

# Ecological Riverfront: A Sustainable Approach to Urban Waterfronts

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**Abstract**—*The river faces several ecological and environmental challenges. The rapid urbanization and industrialization in the urban area, that has been escalating since the late 1980s, have led to a heavy exploitation of the water resources. This has resulted in pollution and degradation of the water quality. In many places untreated sewage water and solid waste is directly discharged and dumped into the river. This is a common practice has been going on for several decades.*

*The rapid urban growth in the 1990s-building boom, called for easy access to raw material. I.e. Sand for mortar and cement. The river was therefore heavily exploited as the sand was excavated out from the site. This resulted in a hollowed-out riverbed and new exposed banks.*

*Simultaneously, the influx of people to the urban cities put pressure on the existing housing stock, which gave rise to many informal settlements around the cities, also along the rivers. The sand mining, has changed the morphology of the rivers significantly, by lowering and narrowing the course of the river, revealing large sand flats in the riparian zone. Some of this land was then occupied by informal settlements*

*As cities reclaim their rivers, a rare opportunity is offered to repair past damage, to prevent new injury, and to create more sustainable communities. In virtually every case, these cities have a tremendous opportunity to direct riverfront revitalization efforts that will help to bring rivers and the communities that depend on them back to health*

## 1. Introduction

Cities & Towns along rivers:

These cities & towns are an outstanding example of a traditional rural human settlement, land-use, or sea-use which is representative of a culture, or human interaction with the environment and is directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. These cities & towns have a characteristics that have component of religious, spiritual & ecological significance



Figure 1: Confluence Riverfront Park

## 2. History

A typical river city was established in the early nineteenth century with a simple wooden jetty, which later grew to include multiple piers and a street network that linked the waterfront to commercial buildings as river traffic increased. Growth occurred whenever this pattern—more piers, followed by more roads and more buildings—was repeated. As a result, growth was centered around transportation, general commerce, shipbuilding, and commercial fishing. Railroads entered most towns and cities by the mid- to late 1800s; accordingly, more river-edge lands were filled in to accommodate rail infrastructure, and warehouse and downtown commercial space increased.

As transportation shifted from water to rail, the river edge became less important as a social and retail space, and the city's downtown moved away from the river. Yet the urban riverfront remained active and vital as an economic center. Warehouse, road, and rail infrastructure was expanded, concentrating large-scale commercial and industrial uses along the waterfront. These uses began to dominate many cities' waterfronts by the late nineteenth and early twentieth centuries (Wrenn, 1983).

### 3. Urban Health and Ecology Of River

River ecosystems are complex, with many interacting components. In order to understand how an function, it is first essential to understand the basic components of a natural river ecosystem. To do so requires information from many scientific disciplines and an appreciation of the ways in which various river components are deeply interwoven.

To make informed decisions regarding riverfront development, planners and riverfront decision makers should be aware of the fundamentals of river ecosystems

#### 3.1. Components of a River Ecosystem

- a) **Water:** water quality in terms of bod, cod, turbidity, pollution content, mineral content etc. Must be determined and monitored time to time. Water reservoirs & retention ponds must sustain aquatic life & feed optimum food to avifauna and aquatic species.

Water flow must be monitored and flood lines must be kept repetitively change as per flow and water quality and flow must take into consideration the situation of irrigation and commercial fishing.



Figure 2: Thames Riverfront

#### b) Floodplains:

The riverside land that is periodically inundated by a river's floodwaters is called the floodplain. Floodplains serve important purposes. They: • temporarily store floodwaters; • improve water quality; • provide important habitat for river wildlife; and • create opportunities for recreation. Natural floodplains help reduce the heights of floods. During periods of high water, floodplains serve as natural sponges, storing and slowly releasing floodwaters. Floodplains therefore provide additional “storage,”

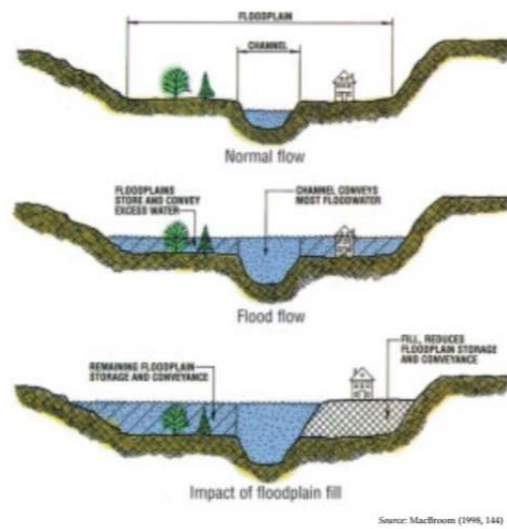


Figure 3: Floodplain Water Storage

### 4. HOW URBANIZATION AFFECTS STREAMS

Changes in stream hydrology resulting from urbanization include the following (Caraco 2000):

- Increased peak discharges compared to predevelopment levels
- Increased volume of urban runoff produced by each storm
- Decreased time needed for runoff to reach the stream, particularly if extensive drainage improvements are made
- Increased frequency and severity of flooding
- Reduced stream flow during prolonged periods of dry weather due to reduced level of infiltration in the watershed
- Greater runoff velocity during storms due to the combined effects of higher peak discharges, rapid time of concentration, and the smoother hydraulic surfaces that occur as a result of development..

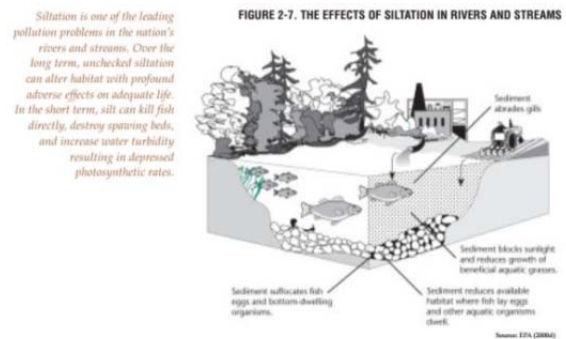


Figure 4: The effect of siltation on River Ecology

### 5. Planning & Marking the Riverfront Corridor and Its Watershed

Too many urban riverfront plans suffer from a “me-too” mentality. Politicians and planners mistakenly want their urban riverfront to become just like the San Antonio

Riverwalk or Baltimore's Inner Harbor. They soon find that attempts to transplant ideas from other places often don't work.

Every urban riverfront is different and requires planning solutions appropriate to its unique conditions. Before considering how to apply these principles, planners must carefully define their urban riverfront, including its characteristics, measurements, and boundaries.

There are mainly **five general principles** for ecologically sound riverfront design. It states that economic and ecological goals can work in concert, although compromises may be necessary, and the public always must be engaged.

**5.1. PLANNING PRINCIPLE 1: Demonstrate characteristics of the city's unique relationship to the river in the riverfront design**

**5.2. PLANNING PRINCIPLE 2: Know the river ecosystem and plan for a scale larger than the riverfront**

**5.3. PLANNING PRINCIPLE 3: Because rivers are dynamic, minimize new floodplain development**

**5.4. PLANNING PRINCIPLE 4: Provide for public access, connections, and recreational uses**

**5.5. PLANNING PRINCIPLE 5: Celebrate the river's environmental and cultural history through public education programs, riverfront signage, and events.**



Figure 5: Nanjing Haxi riverfront , China

## 6. BETTER SITE DESIGN FOR SUBURBAN DEVELOPMENT

Some A collection of planning practices known as "better site design" can conserve natural areas, reduce watershed pollution, save money, and increase property values. Better site design is an approach fundamentally different from typical subdivision design for residential and commercial development. These practices seek to accomplish three goals: reduce impervious cover, conserve more natural lands, and use porous areas for effective storm water treatment.

In 1996, the Center for Watershed Protection convened a national site-planning roundtable, which created 22 model development principles. The following 16 principles, based on the roundtable's work, are adapted with permission from CWP (2003b). They are intended to help local governments to modify their ordinances rather than to serve as national design standards.



Figure 6: Design proposal for Thames river Front

### Improvements & Benefits

Riverfront communities should provide facilities for as many recreational uses as possible while balancing some conflicting uses (for example, between power boats and bird watching platforms) and managing possible overuse of the river corridor.

Cities and towns have also done much to encourage Americans to return to urban riverfronts over the past two decades. These combine public gathering spaces and trails with natural flood control and naturalized infiltration swales.

## 7. Case Studies

### 7.1. The Guadalupe river front development san jose, california

The Guadalupe River has a long history of winter flooding that has repeatedly damaged adjacent homes and businesses in downtown San Jose, California.

As the economic investment, there has increased dramatically in recent years, the impetus for flood protection, coupled with the community's desire for open space, has grown.

#### *What Is Planned.*

Guadalupe River Park, being developed by the city of San Jose in conjunction

With a federal flood control project, is a three-mile stretch of parkland along the river on the edge of downtown San Jose. While a substantial amount of the park is already in place, the

remaining elements will be built as part of a flood control project to be completed in 2004.

In addition to providing recreational amenities to the local community, the project will provide an ecologically sound system of flood control and habitat restoration.

The U.S. Army Corps of Engineers, the Santa Clara Valley Water District, and the city of San

Jose are developing an underground system of box culverts to create a flood control mechanism.

Without destroying the streamside vegetation and trees. Maintaining the natural channel is critical to providing water temperatures cool enough to sustain the chinook salmon and steelhead populations in the river. While protecting the ecological integrity of the river, the system will have the capacity to divert significant amounts of floodwater to an existing floodplain.

Extensive mitigation planting also is part of the project, with many plants propagated from seeds gathered within the Guadalupe watershed. An extensive system of recreational trails will extend the length of the park and link to surrounding neighborhoods.

Playgrounds, picnic areas, and plazas for community celebrations will make the park a center of active urban life. Integrated into the plazas and along the trails will be interpretive information on the history, ecology, and hydrology of the project.

**Benefits to the River and Community.** The Downtown Guadalupe River Flood Control Project,

The foundation of the Guadalupe River Park plan, has been extensively refined over the past 15 years to meet the ecological needs of the river and to preserve native fish habitat. These revisions have been a result of changing regulatory requirements, new legislation, protected species listings, threats of citizen lawsuits, and, most recently, a collaborative process launched to seek consensus among all parties involved. Rather than using traditional flood control mechanisms, such as channel widening and armoring, the partners have been able to maintain a more natural riparian corridor along most of the river that complements the recreational amenities offered by

The park.



**Figure 7: Hudson Riverfront development**

## 8. Conclusion:

- a) This is the political reality faced by today's riverfront planner. Cities and industries located within river floodplains cannot be dislodged, nor should they be.
- b) Agencies and utilities that control the flow and use of water will be reluctant to cede their power, although they can be encouraged to take a broader view of river management that includes wildlife and recreation. As a result, riverfront planners may not be able to apply every principle described in this chapter to every project. In some cases, compromises may leave doors open for future river improvements.
- c) For several generations, we abused and nearly destroyed our rivers. Now, slowly, we are learning to appreciate, restore, and live with them in the best possible sense.

### I. Economic Benefits of Riverfront Design:

Urban riverfronts are being redeveloped with trails, plazas, parks, housing, restaurants, shops, offices, cultural and recreation attractions, and other amenities that draw residents, businesses, and visitors to the water. Many cities have shown that riverfront revival can improve residents' quality of life, encourage new economic vitality, and beautify downtowns.



**Figure 8: Pennsylvania Riverfront**

## 9. RECOMMENDATIONS: THE BENEFITS OF RESTORATION AND REDEVELOPMENT

It is not always possible to distinguish the economic benefit of restoring riverfronts from the value of restoring rivers themselves. Watershed protection and restoration activities upstream often may have a greater impact than ecological design practices along the riverfront itself. In some instances, however, riverfront restoration efforts can make a significant difference to overall river health.

Still, the experience of many cities has shown that river restoration and ecologically sensitive redevelopment can:

1. Improve water quality and reduce costs associated with cleanup and drinking water treatment;
2. Curb flood damage and lower the costs of flood control;
3. Decrease stormwater management costs; 4. Reduce sprawl and related infrastructure costs;
5. Revitalize the downtown riverfront with new opportunities for housing, offices, and commercial services that attract new residents, businesses, and visitors;
6. Provide jobs for residents in construction and commercial businesses;
7. Offer recreational opportunities, open space, and park amenities;
8. Raise property values and generate new tax revenues; and
10. Attract state and federal funding, new volunteers, and broad financial support.



**Figure 9: Design Proposal for Thames Riverfront Development**

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