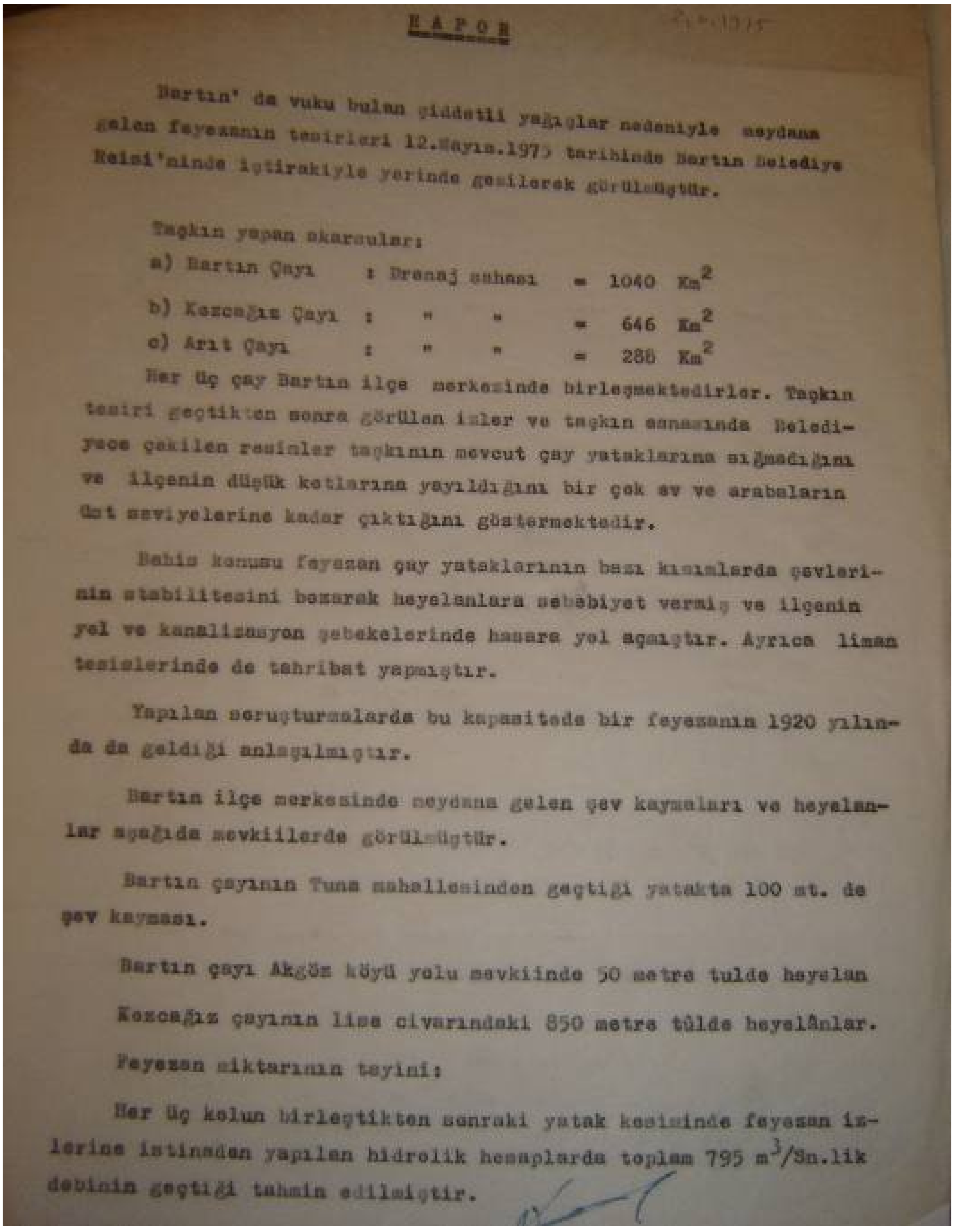
DAĞITIM

Gereği
Davutlar Kasabası Bel.Bşk.
Kuşadası/AYDIN

Bilgi
DSİ XXI.Bölge Md./AYDIN

APPENDIX D

AN EXAMPLE OF A SURVEY REPORT



RAPOR

Bartın' da vuku bulan şiddetli yağışlar nedeniyle meydana gelen feyezanın tesirleri 12.Mayıs.1975 tarihinde Bartın Belediye Reisi'ninde iştirakiyle yerinde gezilerek görülmüştür.

Taşkın yapan akarsular:

a) Bartın Çayı	: Drenaj sahası	=	1040 Km^2
b) Kozcağız Çayı	: " "	=	646 Km^2
c) Arıt Çayı	: " "	=	288 Km^2

Her üç çay Bartın ilçe merkezinde birleşmektedirler. Taşkın tesiri geçtikten sonra görülen izler ve taşkın esnasında Belediyece çekilen resimler taşkının mevcut çay yataklarına sığmadığını ve ilçenin düşük kotlarına yayıldığını bir çok ev ve arabaların üst seviyelerine kadar çıktığını göstermektedir.

Bahis konusu feyezan çay yataklarının bazı kısımlarda şevlerinin stabilitesini bozarak heyelanlara sebebiyet vermiş ve ilçenin yol ve kanalizasyon şebekelerinde hasara yol açmıştır. Ayrıca liman tesislerinde de tahribat yapmıştır.

Yapılan soruşturmalarda bu kapasitede bir feyezanın 1920 yılında da geldiği anlaşılmıştır.

Bartın ilçe merkezinde meydana gelen şev kaymaları ve heyelanlar aşağıda mevkiilerde görülmüştür.

Bartın çayının Tuna mahallesinden geçtiği yatakta 100 mt. de şev kayması.

Bartın çayı Akgöz köyü yolu mevkiinde 50 metre tulde heyelan

Kozcağız çayının lise civarındaki 850 metre tûlde heyelânlar.

Feyezan miktarının tayini:

Her üç kolun birleştikten sonraki yatak kesitinde feyezan izlerine istinaden yapılan hidrolik hesaplarda toplam 795 m^3/Sn.lik debinin geçtiği tahmin edilmiştir.

Büroda yapılan hidrolojik hesaplarda:

Bartın Çayının tekerrürlü feyezanları:

Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}	Q_{1000}
262	400	451 m^3/sn.	614	853	930

Kocaçâ Çayının tekerrürlü feyezanları :

Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}	Q_{1000}
181	274	342	420	585	635

Arıt Çayının tekerrürlü feyezanları :

Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}	Q_{1000}
74	112	141 m^3/sn.	175	243	265

bulunmuştur.

Üç kol birleştikten sonra tekerrürlü feyezan değerleri:

Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}	Q_{1000}
376	466	703 m^3/sn.	916	1280	1400

hesaplanmıştır.

<u>Alınması gerekli tedbirler:</u>

I- Taşkın ancak membada yapılacak depolama tesisleriyle önlenebilir. Batı Karadeniz havzası istikşâf raporunda Bartın Projesi adı altında etüd edilen Projeye (formülasyona) göre ;

a) Bartın çayı üzerinde sulama ve taşkın gayeli Kumar barajı düşünülmüştür. Ancak Plânlama safhasında aks yeri jeolojikması uygun görülmiyerek elimine edilmiştir.

Yine aynı istikşaf raporunun alternatifler kısmında Kumar barajının daha membaında Düzağaç ve Sarpın barajlarından ve Ulus kolu üzerinde Ulus ve Ucra barajlarından bahsedilmektedir. Bu barajlar üzerinde etüdlere devam edilmelidir.

b) Kocaağız çayı üzerinde sulama ve taşkın gayeli Kocaağız barajının plânlama çalışmaları yürütülmektedir.

c) Arıt çayı üzerinde enerji ,sulama ve taşkın gayeli Arıt Barajı üzerinde etüdler yapılmalıdır.

II- İlçe merkezinde yatak şevlerinin stabilitesinin temini için kazıklı iksa sisteminin tatbiki uygun görülmüştür.

__Netice:__ İlçenin, liman ve fabrikaların taşkından korunması için membada depolama tesisleri yapılmalıdır. İlçe içinde heyelân yapan şevlerin tahkim edilmesi, yol ve kanalizasyon şebekelerinin fonksiyonlarının aksatılmaması yönünden gerekli görülmüştür.

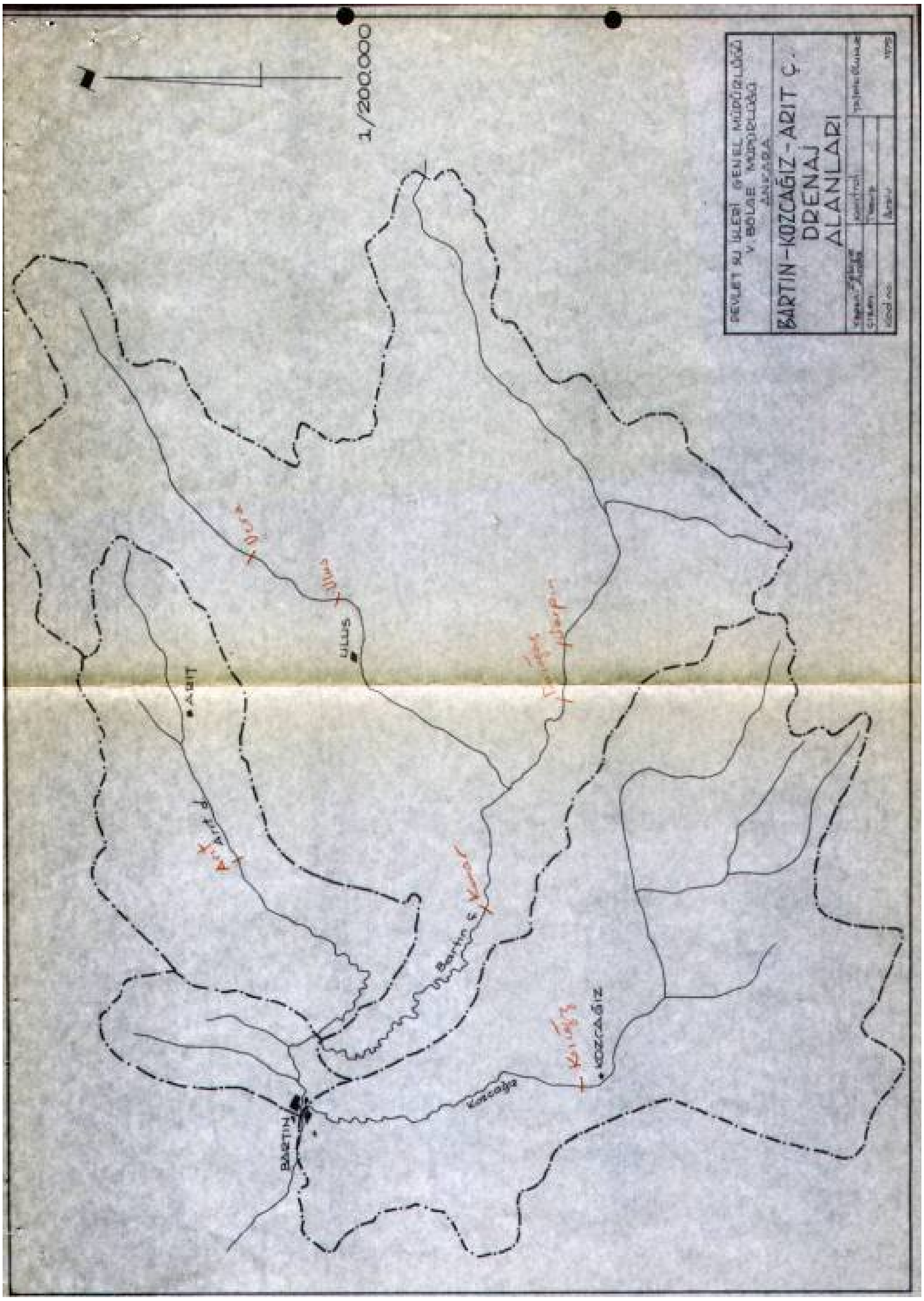
İşbu rapor tarafımızdan 5 nüsha tanzim edilerek ,bilgilerinize arz edilmiştir. 2.6.1975

Eki: Drenaj sahaları.

DSİ.V. BÖLGE
Etüd-Plân Başmühendisi
Erdoğan Bahçeci
İnş.Yük.Müh.

DSİ.V.Bölge
Proje Uzmanı
Zeki Ekerbiçer
İnş. Müh.

EB/PÖ.


DEVLET SU İŞLERİ GENEL MÜDÜRLÜĞÜ
V. BÖLGE MÜDÜRLÜĞÜ
ANKARA
BARTIN-KOZCAĞIZ-ARIT Ç.
DRENAJ
ALANLARI
1/200.000
ULUS
ARIT
BARTIN
KOZCAĞIZ
Bartın Ç.
Kozcağız

APPENDIX E

CIRCULAR OF THE MINISTRY OF INTERNAL AFFAIRS DATED 2006

<u>Başbakanlıktan:</u>

Konu: Dere Yatakları ve Taşkınlar

GENELGE*

2006/27

Yurdumuzun değişik yörelerinde meydana gelen ve can ve mal kayıplarına sebep olduğu kadar, günlük hayatı, her türlü ekonomik ve ticari faaliyeti olumsuz yönde etkileyen taşkınların önlenmesi ve yol açtığı kayıpların giderilmesi için aşağıda belirtilen tedbirlerin alınması uygun görülmüştür.

1 – İl, ilçe ve belde gibi büyük ve orta ölçekteki planlı yerleşim yerleri ile mevzii planlara göre yapılan küçük ölçekteki her türlü yerleşim birimlerine ait imar planlarının düzenlenmesi esnasında Devlet Su İşleri Genel Müdürlüğü'nün (DSİ) tedbir ve tavsiyelerine titizlikle uyulacaktır.

2 – Çeşitli kullanım alanları oluşturmak maksadıyla derelerin üzeri, zaruri hallere münhasır olmak üzere DSİ Genel Müdürlüğünün izni alındıktan sonra gerçekleştirilecek işlemler hariç, kesinlikle kapatılmayacaktır. Bunun dışında dere yataklarında gerçekleştirilecek her türlü yapılar ilgili kurum veya kuruluşlarca onaylı bir projeye dayandırılacaktır.

3 – Dere yatakları üzerine her ne sebeple olursa olsun yapılacak köprü ve menfez gibi sanat yapıları ile dere yatakları üzerinden veya sınırından geçirilecek enerji nakil hattı, yol, petrol-doğal gaz boru hattı, telefon hattı, içme suyu ve kanalizasyon hatları ve benzerleri gibi çeşitli kuruluşlarca değişik maksatlı yapılar inşa edilmeden önce DSİ'nin ilgili Bölge Müdürlüklerinden mutlak surette görüş alınacak ve yapılacak tesislerin bu görüşe uygun olarak inşası sağlanacaktır. Yapılan müracaatlara DSİ tarafından 30 gün içinde cevap verilmemesi halinde uygun görüş verilmiş sayılacaktır.

4 – Kamu kurum ve kuruluşlarınca, köprü altındaki su akış kesitinin daralmasına sebebiyet veren ve su akışını engelleyen yapılar yapılmayacaktır. Özel ve tüzel kişilerce yapılmak ve yaptırılmak istenen bu tür yapılara da kesinlikle izin ve ruhsat verilmeyecektir. İlgili kurumlarca yapılan denetimler neticesinde su akış kesitinin daralmasına sebebiyet verdiği tespit edilen yapılar, imar mevzuatına göre mülki amirlerin sorumluluğunda yetkili belediye veya özel idare tarafından derhal kaldırılacaktır.

5 – Dere yatağından alınacak malzeme yerleri, köprüye göre tercihen memba tarafında olacak ve hiçbir şekilde köprüye 750 m. den daha yakın mesafede olmayacaktır. Malzemenin alınması, derenin akış rejimini ve akış doğrultusunu değiştirmeyecek şekilde olacaktır. Mansap tarafından malzeme alınması durumunda malzeme alınan yerle köprüye olan mesafesi, yatağın topoğrafik, hidrolik ve taban malzemesi koşullarına göre tespit edilecek ve bu mesafe hiçbir zaman 1000 m. den daha yakın olmayacaktır. Orijinal talveg hattının muhafaza edilmesi şartıyla ruhsat verilecek, kum-çakıl işletmeleri bu esasa göre denetlenecek, aksi davranışta bulunanların ruhsatları iptal edilecektir.

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* Published in Official Gazette Dated 09.11.2006 and Numbered 26284

6 – Dere ıslah çalışmaları esnasında, kamu kurum ve kuruluşlarının sorumluluğundaki yapıların (yol, köprü ve benzeri) zarar görmemesi için ilgili kuruluşların koordinasyonu sağlanarak gerekli tedbirler alınacaktır.

7 – Karayolları Genel Müdürlüğü'nün sorumluluğundaki bölgelerde ilgili kuruluşlarca yapılacak olan yol ve sanat yapılarının projeleri için Karayolları Bölge Müdürlüklerinden görüş alınacak ve mezkûr Genel Müdürlük standartlarına uygun olarak yapılacaktır.

8 – Yol çalışmaları sırasında arazinin düşük kotlarında suyun akışını sağlamak, aynı zamanda alt yapı tesislerinin inşasına imkân tanımak için ilgili kurumların, DSİ'nin görüşleri doğrultusunda yeterli miktarlarda menfez yapmaları sağlanacaktır.

9 – Dere yatağı içinde veya dere yatağına bitişik alanlarda yapılan kum, çakıl ve stabilize malzeme ocağı işletme faaliyetleri, DSİ'nin görüşleri doğrultusunda yapılacaktır. Usule aykırı uygulamalarda ocakların izinleri, ruhsat veren idarelerce iptal edilecektir.

10 – Pek çok yörede, hafriyat, molozlar ve çeşitli atıklar düzensiz bir şekilde yollara, havzalara ve dere yataklarına boşaltılmaktadır. Boşaltılan katı atıklarla dolan derelerin yatak kapasiteleri fevkalade azaldığından taşkın riski çok büyük ölçüde artmaktadır. Dere yataklarına her türlü atık malzemenin dökülmesi, mülki amirler ve/veya mahalli idareler marifetiyle sürekli kontrol altında tutulmak suretiyle önlenecektir.

11 – Akarsu yatakları içerisinde oluşan ve dere yatağı kesitini daraltarak veya mevcut sanat yapılarının tıkanmalarına neden olarak taşkınlara ve muhtemel taşkının boyutunun artmasına sebep olan ağaçlar ilgili idarece temizlenecektir.

12 – Ana dere güzergâhlarında öngörülen bu tedbirler, yan dereler için de aynen uygulanacaktır.

13 – 4373 sayılı "Taşkın Sulara ve Su Baskınlarına Karşı Korunma Kanunu" içinde lüzumlu görülen tedbirler alınacak ve yasaklanan faaliyetlerin önlenmesi takip edilecektir.

14 – Kadastro çalışmaları sırasında, dere yataklarında tabii akışa imkân verecek ve kendiliğinden oluşmuş dere yatağı kesiti tescil dışı bırakılarak, derenin tabii akışına tahsis edilecektir. Dere yatak genişliğinin tespitinde DSİ'nin bilgisi ve görüşü doğrultusunda uygulama gerçekleştirilecektir. Kadastro çalışması tamamlanmış olan sahalarda münferit tescil müracaatları halinde de aynı usul ve esaslar uygulanacaktır.

Bilgilerini ve gereğini önemle rica ederim.

RecepTayyip ERDOĞAN

Başbakan

APPENDIX F

CIRCULAR OF THE MINISTRY OF INTERNAL AFFAIRS DATED 1994

T.C.
İÇİŞLERİ BAKANLIĞI
ANKARA

SAYI :B050MAH0060001/521.88.37.28/5496 — 3/08/1994
KONU :Taşkın Kontrolu amacıyla inşa edilen tesislerin üzerlerinin kapatılması

VALİLİĞİNE

1- Bayındırlık ve İskan bakanlığı Devlet Su İşleri Genel Müdürlüğünden alınan 12.7.1994 gün ve 2894 sayılı yazı 2.nci maddeye aynen çıkarılmıştır.

2-Bakanlığıma bağlı Devlet Su İşleri Genel Müdürlüğü'nün 6200 sayılı yasada belirtilen görevleri arasında muhtelif ölçekteki yerleşim yerlerinde taşkın kontrolü maksadı ile tesisler inşa edilmesi de bulunmaktadır.Bu tesislerin inşaatları bütçe imkanlarına bağlı olarak belirli bir program çerçevesinde yürütülmektedir.

Belde,ilçe ve il gibi planlı yerleşim yerlerinin imar planlarının düzenlenmesi aşamasında,Devlet Su İşleri Genel Müdürlüğü'nce planlanacak sahalara ait taşkın etüt raporları hazırlanarak ilgili mahalli idarelere iletilmektedir.Bu raporlarda; imar planı yapılacak sahada yer alan dere ve akarsular,taşkın sahaları,yapılması gereken taşkın kontrol tesislerine ilişkin detaylar ve iskana açılması uygun görülmeyen sahalar ayrıntılı olarak gösterilmektedir.

Ülkemizde son yıllarda yaşanan taşkınlardan edinilen müşahadeler,büyük boyutlarda mal ve can kaybı ile sonuçlanan önemli taşkınların,Devlet Su İşleri Genel Müdürlüğünün görüşü alınmadan,akarsu ve derelerin yatakları içinde iskan yapılması ile daha önce inşa edilmiş bulunan taşkın kontrol tesislerinin üzerlerinin kapatılarak açık mecraların kapalı mecraya dönüştürüldüğü durumlarda oluştuğunu göstermektedir.

Dere yatakları içindeki her türlü yapı,muhtemel bir taşkında doğrudan zarar görecek olmasının yanısıra yatağın diğer kesimlerinde de akış şartlarını bozarak normal koşullarda beklenmeyen zararlara neden olmaktadır.

Açık mecraların kapalı mecra haline dönüştürülmesi ise,her yıl periyodik olarak yapılması gereken bakım-Onarım hizmetlerinin yapılmasını imkansız hale getirmekte,bunun sonucunda zamanla dolan mecralar şiddetli yağışlarda tıkanıp taşarak daha büyük boyutlarda can ve mal kayıplarına neden olmaktadır.

Yukarıda açıklanan nedenlerle;

1- İl,ilçe ve Belde gibi büyük ve orta ölçekteki planlı yerleşim yerleri ile mevzii planlara göre yapılan küçük ölçekteki her türlü yerleşmeler için,imar planlarının düzenlenmesi aşamasında Devlet Su İşleri Genel Müdürlüğü tarafından hazırlanan taşkın etüt raporlarında öngörülen önlem ve önerilere titizlikle uyulması,

2- Akarsu ve derelerin yatakları içinde Devlet Su İşleri Genel Müdürlüğü'nün görüşü alınmadan iskan yapılmaması,

3- Daha önce inşa edilmiş olan taşkın kontrol tesislerinin üzerlerinin kapatılarak açık mecraların kapalı mecralara dönüştürülmemesi,

4-Akarsu ve derelerin yataklarının yol olarak kullanılmaması,hususlarında Bakanlığınız ilgili birimlerine gerekli talimatın verilmesini takdirlerinize arz ederim

III- Bilgilerinizi ve ilgili birimlere duyurularak gereğinin ifasını rica ederim.

(imza)
Dr.Süleyman OĞUZ
Bakan a.
Vali
Müsteşar Yardımcısı

ASLI GİBİDİR
9/08/1994
Özlem Çiğdem ÇELİK
Veri Haz.Kont.İşl.

APPENDIX G

LAW NUMBERED AS 4373

TAŞKIN SULARA VE SU BASKINLARINA KARŞI KORUNMA KANUNU (1)

Kanun Numarası :4373
Kabul Tarihi :14/1/1943
Yayımlandığı R. Gazete :Tarih:21/1/1943 Sayı:5310
Yayımlandığı Düstur :Tertip: 3 Cilt: 24 Sayfa:198

Madde 1 - Yüksek seviye gösteren umumi ve hususi, kapalı veya akarsuların taşmasiyle su altında kalan veya su baskınlarına uğrayabilecek olan sahaların sınırları Nafıa Vekaletinin teklifi üzerine İcra Vekilleri Heyetinin kararı ile tesbit ve ilan edilir.

Madde 2 - Birinci madde hükümlerine göre tesbit ve ilan edilen sahaların sınırları içinde suların akmasına engel olan bina, tesisler, fidan, ağaç, set, savak gibi manialarla değirmen ve sulama arkları hakkında aşağıdaki hükümler tatbik olunur:

a) Bina ve tesisler hakkında istimlak hükümlerine göre muamele yapılır. Bu bina ve tesislerin arsaları ve bitişik arazileri sahiplerinin faydalanabilecekleri durumda ise, bunların kıymetleri istimlak bedelinden indirilir ve arsa veya arazi sahiplerine terkedilir.

b) Fidan, ağaç ve asmalıklarla esaslı bent ve savaklar belediye sınırı içinde ise belediye encümeninin, bu sınır dışında ise vilayet daimi encümeninin seçeceği üç vukuf ehli tarafından kıymetleri takdir edilerek, bedelleri sahiplerine peşinen ödendikten sonra kaldırılır veya yıkılır. Bunların takdir olunan kıymetleri için tebliğ tarihinden itibaren beş gün zarfında ilgililerce vilayet idare heyetlerine itiraz edilebilir. Vilayet idare heyetlerinin nihayet bir ay içinde karar vermeleri lazımdır. Bu kararlar icrayı durdurmaz. Ancak bu fıkra hükmü dairesinde kaldırılacak veya yıkılacak olan fidan, ağaç ve asmalıklarla bent ve savakların kısmen veya tamamen başka yerlere nakli için sahiplerince alakalı makamlara yazı ile vukubulacak müracaatlar üzerine lüzumlu ve mümkün mühletler verilir. Bu hallerde takdir edilmiş olan bedellerden nakledilen kısımlara isabet eden miktarlar indirilir. Kaldırılan fidan, ağaç ve asmalıkların arazisi sahiplerince hiç bir surette kullanılmıyacak hale girmiş bulunursa, bunlar da (a) fıkrası hükümlerine göre istimlak olunur.

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(1) Bu kanunun, 15/5/1959 tarih ve 7269 sayılı Umumi Hayata Müessir Afetler Dolayısı ile Alınacak Tedbirlerle Yapılacak Yardımlara Dair Kanun`a aykırı hükümleri 51. maddesinin (a) bendi ile yürürlükten kaldırılmıştır.

c) Yukarıki fıkralara göre takdir edilecek bedeller Nafıa Vekilliğince ödenir. Ancak Devlet ve belediyeye ve hususi idarelerle köy hükmi şahıslarına (veya Vakıflar İdaresine) ait olan bina, tesisler, fidan, ağaç ve asmalıklarla diğer manialar için hiç bir tazminat verilmez. (1)

d) Adi bent ve setlerle çit dolma ve toprak birikintisi gibi manialar da hiç bir tazminat verilmeksizin kaldırılır.

e) Baskın sahalarının dışındaki değirmenlere, sınai tesisleri veya ekim sahalarına giden ve su baskın sahasından geçen ark ve kanallardan zararlı olanların fenni icaplara uygun olarak düzeltilmeleri için sahiplerine kafi bir mühlet verilir. Bu müddetin sonunda düzeltilmedikleri takdirde yukarıdaki hükümler tatbik olunur.

Madde 3 - Birinci madde hükümleri dairesinde tesbit ve ilan edilmiş olan sınırlar içinde tesisat, inşaat veya tadilat yapmak, fidan veya ağaç dikmek yasaktır. Müsaade verilmesi, Su İşleri Müdürünün, bulunmıyan yerlerde Nafıa Müdürünün fenni mahzur olmadığı hakkında rapor vermiş olmasına bağlıdır.

Birinci fıkra hükmüne muhalif olarak izin istihsal edilmeden yapılan ve suyun akmasına veya su seviyesinin yükselmesine tesiri olan tesisat, inşaat veya tadilat, dikilen fidan veya ağaçlar mahalli Su İşleri Müdürünün, yoksa Nafıa Müdürünün teklifi üzerine valinin karariyle yıktırılır veya kaldırılır ve bu hususta yapılan masraflar sahiplerinden alınır.

Madde 4 - Daimi bakıma tabi olsun olmasın kenar ve setlerin taşkın sularla yıkılma tehlikesine veya halkın su afetine maruz bulunduğunu görenler, bunu derhal mahallin Su İşleri, Nafıa Müdür ve teşkilatına veya en yakın muhtarlara, andarma dairelerine veyahut mülkiye amirlerine haber vermeğe mecburdurlar.

Bu mecburiyet, suların kabarma ve taşması mevsimlerinde halka ilan edilir.

Madde 5 - Tehlikenin aşağı mıntakalara sirayeti ihtimali varsa keyfiyet o ıntakalara da en seri vasıtalarla ihbar olunur.

Madde 6 - Taşkın sularla kenar ve setlerin yıkılma ve yarılma tehlikesine maruz bulunması veya yakın arazinin su baskınına uğraması gibi hallerde, hadisenin vukubulduğu mahallin en büyük mülkiye memurunun emriyle tehlike ile karşılaşan köy ve kasabaların 18 yaşını bitirip 50 yaşını doldurmamış bulunan erkekleri, ellerinde bulunan ve yıkıntıları düzeltmeğe yarayacak her türlü alat, edevat ve malzeme ve vasıtalarla tehlike yerine yardıma koşmağa ve gösterilen işlerde çalışmağa mecburdurlar.

Köylünün temin edemiyeceği anlaşılan lüzumlu vasıtaları Nafıa Vekilliği önceden kafi miktarlarda ve taşkın sahalarında bulundurur.

Tehlike ile karşılaşan veya tehlikeye uğrayan mahaller halkı ile bu afetin önlenemiyeceği anlaşıldığı takdirde, tehlike mıntakası dışında kalan komşu köy ve kasabalar halkı da birinci fıkra hükümleri dairesinde yardıma çağırılırlar.

Bunlar da gösterilen işlerde çalışmağa mecburdurlar.

Mülki idare mıntakası ayrı dahi olsa komşu köy ve kasaba halkı tehlikeye maruz mahallin en büyük mülkiye memurunun bu yoldaki emirlerini yerine getirmekle mükelleftir. Şu kadar ki bu komşu köy ve kasabaların bağlı bulunduğu vilayet veya kazaya derhal malümat verilir ve yardım istenilir.

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(1) Bu benddeki (veya vakıflar idaresine) şeklindeki ibare Anayasa Mahkemesi`nin 22/7/1970 tarih, E. 1969/35, K. 1969/70 sayılı kararı ile iptal edilmiştir.

Yardıma giden komşu köy ve kasabalar halkı da ellerinde bulunan alat ve malzeme ve vasıtaları, ameliyatı idare edenlerin emrine vermeğe mecburdurlar.

Vali ve kaymakamlarla nahiye müdürleri ve köy muhtarları ve civardaki askeri ve jandarma, gümrük muhafaza ve orman koruma kıta komutanları mafevklerinden emir beklemeksizin tehlike ile karşılaşan yerlere yardımcı göndermek ve icabında bizzat tehlike yerine gitmekle mükelleftirler.

Madde 7 - Altıncı maddede yazılı mükelleflerin önceden köy ve belediyelerce ikişer nüsha defterleri tanzim ve taşkın sahasının tabi olduğu vilayet makamınca tasdik olunarak birer nüshası köy muhtarlarına, belediye reislerine ve birer nüshası da mahallin en büyük mülkiye memuruna tevdi edilir. Lüzumu halinde mükellefler bu defterler mucbince işe davet ve sevkolunurlar.

Madde 8 - Tehlike büyük ve geniş görünürse koruma işlerini idare eden amir, gerek o mahalde ve gerek o civarda bulunan askeri ve mülki veya hususi, tahlis işlerinde faydalı teşekkül ve vasıtalardan yardım istemeğe ve bu hususta kendisine müracaat olunan her makam da derhal yardım etmeğe mecburdur.

Madde 9 - Yukarıki maddelerde yazılı koruma işlerinde çalışanların beraberlerinde getirdikleri veya ameliyatı idare edenlerin emrine verdikleri alat ve edevat ve malzeme ve vasıtalardan kırılan veya kaybolanların bedelleri Hükümetçe sahiplerine ödenir.

Madde 10 - Taşkın tehlikesine maruz bulunan yerlere geleceklerin muayyen tarifeli vasıtalarla hareket etmeleri takdirinde, nakliye ücretleri Hükümetçe ödeneceği gibi müstacel hallerde salahiyetli memurların gösterecekleri lüzum üzerine bunlar kamyon, araba gibi diğer vasıtalarla gönderilir. Bunların nakliye ücretleri de Hükümetçe ödenir. Bu işlerde çalıştırılanlara bu mesailerine mukabil ücret verilmez. Yalnız çalıştıkları müddetçe kendilerine parasız ekmek ve katık temin edilir.

Madde 11 - Bu işlerde çalıştırılırken sakatlananların sakatlık derecelerine göre kendilerine ve ölenlerin ailelerine polis ve jandarma efradı için tatbik edilen esaslar dairesinde tazminat verilir. Yaralananlar veya sakatlananlar en yakın hastanelere sevkedilir. Bütün hastaneler bu yaralı ve sakatları hemen kabul ve tedaviye mecburdurlar. Devlet ve amme müessesesi hastanelerinde bunlar parasız tedavi ettirilirler. Hususi hastanelerde yapılan tedavi bedelleri Hükümetçe ödenir.

Madde 12 - Taşkınlar için çekilen tel yazılarını ve telefon muhaberatını posta, telgraf ve telefon merkezleri ve demiryol istasyonları parasız ve acele olarak kabul etmeğe ve tel yazıyı alan memurlar da hemen mahalline göndermeğe mecburdurlar.

Madde 13 - Mahalli Hükümetin veya Su İşleri veya Nafıa Müdürlüğü memurlarının sevk kağıtları üzerine taşkınları önlemeğe gidecek olanları Devlet Demiryolları istasyon memurları asker tarifesiyle ve mahsubu bilahara yapılmak üzere hadise mahalline veya civarına indirmek şartiyle yolcu veya marşandiz katarları ile göndermeğe mecburdurlar.

Madde 14 - Bu kanunun muhtelif maddelerinde yapılacağı ve ödeneceği tasrih edilen masraflar Nafıa Vekaleti bütçesinden ödenir.

Madde 15 - 6 ncı maddeye göre taşkınları önlemek, yangın ve yıkıntıları kapamak üzere salahiyetli memurlar tarafından hadise mahalline gitmeleri emrolunanları, hastalık veya diğer makbul bir sebep olmadıkça iş başına cebren sevketmeğe mahallin en büyük mülkiye memuru mezundur. Bu husustaki emirleri zabıta kuvvetleri derhal ifaya mecburdurlar.

Davet anında köy ve kasabalarında bulunup da sıhhi vaziyetleri müsait olduğu halde ve başkaca makbul bir sebep olmaksızın bu davete icabet etmiyenlerle gidip çalışmıyanlardan kaymakam veya valinin karariyle beş liradan on liraya kadar hafif para cezası alınır. Bu kararlar katidir ve amme cezalarının tahsili hakkındaki hükümlere tevfikan icra olunur.

6 ncı maddede yazılı memurlardan hadise mahalline yardımcı göndermiyenlerle bu kanunun hükümlerini tatbikte ihmali görülenler hakkında Türk Ceza Kanununun 230 uncu maddesi hükümleri tatbik olunur.

Madde 16 - Bu kanunun hükümlerinin tatbikına ait esaslar alakalı vekaletlerce müştereken tesbit olunur.

Madde 17 - Bu kanun neşri tarihinden mer`idir.

Madde 18 - Bu kanunun hükümlerini icraya İcra Vekilleri Heyeti memurdur.

APPENDIX H

PROTOCOL ON THE PROTECTION OF FLOOD-PRONE SETTLEMENTS

T.C.
ENERJİ VE TABİİ KAYNAKLAR BAKANLIĞI
DEVLET SU İŞLERİ GENEL MÜDÜRLÜĞÜ
Etüd ve Plân Dairesi Başkanlığı

Sayı : 124.1-~~501~~- 6743

Konu : Taşkına maruz yerleşim yerleri için tanzim edilen protokol.

ANKARA
24.12.1984

DSİ BÖLGE MÜDÜRLÜĞÜNE

Afet İşleri Genel Müdürlüğü ile Genel Müdürlüğümüz arasında, taşkına maruz yerleşim yerlerinin korunması veya nakli için yapılacak etüdlerin ve etüd sonucu uygulamaların tesbit edilmesi için tanzim edilmiş olan prensip protokol'undan 1 örnek iliçik olarak gönderilmiştir.

Yerleşim yerlerine ait etüdlerin yapılması sırasında adı geçen protokol'un gözönünde bulundurulmasını rica ederim.

GENEL MÜDÜR ADINA

Sayhan DAYOĞLU
Genel Müdür Yardımcısı

EK : 1 Adet Protokol.

Tümay Bilgeler

AFET İŞLERİ GENEL MÜDÜRLÜĞÜ İLE DEVLET SU
İŞLERİ GENEL MÜDÜRLÜĞÜ ARASINDA YAPILAN
PRENSİP PROTOKOLU

Madde : 1- TARAFLAR

Bayındırlık ve İskan Bakanlığı Afet İşleri Genel Müdürlüğü ile Enerji ve Tabii Kaynaklar Bakanlığı Devlet Su İşleri Genel Müdürlüğü arasında aşağıda yazılı prensip anlaşması için düzenlenmiştir.

Madde : 2- 7269-1051 sayılı Afetler Yasasının 2 ci maddesi su baskınına uğramış veya uğrayabilir bölgelerin tesbit işleminin İmar ve İskan Bakanlığının teklifi üzerine Devlet Su İşlerinin bağlı bulunduğu Bakanlıkça yapılacağı, 3 üncü maddesi ise su baskını dışında diğer doğal afetlerde meskun yerlerde alınacak önlemlerin İmar ve İskan Bakanlığınca; su baskınına uğrayabilecek yerlerde ise önlemlerin D.S.İ.nin bağlı bulunduğu Bakanlıkça alınacağı ve bu işlere ilişkin ödeneğinde önlemleri almakla görevli Bakanlıkça karşılanacağı hususlarını öngörmektedir.

Yasanın bu hükümlerine göre tarafların koordineli bir şekilde çalışmasını sağlamak amacı ile işbu protokol düzenlenmiştir.

Madde : 3- Taşkın yönünden Valiliklerince(Bayındırlık ve İskan Müdürlüğü) düzenlenen ön raporlar ile, olmuş afet yönünden düzenlenen hasar tesbit raporlarından ikişer takım Afet İşleri Genel Müdürlüğünce, incelenmek üzere D.S.İ. Genel Müdürlüğüne iletilir.

Madde : 4- D.S.İ. Genel Müdürlüğü, Madde: 3 te belirtilen taşkın konusuna öncelik vererek yıllık etüd programlarına alır ve program gereği hazırlanan etüd raporu sonucu bilgi olarak Afet İşleri Genel Müdürlüğüne gönderilir.

Madde : 5- D.S.İ. Genel Müdürlüğünce yapılan taşkın etüdleri sonunda hazırlanacak rapor ekonomik bulunduğu takdirde konu bütçe imkanlarına bağlı olarak yıllık uygulama programlarına dahil edilir.

Korunması ekonomik bulunmayan ve nakil önerilen yerleşme yerlerine ait raporlar için, her iki Genel Müdürlüğün uygun gördüğü tarihte konu mahallinde birlikte tetkik edilerek; yeni yapılacak konutların maliyetleri ve alt yapıları dikkate alınarak ekonomik değerlendirme yeniden ele alınarak Devlet için mümkün olan en uygun çözüme bağlanır.

-1-

-2-

Madde : 6- Bu protokol imza tarihinden itibaren yürürlüğe girer.

Afet İşleri Genel Müdürlüğü		Devlet Su İşleri Genel Müdürlüğü
(İMZALI) Rafet GÜNEY Genel Müdür	20.12.1984	(İMZALI) Ata Erol ENACAR Genel Müdür
(İMZALI) Muhsin SEFEROĞLU Genel Müdür Yardımcısı		(İMZALI) Sayhan BAYOĞLU Genel Müdür Yardımcısı

ASLININ AYNIDIR.

APPENDIX I

AN EXAMPLE OF THE SEMI-STRUCTURED QUESTIONNAIRE

ANKET FORMU:

Aydın ili 1956, 1958, 1965, 1993, 1995, 1996, 1998, 1999, 2001, 2003, 2004, 2005 ve en yakın 2007 yılında olmak üzere giderek artan şiddet ve etkide Büyük Menderes Nehri ve kollarının taşkınlarına maruz kalmaktadır. DSİ'nin arşivlediği can ve mal kayıpları incelendiğinde özellikle 2001 yılında meydana gelen taşkınlarda il genelinde 1 kişi hayatını kaybetmiş, yaklaşık 305 adet konut etkilenmiş, ve 1000 hektar tarım alanı taşkın suları altında kalmıştır.

SORULAR:

1. (a) Belediyeniz'de / İlçeniz'de taşkın (sel) tehlikesi ve yarattığı muhtemel can ve mal kayıpları zaman içinde önemini korumakta mıdır?

   (b) Sizce akarsu ıslah tesisleri ve bentlerin inşası gibi alınmış olan tedbirlere rağmen bu kayıplar zamanla büyümekte mi, yoksa azalmakta mıdır?

   (c) Neden?

2. (a) Belediyeniz'de / İlçeniz'de yaşanan son taşkın sonrasında, gelecekte tekrarlanması ihtimaline karşı hangi tedbirler alınmış bulunmaktadır?

   (b) Başka hangi tedbirleri almayı yararlı görmektesiniz?

   (c) Yeterli parasal destek ve yetkiler verilse, Belediyeniz'de / İlçeniz'de hangi önlemleri almak uygun olurdu?

3. (a) Devlet Su İşleri tarafından taşkın ihtimaline, taşkına maruz alanlara ve taşkından korunmak için alınması gereken önlemlere ilişkin idarenize yeterli bilgi veriliyor mu?

   (b) Belediyeniz'de / İlçeniz'de imar planı hazırlama ve uygulama aşamasında DSİ tarafından verilen bu bilgi ve önerilere uyulması zorluk yaratıyor mu? Örneğin; imar planlarını hazırlarken ve/veya uygularken, DSİ'nin "taşkına maruz alanların akarsu ıslah projeleri tamamlanıncaya kadar hiçbir suretle yerleşime açılmaması gerektiği" görüşü ne tür zorluklar yaratmaktadır?

   (c) Belediyeniz'de / İlçeniz'de taşkın tehlikesine maruz alanlarda yapılaşma ve arazi/ bina kullanım konularında hangi genel karar ve kısıtlamalara başvurulmaktadır?

   (d) Belediyeniz'de / İlçeniz'de taşkın tehlike bölgelerinde kamu mülkiyetinde ve özel mülkiyette bulunan arsa ve araziler üzerinde ne gibi kısıtlamalar uygulanabilmektedir?

   (e) Belediyeniz'de / İlçeniz'de taşkın tehlike bölgesinde korunması gereken tarihi eser varsa bunlarla ilgili hangi uygulamalara başvurmaktasınız?

4. Belediyeniz'de / İlçeniz'de özellikle hazırlanmış imar planlarında:

   (a) yerleşim merkezinden geçen akarsuların yakın çevresiyle birlikte açık ve yeşil alanlar, spor alanları, parklar, yürüyüş ve bisiklet yolları, çay bahçeleri vb... kullanımları içeren ortak bir kamu değeri olarak mı?

   (b) yerleşim merkezinden geçen akarsuların üstü kapatılmış kanallar olarak tasarlanarak, kent merkezinde ihtiyaç duyulan (alışveriş merkezleri, otopark, cami, ticarethaneler, ulaşım yolları vb...) kullanımların karşılanması mı?

   tercih edilmiştir.

5. (a) Belediyeniz'de / İlçeniz'de, meydana gelebilecek taşkınlarda kullanmak üzere yeterli araç-gereç ve kurtarma faaliyetinde uzman personel bulunmakta mıdır?

   (b) Belediyeniz'de / İlçeniz'de taşkın sonrasında acil yardım ve kurtarma çalışmaları için hazırlanmış bir plan var mıdır? Var ise; bu plan hazırlanırken Valiliklerin sorumluluğundaki 'İl Afet Planları' dikkate alınmakta mıdır? Ve hangi sıklıkta yenilenmektedir?

   (c) Belediyeniz'de / İlçeniz'de taşkın tehlikesi karşısında, kayıpları en az düzeye indirmek amacıyla, taşkın öncesinde uygulanan hangi çalışmalar yapılmıştır? Bu çalışmalarda hangi kişi, kurum ve kuruluşların bilgisinden yararlanılmıştır?

6. (a) 'Taşkına Maruz Alanların Yönetimi' konusunda bir yasa taslağı hazırlanması söz konusu olursa yerel yönetimlere hangi yetkilerin verilmesi uygun olur?

   (b) Belediyeniz'de / İlçeniz'de taşkın tehlikesinin yaratacağı kayıpların giderilmesinde yerleşim alanı ve yönetim alanınızın sınırları dışında (akarsu havzası sınırları içinde) alınacak önlemlere ilişkin tarafınızca yetkiler edinilmesi gerekir mi?

   (c) Yeni bir yasal düzenleme yapılmak istenirse; akarsu havza sınırları dahilinde taşkın risklerini belirleyen, değerlendiren ve bu riskleri azaltmaya yönelik bütünleşik önlemler programını içeren bir plan hazırlama yetkisi ile buna bağlı olarak hazırlanmış imar planlarını denetleme yetkisinin, kurulacak ne tür bir kurum bünyesinde olmasını beklersiniz?

Gösterdiğiniz ilgi için teşekkürler.

Anketi cevaplayan kişinin adı-soyadı:..
Mesleği:..
Kurumda çalıştığı bölüm:..
Telefon Numarası:..
E-posta adresi:..

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Şenol Balaban, Meltem
Nationality: Turkish (TC)
Date and Place of Birth: 5 May 1976, İzmir
Marital Status: Married
email: meltemsenol@gmail.com

EDUCATION

Degree	Institution	Year of Graduation
MS	METU Urban Design	2001
BS	METU City and Regional Planning	1998
High School	Karşıyaka Gazi	1993

WORK EXPERIENCE

Year	Place	Enrollment
2005-2008	METU City and Regional Planning Dept.	Part-time Instructor
2004-2005	GeoForschungsZentrum-Germany	Researcher
1999-2005	METU City and Regional Planning Dept.	Research Assistant

FOREIGN LANGUAGES

Advanced English, Grund Stüfe Deutch

PUBLICATIONS

1. Şenol Balaban, M. "Global Warming, Flood Disasters and Turkey", pp. 58-70 in Proceedings of *Flood Conference for 5th World Water Forum*, 19-20 June 2008 held by State Hydrolic Works, Edirne (2008) (in Turkish)
2. Şenol, M., "Floods and Flood Management", pp. 119-124 in Architects and Disasters: Summer School 2004 held by International Union of Architects (UIA), edited by Emine Komut, Ankara (2005)

HOBBIES

Movies, Music, Cooking, Traveling