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Flood prevention and Sustainable Spatial Planning.

The case of the River Diakoniaris in Patras

Abstract

The danger of floods from overflow of rivers that crosses urban regions is a frequent phenomenon that concerns many of European countries. In the framework of Sustainable Spatial Planning arise some serious questions for the way that should such phenomena be handled, apart from the purely hydraulic conventional interventions. Noteworthy that at his flow a river runs through usually at all the length completely dissimilar regions as long as they concern in geomorphology but also their urban characteristics (urban density, existing land uses etc). Through the experience of other countries, different approaches in institutional and urban metres will be studied. Also, the possibility of redesigning the flood region of urban rivers will be examined, proposing suitable uses per case. The article will investigate the example of Diakoniaris River in Patras/Greece It is a river that crosses the coastal city of Patras in length of 4 kilometres roughly in address E-W, and in the past (1962,2001) he has created catastrophic floods. Our approach focuses on the suggestion of proposed institutional regulations but also methodological approaches that concern in the flood-preventing protection of urban regions

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Introduction

The climate changes and the fact that between 1998 and 2004 Europe suffered over 100 major damaging floods, led E.U. to an intensive reconsideration of flood protection policies in general, through the establishment 2002 of the European Union Solidarity Fund, the INTERREG Initiative for transboundary rivers and lakes' management, Research Projects and Strategies etc..

The cornerstone of EU water protection policy is the 2000/60 Water Framework Directive¹ (WFD), which develop the river basin as a single management system. Lately, in January 2006, EU creates a Proposal for a Directive² on the Assessment and Management of Floods. At this Proposal Directive is a three-step process developed. First, Member states will undertake a preliminary flood risk assessment of their river basins and associated coastal zones. Where real risks of flood damage exist, member states shall then develop flood risk maps. Finally, flood risk management plans must be drawn up for these zones. The implementation of the directive will follow on gradually and the first results are not expected before 2013.

Floods can be caused by river overflowing but also (which is very typical of Greece) by high rain intensities over the city combined with inappropriate sewer system. In Greece the incorporation of flood prevention as a parameter of urban planning context is relatively ignored by planners and public. Parallel to this, different technical approaches of flood prevention strategies, which follow purely hydraulic engineering interventions, are practiced. City-rivers in Greece have lost their natural existence as open physical (eco)-systems and are used as drainage or sewerage channels-“pipes” and transportation axes. These river banks as well as many coastal regions in Greece are threatened by flood catastrophes.

The Stream river of Diakoniaris in Patras/Greece is held to be one of the most catastrophic overflowed³ rivers in Greece, recently it flooded in 2001⁴. In the case-

¹ The Implementation of the WFD in the Greek law followed by the law 3199/2003, that was hardly criticized as deficient (Spyrou 2003)

² a framework for flood risk management

³<http://tovima.dolnet.gr> , Newspaper “To Vima” 10/11/2002, pp. A45, articelcode B13711A451

⁴ Two people got drown then

study of the River Diakoniaris we will investigate the land uses over the years, its environmental degradation and finally we suggest some strategies for integrating flood prevention measures within spatial planning practice, that could be adopted in many cases elsewhere in Greece.

1. The City of Patras and the River Diakoniaris

The River Diakoniaris flows from the central heights of Mt. Panachaiko, crossing the southern part of the coastal city of Patras in a more or less E-W direction until its estuary runs into the Gulf of Patras. The Diakoniaris is 10km long, with an urban length of 3.8km and a total river basin⁵ of 20.83km² included within the municipality of Patras.

1829⁸⁶ saw the first city plan for Patras and, over the next 100 years, the city underwent continual expansion to incorporate neighbouring rural areas into its administrative and city plan. The 1930 Patras city plan, with a population of 61,278 inhabitants, covers over 400 ha. Even today, the River Diakoniaris flows outside the central areas of Patras.

Up to the beginning of '30s (figure 1), the Diakoniaris was bordered solely by fields and a great percentage of it was intact in its natural form, its riverbed undefined, with marshes and other natural elements in the wider region of the river. The land bordering on the river was cultivable. Moreover, it is believed that the river also fed irrigation canals.



Figure 1: The Riverside Zone of the River Diakoniaris, from an aerial photograph of 1931

(Source: Hercules Programme – Issue: Patras – Editor: V. Despiniadou)

The high influx from rural areas not only to Patras but also to all big cities throughout Greece at the beginning of the 1950s resulted in the city growing considerably. The

⁵ Together with six other streams that flow into it

⁶ Planned by S. Voulgaris during the early Kapodistrias Government of 1828

majority of domestic immigrants⁷ who came to Patras settled in the southeastern part of the city in illegal constructions (without building permits).

In the 1960s, large estates were divided into small 100-120m² building plots. On the banks of the Diakoniaris, universal land-grabbing or property expansion occurred through land occupation or by filling the river course with debris. In this manner, many people obtained a small residence with a backyard (on the riverbed) either for water pumping or sewerage purposes. This was not insignificant at that time, as it happened after a long period of poverty and there was no urban infrastructure in the area. The above-mentioned phenomena took place with the tolerance, not to say the co-operation of police authorities and the municipality. To date, many inhabitants still have doubtful title deeds.

In the aerial photograph of the 1959 city plan (figure 2), in the southeastern part of Patras, one can see that the building blocks extend gradually into the area of the river bed, thus not only permitting but encouraging deliberate filling with debris and building on the banks. This phenomenon is mainly observable in the coastal zone and the southwestern regions where there is a road network and connection to the city of Patras.

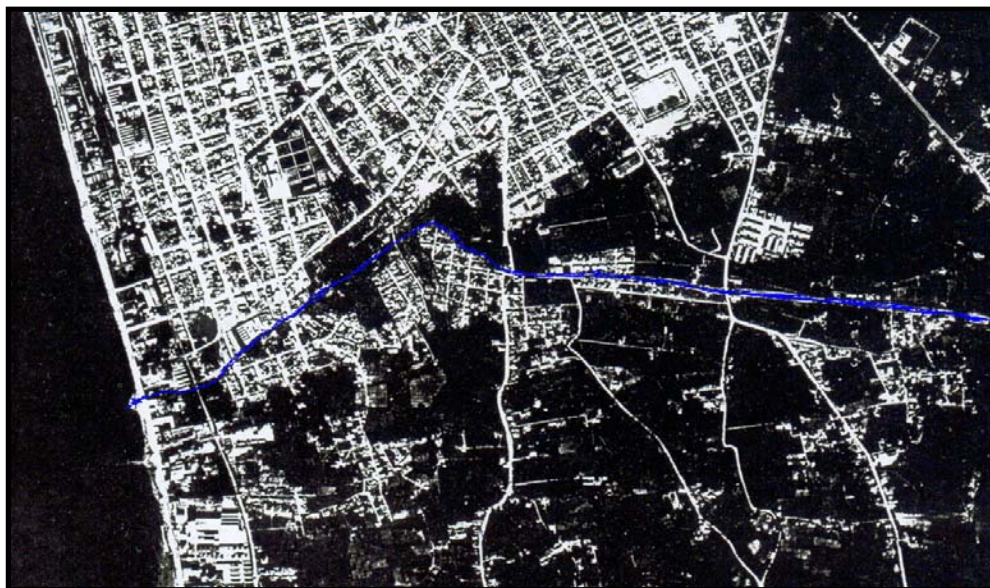


Figure 2: The southwestern part of Patras, from an aerial photograph of 1959

⁷ Characteristics of the area which proved to be of decisive significance for the mass influx of domestic immigrants were: a) the sparse structure of the area and the great number of available non-structured spaces, b) its small distance from the city centre, c) low prices of the building plots because they remained outside the city limits without even the basic infrastructure and d) the later appearance of textile, wine, brewery, tannery and paper mills in the southwestern coastal zone of Patras and the need for cheap manpower.

The human interventions which had begun to encroach on the river did not only come about from the aim to construct densely on the riverside zones but also as a result of gradual change in land use and the way of living. Consequently, the industrialization of production and progress in general were the starting point for the creation of structures causing nuisance (gas stations, garages, etc.) and burdened the river with wastes which were not natural and directly recyclable.

Consequently, opinion had it that the stream was a source of pollution and mosquitoes, and the first effects from its being filled with debris gradually began to be felt, i.e. the 1962 floods. At that time, the Municipality itself implemented full coverage of the secondary canals of the River Diakoniaris, converting them into roads or building blocks and began to discuss (Proposal for the Master Plan of Patras by Skiadaresis, 1964) the positive impact the coverage of the Diakoniaris had had up to then.

1971 was very crucial with regard to the residential development of the area because of the incorporation of its the northern section into the city plan⁸. The population of Patras counts 111,607 inhabitants and the City plan covers 920 ha. The southern part was incorporated during the 1975 'South Side: 2nd phase' expansion programme. This means that, for many decades, the Diakonaris area was built up under the principles of "outside the City Plan limits area", which explains not only the lack of uniformity of its Building Blocks and their constructions but also its complicated transport network. The exploitation of land in the northern area of the Diakoniaris does not come under statutory land use (in fact, all possible types of land use are allowed), while in the southern area of the Diakoniaris, various types of land use are permissible. The building coefficient ranges from 0.8 to 1.2 (not especially high).

However, the incorporation of the riverside area into the city plan notwithstanding (to the extent that this ever took place), the lack of cadastre led to the city plan not being implemented. Consequently, even after the revision of 1985, in many cases construction was bound by the provisions regarding settlements that existed before 1923. In the mid-90s, the southwestern part of Patras became a densely-structured area that continued gradually to 'develop', there being numerous spaces for building on or buildings that had completed their life circle, either in areas susceptible to 'residential renewal' or those close to transportation infrastructures.

⁸ At this time, half of the population of Patras resided within the area covered by the old plan, only 29.3% in the developing regions and 21.06% in areas outside city limits.

Today, the urban grid has arisen from the ‘stitching together’ of a large number of sections with very different geometrical characteristics and which exhibit discontinuity with the neighbouring areas. This results from the fact that the Diakoniaris and its confluent streams have played a disruptive role in the city grid for many decades. Upon coverage of these streams (a part of the Diakoniaris) and the structures constructed over these streams, the ‘unification’ of the various ‘remote’ areas was achieved; these areas were developed at different times and at different speeds and for this reason they now display dissimilar urban planning characteristics. The types of residence found in this area vary from huts and old, illegally-constructed detached houses to new multi-storey apartment buildings which have been constructed in accordance with the land-for-apartment exchange system. However, the common characteristics in most of the areas are large-scale segmentation, narrow roads and mixed land uses. The sectional and coincidental manner of urban growth has led to a labyrinthine road network lacking relatively major road axes, with the exception of Agios I. Pratsikas St., Akrotiriou St. and Patras-Clauss St.

The banks of the Diakoniaris from the estuary up to 1100 m upstream are now covered and constitute one of the main transportation axes (Avenue E. Venizelos) of the City of Patras. The estuary of the River Diakoniaris flows next to the new Port of Patras (Figures 3,4).

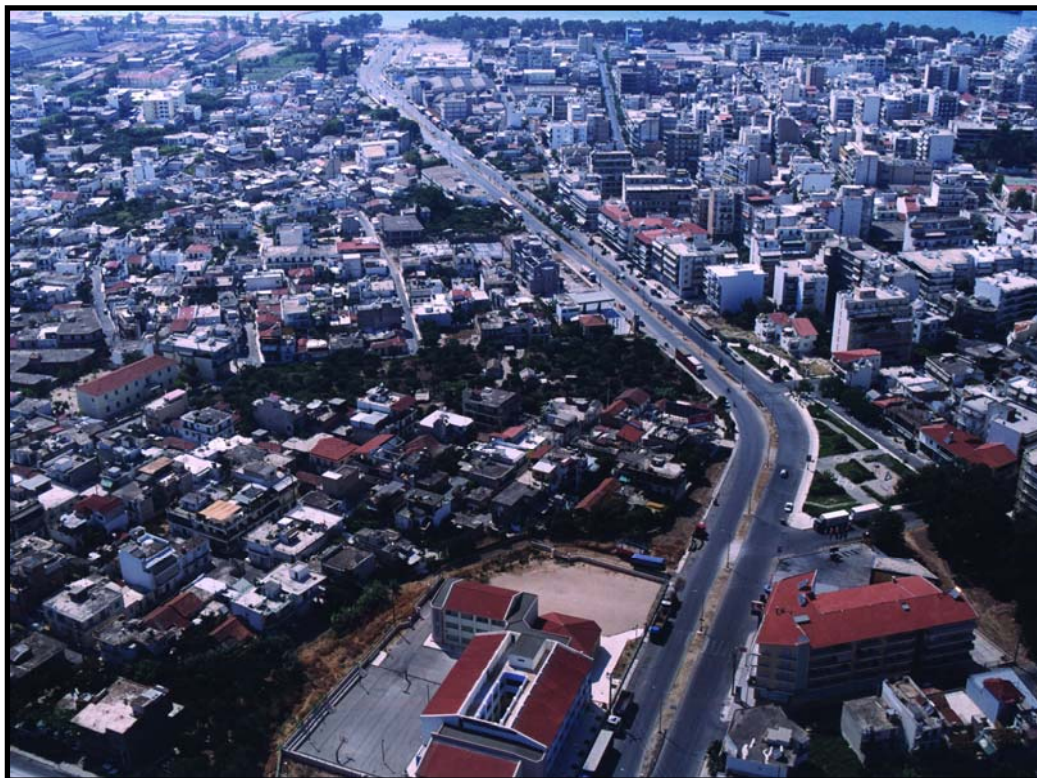


Figure 3: View of E.Venizelos St. from the estuary to Agios I. Pratsikas St. (Source: Aerial photograph file, Laboratory for Architectural Technology and Spatial Planning, University of Patras)



Figure 4: View of E.Venizelos St. from the estuary. (Source: Aerial photograph file, Laboratory for Architectural Technology and Spatial Planning, University of Patras)

The part of the River Diakoniaris (from the 5th km up to the 10th km), reflects the typical development of a peripheral Greek urban area and is characterized from the presence of small settlements with low residential density, mixes pointed land uses such as housing, farmlands, sheepfolds, e and a simple nature with some forests but not specific habitats. The networks of roads mark poor assess from one place to another. For these areas there is no specific land use regulation and the construction activities follow the built up principles of “outside the City Plan limits area”, that leads at least to an “anarchic” land usage.

In November 2005 began the conduction of the Revision⁹ of the Development Plan of Patras (Geniko Poleodomiko Sxedio). The integration of water management issues (i.e. flood prevention) to this Development Plan (which promotes according to the familiar law 2508/97 the Sustainable Urban Development), was and still is not one of its objectives.

2. Structural Projects and Environmental degradation of the River Diakoniaris

⁹ the old one was implemented 1986

In the last 30 years, from 1967 to date (2006), there have been - for various purposes - over 30 different hydrologic and hydraulic studies and more than six large-scale construction projects¹⁰ covering the greater part of the final 5km downstream (across the urban part of the river).

The most important of these have been those emphasizing the increase in capacity of the sewer systems, transforming over 2000m of the river into a sewerage outlet. In the area mainly northwards of the Diakoniaris, the Municipal Enterprise for Water and Sewage of Patras has constructed waste-water and sewerage networks, projects which are part of its effort to improve the current situation, which is untenable due to the operation of old, problematic constant-flow pipes which empty uncontrollably into the river and the sea. The Diakoniaris passes under the K4 interchange of the perimetric Patras By-pass, with a covered sewer and a dam to retain surface materials. The basin used for the deposition of surface materials had filled up during the flood of 2001. Overall, several problems with regard to the size of the sewers and non-access to them for cleaning have arisen.

Uphill from the perimetric riverbed of the Diakoniaris, there are several stone-built dikes, constructed by the Forest Authority within the framework of previous programmes.

As mentioned before one of the greatest interventions in the river is its coverage and use of its first downstream 1100m as a basic transport axis for Patras.

The Environmental degradation pointed out below is quite typical of many rivers in Greece. In detail, across the wider Diakoniaris area and along its 5km downstream course we noticed:

- The unplanned and limited riverbanks
- Banking up of the riverbank and riverbed and reduction of its width. In many cases, wall supports for buildings encroach on the river
- Illegal sandstone removal for construction use
- Use of the riverbank as building ground by land-grabbers
- Establishment of public buildings on the riverbed (e.g. the Athletics Gymnasium of Patras) or the council estates of St. Nektarios and the Music Gymnasium of Eglykas built directly on the riverbank
- Degradation or total destruction of natural vegetation across the wider Diakoniaris urban area
- Riverbank erosion

¹⁰ See Anastasopoulos I. – Zappis D. 2004

Because of this, the residents of Patras and its visitors have lost all possibility of access to the banks of the Diakoniaris.

3. Rivers and the legislation-regulation framework

Firstly, rivers and streams are protected by article 24 of the Constitution of 1975 as being elements of the natural environment (rivers are public entities), while in accordance with Law 1650/86 their protection falls under the protection of surface and underground waters and natural formations.

The legislation framework tries to regulate different topics¹¹ and issues relating to rivers and streams/river such as:

- Determination of mountainous and flat riverbed
- Demarcation of streams
- Permission of building structures near streams
- Proprietorship
- Construction of hydraulics projects and maintenance of flood-prevention projects
- Sand removal
- Policing
- Deposition of solid wastes
- Emission limits for pollutants in aquatic receivers and the terms regarding the disposal of waste-water and wastes on surface waters.

The fragmentation of the Legislative Framework, among other things, has led to division of the relevant competences (Ministry for the Environment, Spatial Planning and Public Works, Ministry of Agriculture and Forestry, Regions, Prefectures, Municipalities, Local Administration Organization, Municipal Enterprise for Water and Sewage of Patras and Municipal Enterprise for Sewerage, etc.).

On the other hand, issues relating to urban and land use planning are administered through regional and municipal agencies and/or different levels of government, which of course is not exclusive to Greece.

¹¹ The land reclamation works Directive (D7) of the General Secretary of Public Works, Ministry for the Environment, Spatial Planning and Public Works, codified these laws in Circular No. 33

However, a basic problem with the statutory framework was, and to a large extent still is, the belief that the river is an open channel for sewerage, not taking into account the social, environmental and ecological dimension of the problem.

The labyrinthine character of the procedure and competences involved in the demarcation of rivers and streams is exemplified below.

Both the General Construction Regulation and the Building Regulation define the distances (10-20m) from the riverbank and the boundary line of the river or stream respectively and one is allowed to build depending on whether or not the riverbed has been adjusted or its boundary lines have been defined. On this matter, the rich jurisprudence of the Council of the State makes it clear that, before every urban planning arrangement in an area with rivers or streams, they should first be demarcated, while sectional demarcation is excluded. Law 3010/2002 introduces sectional demarcation, accepts that any technical elements can be an integral part of a stream and requires justification of the demarcation proposal, not through studies but through a technical report accompanied by hydrological, hydraulic and environmental data on the entire river or stream. The competence of the Regional Administration to define the boundary lines was expanded to include the Local Administration Organizations but also any other person who assigns this task to an engineer entitled to draw up such diagrams. A particularly significant change is that the verification of the determination of boundary lines is now implemented by a simple decision of the General Secretary of the Home Region or the Minister for the Environment, Spatial Planning and Public Works. The Prefectures and the Municipalities are now competent to inspect the observance of the relevant legislation.

4. Sustainable Spatial planning and flood prevention

In many other countries such as Netherlands, Great Britain but also USA, Canada etc.¹² there is much experience in theory and praxis developing policies and strategies, methods and models for alternative flood control policies, that based on non exclusively hydraulic and hydrological measures.

2003 updated the UN/ECE¹³ its document “Guidelines on Sustainable flood prevention” on flood prevention, protection and mitigation. This document¹⁴ presents

¹² see references { 4, 5, 6, 11, 12 }

¹³ United Nations and Economic Commission for Europe

¹⁴ See literature {16}. Relatively, but not such detailed, lies the Proposal for the Directive 2006/66 www.europa.eu.int

principles and strategies for a sustainable planning approach for Flood prevention and draws up some best practices relating this issue.

For the development of policies and strategies concerning sustainable flood prevention and protection the UV/ECE some basic principles follow below (UV/ECE, 2003):

- a. Flood events are part of the nature. As far as possible human interference into the processes of nature should be reversed, compensated and, in the future, prevented.
- b. Flood strategy should cover the entire river basin area and promote the coordinated development and management of actions regarding water, land and related resources.
- c. To implement the basic principles and approaches cooperation an integrated approach covering all relevant aspects of water management, physical planning, land use, agriculture, transport and urban development, nature conservation, at all levers (national, regional and local) is needed. In the development of a flood management plan, decision makers at all levers (local, regional, national and international) as well as stakeholders and civil society should be involved (p.29, 2003).
- d. In setting up the strategies local problems, needs and knowledge, and local decision-making mechanisms should be duly taken into consideration. An information policy that covers risk communication and facilitates public participation in decision-making should be also developed.

Where applicable, the best practices described in this document should be taken into account, in particular on:

- Integrated river basin approach
- Research, education and exchange knowledge
- Retention of water and non-structural measures
- Land use, zoning and risk assessment
- Structural measures and their impacts
- Flood emergency
- Public awareness, public participation and insurance
- Prevention of pollution

Flood control strategies and measurements, apart from the purely hydraulic conventional interventions, were also developed in the framework of IRMA - which stands for Interreg Rhine-Meuse Activities¹⁵ - programme. In order to reduce the risk of flooding in the future, an international flood control partnership was created. The countries in the catchment's areas of the Rhine and Meuse - Belgium, France, Germany, Luxembourg and the Netherlands - submitted a joint flood control programme to the European Commission within the framework of the INTERREG-IIC initiative. Besides the EU Member States mentioned, Switzerland is also participating in various projects. IRMA-programme supports projects¹⁶ focusing on different objectives. The results are not only of scientific importance, but they have a practical value in terms of flood protection.

In Greece there is no similar experience with the exception of some research projects¹⁷ or (diploma) thesis¹⁸ which give emphasis to scientific or educational purposes. In these projects are mainly presented rehabilitation's and mitigation's measures for environmental degraded river banks. The main objective of those projects was the act of giving open spaces and natural resources, such as rivers, back to the public; flood prevention was more a sided issue.

Conclusion and Recommendations

This paper concludes that there is a need for pragmatic change in the way that flood prevention is managed and river resources are used in Greece.

In this direction the paper recommends a six point discussion agenda for this issue, which have to be a work and discussion objective by responsible bodies and authorities:

¹⁵ it was established after the Rhine and Meuse flooded their banks in 1993 and 1995.

¹⁶ http://www.irma-programme.org/b_projects/factsheets.htm

¹⁷ of different departments of National technical University of Athens see <http://www.arch.ntua.gr/research/erevnikita.pdf> and Aristotelio University of Saloniki, see <http://www.rc.auth.gr/services/labs.asp?tmima=2>

¹⁸ See references {1,2}

1. Responsible joint bodies should be established for each river basin of all rivers of an urban centre. In Patras' case (with three different urban rivers¹⁹) three such joint bodies should be created.
2. There is a need for interdisciplinary co-operation at all government and local levels and a need for a comprehensive (holistic) approach of different (sectoral) policies such as environmental protection, physical planning, land use planning, agriculture, transport and urban development regarding the river basin area and flood prevention management.
3. A strategy and an action plan for flood management should be developed by this joint body. Firstly special attention should be taken to the drainage of rainwater, for instance the capacity of the sewer system of the city of Patras. A specific feasibility study might be needed to define the design sewer system protection level, taking into consideration possibilities of rain water re-infiltration, de-coupling of waste water and rain water drainage system, and the augmentation of storage capacities within the drainage system.
Secondly a number of activities should be developed emergently such as a) identifying and designating areas prone to flooding (for the Diakoniaris e.g. the positions 1100m, 2500m, 3050m upstream) b) demarcation of the Diakoniaris' streambed in its whole length b) cleaning up its river basin from litter and solid wastes c) declaration of the rural area of the Diakoniaris as "a Controlling zone of land uses" according to the law 1337/83, so that further land-grabbing or environmental catastrophes would be controlled.
4. Different structural and non-structural measures²⁰ are probably needed. Alternative measures scenarios have to be built and their economic, environmental and social impacts have to be discussed with city, public and stakeholders as part of a scoping process. That's why is very important to identify all stakeholders and their interests. All possibilities have to be discussed, analysed and measured no matter about costs. In this context a multi-criteria analysis would be a helpful tool.
5. A geological, meteorological and hydrological information system and database, if possible with a fully automated data communication system, should be created for the entire river basin and flood forecasting models should be

¹⁹ Diakoniaris, Glaykos, Elekystras

²⁰ based on improving (also by removing) river basin land-uses, promoting rainwater infiltration with the help of unsealing measures etc.

worked out. On this way flood authorities and citizens in threatened areas could be informed in real-time.

6. The coordination of the flood prevention action plan of all joint bodies for every single river catchments area has to be carried out from the City Planning Organization. Even though the familiar Law, foreseeing the establishing of the Planning Organization of Patras and its responsibility for the Study und Implementation of the Master Plan of Patras, already exists since 2000, nothing has happened yet.

Last but not least the political consensus is prerequisites, for the integration of flood prevention management to the spatial planning context, as it is for all serious matters. Hopefully this will happen before the next great flood catastrophe appears.

References

1. Anagnostopoulos K.: The stream river of Picrothafni in Athens, thesis, National Technical University of Athens, Greece, 2003 (in Greek)
2. Anastasopoulos I. – Zappis D., The stream river of Diakoniaris, thesis, University of Patras, Patras, 2004 (in Greek)
3. Blowers A.: Planning for a sustainable environment. Report by the Town and Country Planning Association pp. 1-18, Blowers A. edit., Earthscan, London, 1993
4. Brouwer R., van Ek R.: Integrated ecological, economic and social impact assessment of alternative flood control policies in the Netherlands, *Ecological Economics* 50, pp 1-21, 2004
5. Conway T., Lathrop R.: Alternative land use regulations and environmental impacts: assessing future land use in an urbanizing watershed, Elsevier – Science Direct – *Landscape and Urban Planning*, 2003
6. Crewe K.: “Linear Parks and Urban Neighborhoods: A Study of the crime impact of the Boston South – West Corridor”, *Journal of Urban Design* V.6, N.3, 2001
7. European Commission of the European communities, Proposal for a Directive of the European parliament and of the Council on the assessment and management of floods, SEC 2006/66, Brussels 18.01.2006
8. Heiland P. – Dapp K.: „Fortschritte beim vorsorgenden Hochwasserschutz durch die Raumordnung“, *Raumforschung und Raumordnung*, Carl Heymanns Verlag, H. 5-6, S. 337-350, 2001
9. Huttenloher Ch.: “Interreg Rhein – Maas Aktivitäten“, *Raumforschung und Raumordnung*, Carl Heymanns Verlag, H. 5-6, S. 359-369, 2001
10. Keystone Stream Team, Alliance for the Chesapeake Bay: “Guidelines for Natural Stream Channel Design for Pennsylvania Waterways” 2003
www.canaanvi.org

11. Ledoux L. – Cornell S. - and others: “Towards sustainable flood and coastal management identifying drivers of, and obstacles to, managed realignment”, Land use policy, volume 22, issue 2, pages 129-144, 2005
12. Pinkham R.: Daylighting. New life for buried streams, Rocky Mountain Institute, Old Snowmass, Colorado, 2001 www.rmi.org
13. Richter G. – Siegel B.: „Vorbeugender Hochwasserschutz in Flusseinzugsgebieten. Konsequenzen für die Raumplanung“, Raumforschung und Raumordnung, Carl Heymanns Verlag, S. 351-358, H. 5-6/2001
14. Spyrou G.: Sustainable management of Water resources, actual situation and the role of the structural funds in Greece, Congress of National Technical University of Athens for the 2000/60 Water Framework Directive, Athens, 2005
15. The Countryside Agency - English Heritage - English Nature - Environment Agency: “Environment Quality in Spatial planning, Incorporating the natural, built and historic environment, and rural issue in plans and strategies”, 2005
16. United Nations and Economic Commission for Europe: Best practices on flood prevention, protection and mitigation, 2003
17. http://www.irma-programme.org/b_projects/factsheets.htm
18. <http://www.floodsite.net>
19. www.irma-programme.org