



PLANNING STUDY FOR THE **CARDENER** RIVER CORRIDOR



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A Vision for The Cardener River



The Cardener region, located in central Catalunya, less than one hour's drive from Barcelona, boasts an outstanding cultural landscape and beautiful natural environment. In the heart of the region lies the Cardener River, a tributary of the Llobregat, which empties into the Mediterranean at the southern edge of Barcelona. Small towns and villages dating back to medieval times characterize the Cardener corridor. The river supports pioneering nineteenth century textile mills and a variety of subsequent industries. The corridor also is home to one of the oldest salt mines in Europe and to a modern potash mine. Despite centuries of intensive use, major areas of natural landscape and layers of cultural artifacts remain intact along the river, providing outstanding opportunities for natural conservation, recreation and visitor use. Today new urban growth patterns and the evolving land use along the river pose challenges. Encroachment of industrial and housing developments into the riparian zone, and agricultural pollution of the water in the upper part of the watershed are undermining the integrity of the ecosystem.

The interlinking of a long cultural history, a beautiful landscape, and an industrial river argue for continuing the regional planning already begun. Seeing the corridor as a whole builds upon multi-jurisdictional partnerships that can facilitate aesthetic and functional improvements, and balance economic development, community character and environmental issues. If utilized, the corridor planning approach can provide a means to bring together places whose futures are joined in social, economic and physical processes resulting from the flow of water. Anchored together with incentive, ownership, and decision making at the local level, this regional planning mechanism brings forth environmental improvements as well as community development benefits.

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Planning Study for the Cardener River Corridor

In 2001 a special workshop at Massachusetts Institute of Technology's School of Architecture and Planning examined the future of the Cardener River corridor in Central Catalunya, Spain. This workshop, sponsored by the Diputació de Barcelona Oficina Tècnica de Cooperació (the Provincial Council of Barcelona Office of Technical Cooperation) and the Willard Prince Memorial Fund, is one of a series of domestic and international workshops carried out by MIT's City Design and Development group. These workshops investigate current urban planning and city design issues in a dynamic setting. In recent years, these workshops have put forward ideas for areas and sites in Boston, New Jersey, Bosnia and Herzegovina and Turkey. The objectives of these workshops is not only to introduce students to the bodies of knowledge, techniques and values that must be engaged in that task of planning and design, but also to have a wider public objective. Thanks to the positive responses of the sponsors of these workshops, the reports of these workshops have stimulated public understanding and debate about pertinent local issues. The final work of these workshops has often been published in public brochures and, in many cases, has been the subject of exhibitions.

The following report describes the issues to be addressed in the planning and design of this corridor and presents the investigations and proposals for the area that were prepared by the student team.

The Planning Report

The report is organized into five sections:

Section I— A Vision for The Cardener River. This section describes the aims and process of the project and highlights its major recommendations.

Section II — Context: Building Upon Existing Initiatives. This section illustrates the main planning and design initiatives now underway along the river on which this projects builds.

Section III— River Corridor Planning: Rationale, Analysis and Planning Frameworks for the Cardener. The frameworks that guide planning initiatives within the river corridor are described in this chapter. These include Watershed Planning, Land Use and Growth, Transportation, Economic Development and Eco Industry, Ecological Restoration and Education.

Section IV— Design and Planning Interventions. This section outlines specific design interventions within the study site. It illustrates prototypical design patterns for various areas such as an urban river edge or a path system, and it describes specific interventions within four municipalities: Manresa, Sant Joan de Vilatorrada, Callús, and Súria.

Section V— Process, Principles and Precedents. This section reviews the methods and procedures of the workshop. It also presents a summary of the planning and design principles for the corridor as well as a sample of cases both from Europe and the United States which afford lessons for the Cardener.



Executive Summary

This Planning Study is built upon the existing regional and municipal plans that set forth common goals for the Cardener River corridor. The Planning Study is an exploration of possible implementations that follow from existing plans and from the current circumstances of the four municipalities: Manresa, Sant Joan de Vilatorrada, Callús and Súria.



The approach here employs the focus of regional planning to encourage the sharing of the common resources and initiatives in order to strengthen each town's uniqueness while simultaneously reinforcing the region's assets. Each suggested intervention addresses the ability of particular sites to attract particular uses while adding to the well-being of the corridor as a whole. Thus, residents from the entire region can take advantage of Manresa's recreational zone, the Rambla at Callús, or the ecological center and forest reserve at Antius and Súria. The goal of each suggested intervention is to create new uses that acknowledge the character of the corridor, rather than turning its back upon the past. All are put forth with strong sensitivity to environmental condition. The proposals seek to help the Cardener watershed and its natural systems to return to a healthy state rather than furthering the damaging effects that development often causes to the landscape.



The suggestions for particular sites rest upon a cluster of three initiatives:

Institutional Invention. Suggestions are offered for committees, councils, non-governmental organizations, and public-private partnerships. Such inventions could facilitate the planning and management of the corridor's economic and transportation improvements, land-use planning, and environmental restoration.

Education. The nurture of citizen awareness of the Cardener River and its resources is a crucial activity that can create a demand for responsible management of the river and its watershed. Education can increase the numbers and variety of citizens who enjoy the river. As a consequence it can foster citizen participation in the planning and improvement process.



Physical Measures of Progress. A complex regional planning process like the one that is now in train for the Cardener can be much aided by the provision of physical measures of progress. The building of physical improvements allows public officials and citizens to measure their joint efforts and to adjust their initiatives to changing circumstances. This report proposes physical measures in the form of two kinds of construction: a new pathway system and a new node for corridor activities. The path network of varying routes will thread through all the communities of the corridor. The node, a regional educational and enterprise zone at Antius will become a center for education and economic development. Together such physical elements will show the tangible results of efforts at regional institutional invention, public-private partnerships, and educational programs.

Context: Building Upon Existing Initiatives



The Cardener River Corridor Study Plan is built upon the results of extensive previous planning work in Catalunya. This report is thus the latest iteration in a process of evolving ideas related to watershed and corridor planning. Two reports in particular, however, were instrumental in shaping the overarching planning goals adopted by this Study Plan: the Diputació de Barcelona Blue Space Plan, and the Universitat Politècnica de Catalunya (UPC) and the Massachusetts Institute of Technology (MIT) joint report *Designing the Llobregat Corridor*. The county and town plans, such as the Green River Project Plan and the various communities' master plans, also provided specific planning directions and ideas for possible physical interventions. Ultimately, none of this work would have been possible without the detailed and exhaustive inventory and analysis conducted by UPC of the Cardener corridor's many natural, cultural and physical resources.

The Blue Space Plan

The Blue Space Plan was developed by the Diputació de Barcelona as part of its Action Plan for 2000-2003. It aims to restore and promote the functioning of rivers, coastal areas and the general water resources of the Province of Barcelona through cooperation with local entities. The Plan places strong emphasis on the value of such resources in economic, recreational, ecological and historical terms. This multiplicity of perspectives implies a complex, integrative approach to managing hydrological resources and represents a definitive paradigm shift in the framing of planning efforts for river corridors



Projecte LÍNIA BLAVA

The objectives of the Blue Space Plan include the following:

- Stimulate continuing discussion that stem from a local focus on water spaces or areas.
- Propose interventions with an integrated perspective that combines environmental, social, cultural and economic considerations.
- Design and deploy tools that can be used to answer the need for integrated planning and management.
- Foster synergies among the various local initiatives organized around issues pertaining to water resources.
- Nurture economic resources.

UTILITY OF A SYSTEM PERSPECTIVE

The ideas developed by the Blue Space Plan establish a useful point of departure for planning in the Cardener River Corridor. The Plan proceeds on the premise that individual components in a given region, while possessing distinct characteristics, are inter-related and together form a single area or system.

In the Plan, water is the element that provides continuity to a “Blue Space” that transcends municipal fragmentation, thus facilitating joint efforts across a territory. This system perspective demonstrates how water can be a catalyst for broader, more “global” action. The creation of the Blue Space Plan by the *Diputació de Barcelona* allows this institution to continue fulfilling its mandate as a facilitator of joint planning efforts among municipalities, but with a new and compelling justification for the importance of such initiatives.

The advent of this integrated approach to managing water resources in regions such as the Cardener River corridor comes at a time when similar activities are being pursued with increasing success in other areas around the world. For example, the Environmental Planning Agency of the United States has institutionalized a widespread policy-making and planning process geared at watershed management. With the formulation of the Blue Space Plan, the *Diputació* finds itself in a unique position to spearhead an approach to regional management that is gaining international currency.

At the same time, the task remains for the *Diputació*, municipalities, area businesses and community members of the Cardener River corridor to find ways to implement the objectives expressed in the Plan. In order for the Blue Space Plan to be translated into a series of concrete initiatives aimed at promoting the value of hydrological resources, serious and coordinated attention must be paid to the importance of such resources to all Cardener River stakeholders.

IMPLEMENTATION PRINCIPLES FOR BLUE SPACE INITIATIVES

While much remains to be done in order to collectively determine specific watershed management interventions that are relevant to, and supported by, the communities along the corridor, it is possible to articulate a number of important guiding principles. These principles include, but by no means are limited to, the following:

- Promote high levels of ongoing coordination between the Generalitat de Catalunya, the Diputació de Barcelona, and the municipalities of the corridor, particularly in the areas of water quality monitoring and flow management.
- Allocate funding that can help local communities and landowners address water quality problems.
- Expand initiatives related to the Blue Space Plan beyond the immediate Cardener River corridor municipalities (Manresa, Sant Joan, Callús, and Súria) to include all localities that fall within the Cardener watershed. Careful measures must be taken to ensure that participation in such efforts is not limited only to those municipalities with direct access to the Cardener River. The inclusion of all the watershed communities is essential because actions taken by 'inland' communities will affect the quality of the River. Connecting these communities to the overall access network will enhance the economic opportunities of all municipalities.
- Relationships of any kind within this watershed are dependent on a shared understanding of — and a shared responsibility for — the ways in which residents make use of water.

Green River Plan Project

The *Projecte Riu Verd* (Green River Project) is primarily an ecological riparian-restoration initiative that addresses river edge conditions within waterways features in Bages county. The project seeks to improve the vegetative edge of the rivers by introducing new plant material, controlling invasive species, and clearing overgrown vegetation. It also tries to improve public access to the river and upgrade the visual qualities of degraded sites.

Specific proposals are concentrated on the creation of two types of spaces: one type that addresses ecological goals, and the other type that seeks to establish new public spaces, often in urban centers. Additionally, the project proposes nature paths, river promenades and information panels. Within the Cardener River corridor seven sites are identified for mitigation and design. These sites range from the Sant Joan de Vilatorrada (creation of public space and promenade)



to Pla de Reguant (ecological conservation of the riparian forest) in the southern part of Súria.

Town Plans

MUNICIPALITY OF SÚRIA.

The municipality of Súria has presented the following action points with regard to its plan for the Cardener river corridor:

- Preserve forest lands, traditional elements and promote restoration.
- Restore riverfront public spaces in the Sant Jaume neighborhood.
- Develop potash mines and tailings as tourism and education possibilities.
- Preserve the Pla de Reguant as one of the most important riparian groves in the Cardener River Corridor. Besides its important environmental value, this area provides great potential for visitor use, and provides a connection to nature trails on the Tordell creek.
- Mitigate potential harmful effects to the ecological integrity of the river posed by the new industrial zones at the southern and northern edges of town.

MUNICIPALITY OF CALLÚS.

With the revision of the Master Plan, the municipality of Callús has started to address issues related to river edge conditions. The city now sees the river as a green corridor consisting of preserved landscapes, a pedestrian and bicycle path and the sensitive integration of economic development sites. One potential site is Antius, an abandoned tenth-century *masia* that was developed as a textile mill and is currently being used as residential space. While the site provides ample educational, recreational and environmental opportunities, its close proximity to the new industrial zone of Súria poses significant planning challenges.

MUNICIPALITY OF SANT JOAN DE VILATORRADA.

The municipality acknowledges that, at present, the Cardener River does not play an important role in the town's plans. The city has historically faced away from the Cardener, relegating a potentially attractive resource to remain an untended residual space.

However, the town has made some recent attempts to connect the river to the urban fabric, as seen in the recent development of Central Park and the restoration of the Gallifa factory. Overall goals include the creation of a river promenade and the recovery of public spaces along the water edge from illegal uses. The gravel mining

operation north of the city merits special attention to lessen negative effects on the river's water quality.

CITY OF MANRESA.

The Master Plan of Manresa calls for the establishment of a system of public spaces along the Cardener River between the town of Sant Joan de Vilatorrada and the bend in the river near the Manresa train station. Current planning initiatives are transforming the river's urban edge, with the express goal of improving the quality of connections between the river and the city. Some of these projects include: the revitalization of the old town, the restoration of a textile factory as a conservatory and music school, and the construction of a new court house in Reforma Square.



River Corridor Planning: Rationale, Analysis and Planning Frameworks for the Cardener



WATERSHED PLANNING

LAND USE AND GROWTH

TRANSPORTATION

ECONOMIC DEVELOPMENT AND ECO-INDUSTRY

ECOLOGICAL RESTORATION

EDUCATION AND OUTREACH

3



RIVER CORRIDOR PLANNING- FRAMEWORK

All rivers are defined by their watershed, the extent of land over which rainfall and snowmelt flow, becoming brooks and streams that eventually feed the main river itself. A watershed often extends beyond the boundaries of governmental jurisdictions, forming a meaningful unit for environmental planning.

A river corridor is a region within a watershed that shares a similar set of concerns, such as economic development, infrastructure, transportation, land use, or cultural preservation. These shared problems may help define the boundaries of the corridor, but successful planning solutions are also determined by the historical clustering of cities and towns, and the traditions and values of residents.

River corridor planning encourages community members to look beyond their immediate neighborhoods in order to devise purposeful strategies for conservation and wise use. A successful corridor planning process requires commitment and cooperative effort. It addresses concerns held by a variety of interests including landowners, river users, management authorities, the general public and, in addition, addresses the effects of these uses on the future quantity and quality of the water in the river. Such a process is intended to achieve a balance among the economic, natural, cultural, agricultural, recreational, tourist, scenic, and historic uses associated with rivers and their corridors. Ultimately, the success of these efforts can be measured by the extent to which all affected interests are willing to support the proposed planning and management concepts.

Balancing interests and goals is not the achievement of a single moment, but of a continuing process that responds to ever-new circumstances. This process rests upon two simple, yet essential, ideas:

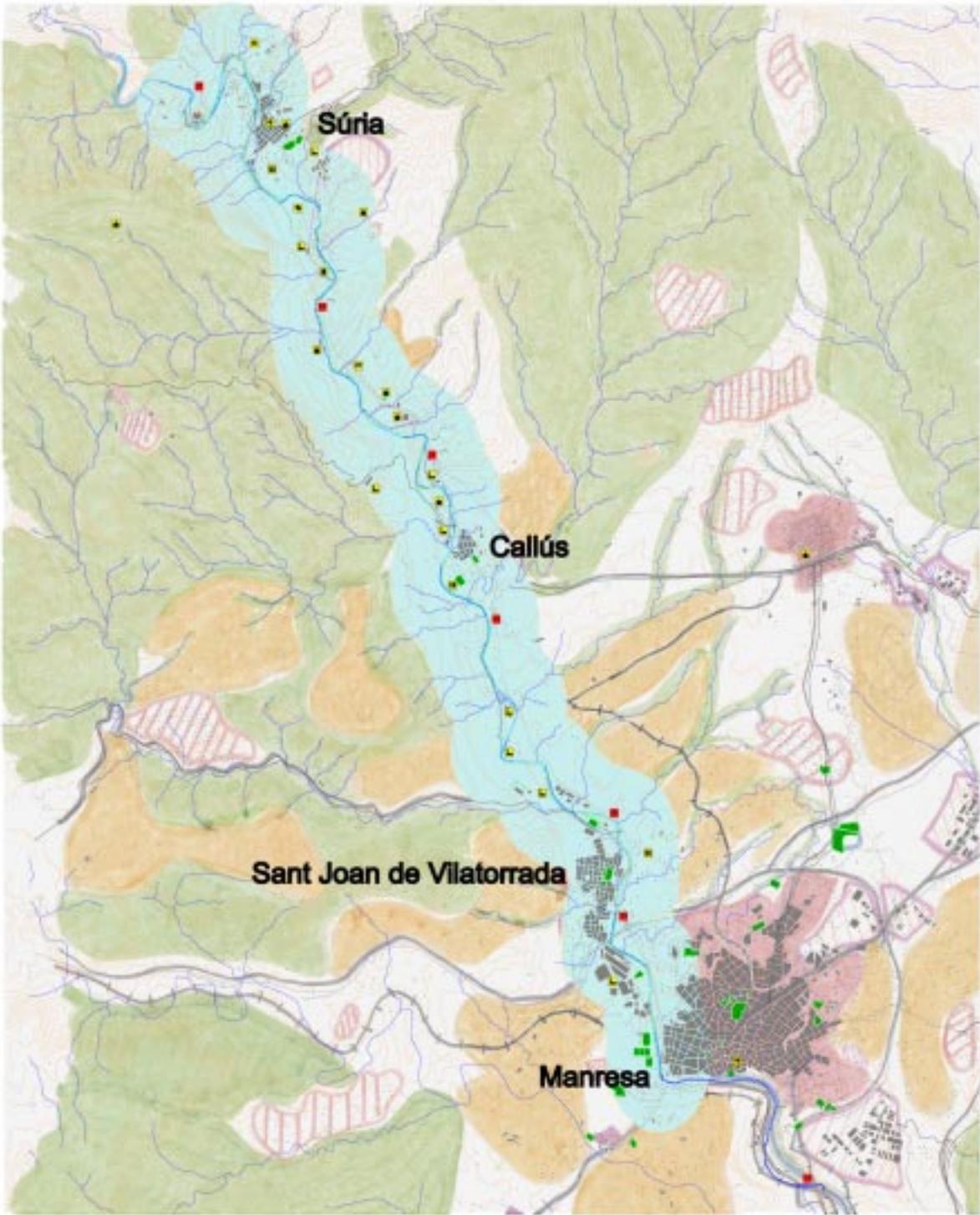
- no public action can replace the wise use of a river by those who live and work along it
- effective river management cannot succeed without local consensus and continuing support

This type of planning effort must look at the totality of the corridor and its setting within the watershed. Too often river planning efforts focus solely on one issue such as building a new dam, providing recreational facilities, or locating new industrial or housing development. For most rivers that pass through communities, single purpose planning is not feasible. All uses must be taken into consideration before decisions can be made.

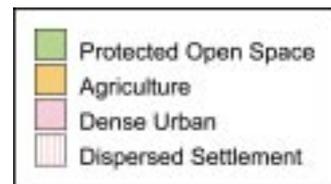
A community based corridor planning project can shape the future of a river's resources through the use of the following specific actions:

Coordination:

Find creative ways to coordinate existing programs at the various government levels (Generalitat de Catalunya, Diputació de Barcelona, the local towns, etc.) to address the problem of overlapping jurisdictions and inconsistent agency actions; improve coordination/cooperation among governments, local agencies, and private groups; es-



THE CARDENER CORRIDOR STUDY PLAN



establish public and private partnerships; develop the means to achieve balanced participation by all river corridor users.

Education:

Develop public awareness of the relationship between the natural environment and land use, thus encouraging active public participation in river planning efforts.

Assistance:

Provide technical and financial assistance to local governments, private groups and individuals to encourage appropriate future uses of river corridors.

Information:

Gather and disseminate information regarding river assets, projects, case studies and other technical data to promote more comprehensive, objective decision-making and conflict avoidance between competing river uses.

Legal:

Identify the appropriate means and agents to ensure adequate public access to river corridor land and water while considering property interests and ecological systems.

Public Involvement:

Develop creative mechanisms to identify and mobilize river corridor constituencies so that the public can easily join in the planning and decision-making process.

Planning:

Ensure that planning for river corridors is coordinated between all levels of agencies and interests; address the full range of resources, problems, opportunities and river interests; use consistent systematic and objective approaches for planning; encourage environmentally sound conservation and resource management strategies; identify opportunities for economic and commercial development; and establish priorities for a range of uses.

Policy:

Establish national and local policies to promote consistency and coordination. Encourage a balance between social and economic priorities while retaining resource values and reducing conflict.

Resource Management:

Develop balanced planning and management mechanisms which provide the opportunity for both conservation and development of river resources, coordinated among all landowners and users, interest groups, and agencies.

RIVER CORRIDOR PLANNING PROCESS:

The planning process builds on citizen-based participation in all phases of the plan's development. Plans are wholly produced by members of the targeted communities in order to build a broad base of support that will facilitate implementation of the plans. A typical process may involve the following steps:

- 1) assessing the special resource values of the corridor;
- 2) identifying the issues of greatest concern to area residents;
- 3) ensuring a broad cross-section of the community participate in or contribute to the process;
- 4) setting goals based on the identified issues and resources;
- 5) considering alternatives for resolving the identified issues; and
- 6) developing a final set of recommendations and a plan of action.

Watershed Planning

The Cardener Region is rich with cultural, historical and natural resources. The Action Plan for the Diputació clearly states the desire to conserve these resources while simultaneously accommodating the uncertainties of economic growth. Such a task challenges communities throughout the world, particularly in the face of the growth of the global economy. Coordinated regional planning represents one way to respond to this challenge, and has been successfully accomplished in many regions. While Manresa, Sant Joan de Vilatorrada, Callús and Súria are all attempting to encourage economic growth and to accommodate cultural and natural resource conservation, their efforts are rather disparate. Our proposal for this region seeks to build on existing town plans, the Blue Space Project, the Green River Project and the Diputació Action Plan 2000-2003. We stress the importance of implementation and coordination. In effect, the following recommendations represent the next steps to implement the existing goals



The Cardener Watershed

and plans. Our proposal suggests that a process-oriented and coordinated development program, a diversity of land uses, environmental sensitivity, and unique design elements which highlight the identities of each municipality along the Cardener River corridor are critical to the successful development of the region.

A COORDINATED PLANNING APPROACH

One means to achieve these goals is to adopt a watershed approach to planning. This approach utilizes a regional perspective, focusing on hydrologically defined drainage basins rather than on politically defined boundaries, thereby encouraging cooperation between municipalities.¹ The image above shows the Cardener River corridor divided by watershed boundaries rather than by municipal boundaries and reflects the literal physical connections between land-use activities throughout the region

IMPORTANCE OF WATERSHEDS

Why are watersheds important and how can they inform the development of a region? In response to this question, we point to a growing body of literature and research which has made connections between

the impervious surfaces in developed, urban areas and the health of regional ecosystems. In a draft review of current literature on Smart Growth by the United States Environmental Protection Agency, the authors note that “dispersed and scattered development reduces water quality, centrally located compact development may improve overall watershed quality, and...concentrating development may produce localized ‘hot spots,’ e.g., areas of further water body impairment due to concentrated development.” These findings suggest that low density, single use development can cause serious water degradation, yet this may be mitigated, in part by infill, mixed-use developments and through the redevelopment of existing facilities. Mixed-use development may also help reduce these problems by requiring less impervious surface area for new developments. These findings reflect the important message that changes in the landscape, particularly the physical characteristics and location of new development, can have a profound impact on water quality and quantity.



REGIONAL PLANNING AND OPEN SPACE PRESERVATION

The watershed approach also has implications for localized and regional development: “These concepts can be applied not only at the level of a particular site, but in the overall development patterns of a geographic region to pursue water quality protection on a watershed scale.” For example, protecting open space in outlying undeveloped areas which often have a high concentration of brooks and small streams (that is, first and second order streams) is one way of ensuring overall regional water quality. “Like New York City, Austin, Texas has developed both a Drinking Water Protection Zone and a Desired Development Zone to protect the city’s drinking water source, the Barton Springs aquifer. The program consists of several measures to identify, acquire and protect the lands most crucial to protecting the drinking water source.”²

Watershed management is becoming more and more commonly practiced, with successes in both the U.S. and Europe. In Malmo, Sweden, “The trend...is to replace traditional planning procedures with a more integrated structure to city planning with water, green structure, and waste plans, developed alongside the masterplan” (p.163.) This type of management can also save agencies time and money, while improving environmental protection. In the US for example, the state of North Carolina was able to monitor nearly 40 percent more waterways with the same level of effort after monitoring was conducted on a more coordinated watershed basis.³

These lessons have particular meaning given the goals of the Green River Project and Blue Space Project to revegetate critical habitat along riparian areas. In addition, the watershed approach can inform many types of decisions and activities, including land-use planning, infrastructure planning, transportation decisions, natural resource management and restoration, and economic development.



INSTITUTIONAL MEASURES FOR PROMOTING A WATERSHED APPROACH

An effective watershed management effort involves cooperation among adjacent towns and cities, and coordination among a wide

array of actors, including citizens, government agencies, non-profit organizations, and the private sector. Successful, long-sustained watershed initiatives draw heavily upon citizen concerns about local or regional problems and are guided by sound data and information. Effective collaborative planning requires broad participation by those likely to be affected by the outcome. Sometimes these stakeholders are beyond the physical boundaries of the watershed or river basin in question, so that a “problemshed” must be accounted for. In a successful process, scientific analysis is married with public participation, ensuring that decisions based on cultural values are informed decisions with respect to likely consequences and a clear understanding of who benefits and who pays. It is also important to increase public awareness and education, to collect necessary information through monitoring and research, establish appropriate plans and priorities, obtain funding and technical assistance, and to pay particular attention to the process of implementation.⁴

There are several models of how a watershed planning approach can be institutionalized by government agencies. In New Jersey, the State Department of Environmental Protection has chosen a range of institutions, from non-profit organizations to municipal water district agencies, to take responsibility for developing and implementing local watershed plans across the state. This structure encourages local participation and education and helps to decentralize the planning process.

In the Cardener River corridor, we suggest that an inter-municipal watershed management team could facilitate such a planning process. Massachusetts uses such a model and it has proven to be very successful. This team is made up of representatives from local and regional agencies, local communities, businesses, and non-governmental organizations. Bringing these actors together facilitates communication and strengthens local capacity to deal with environmental challenges as well as other challenges the region may face. Equipped with grant money from regional or national sources as well as participants from the local community, the team could explore ways of imple-

menting the revegetation and water quality goals expressed in the Blue and Green Projects. In Massachusetts, the teams recruit volunteer teams from the local community and existing organizations to carry out activities including, but not limited to, native habitat restoration and water sampling. In the Cardener region, the team could also explore a physical linking of municipalities by constructing a river path along the River. Such a path could also provide interpretation of key cultural sites and lead visitors through the rich natural environment of the Cardener. The path could thus become a vehicle for recreation, mobility, community-building, conservation, and learning. All these activities would provide a solid foundation for the team to begin looking at the region in an integrated way and would reflect the region's commitment to acknowledging the important linkages between the built environment, the natural ecosystem, and economic development.

Land use and Growth

Land use decisions by their very nature involve externalities, impacting people and places beyond the context of any one particular decision. Principles derived from watershed planning help make these impacts explicit, and suggest a method for dealing with externalities. Broadly speaking, these principles pertain to either 1) where development occurs, or 2) how development occurs.

WHERE DEVELOPMENT OCCURS

Proposals that promote development while maintaining (or even improving) water quality are informed by four ideas relating to the location of development. These ideas are clustering, infill, adaptive reuse, and site sensitivity.

Clustering, by concentrating new development near existing development, minimizes the urbanization of agricultural and forest land. For example, along the Cardener River, clustering new development would protect existing small-scale agricultural areas, such as domestic garden plots (horts) that serve an important function for local communities and form a unique element along the river.

Infill concentrates new housing and commercial construction in empty parcels within the existing urban fabric. Such an approach makes full and efficient use of existing infrastructure, and also discourages scattered site development and the expansion of the urban built boundary.

Adaptive reuse promotes the development of new uses within existing buildings. Reuse reduces the demand for new construction, and maintains the region's existing design and landscape character. In the case of former mills and other cultural elements, the buildings can be renovated to house a variety of contemporary activities such as hotels, educational institutions, housing, high-tech research, production and office space.

Site sensitivity recognizes that not all land is equally suitable for development. For example, in order to protect sensitive water bodies, new development (or certain types of development) are often restricted or prohibited within a 100-year floodplain. Similarly, stricter protection may be offered to feeder streams, since the impacts on the water quality of upstream areas necessarily have downstream effects as well.

HOW DEVELOPMENT OCCURS

Planning for how development occurs is equally important to the location of development. Site design is a critical aspect of the development process. Factors to consider when designing a site include the control of runoff, the minimization of impervious cover, and the quantity and quality of open spaces.

Reducing the amount of impervious cover may require changing the materials used for surface parking. Lattice blocks and bricks set in sand, for example, are two good alternatives. Controlling runoff begins at the rooftops, where techniques such as green roofs can absorb water and release it slowly over time. Using mulch in landscaping performs a similar function, and retains soil moisture to conserve water usage. Many stormwater events can be mitigated simply and cheaply with strategic landscaping. Swales, filter strips, and bioretention cells —open space elements strategically placed on the site — all help slow and filter the fast-moving and heavily polluted water that runs off after the first few minutes of a storm.



Transportation and Land Use

The movement of people and goods to, from, and through the Cardener River corridor is also a force that exercises considerable influence on its development. In recent years, a number of transportation interventions have been made in the corridor, the long-term effects of which are still largely unclear. The rate and direction of demographic changes in the corridor are uncertain, as are the interactions between economic development and environmental imperatives. Transportation plans and policies have strong effects on these core variables and thus population, business, the environment and transportation must be considered together.



IMPACTS OF NEW HIGHWAY PLACEMENTS

The highway system in the Cardener River Corridor – far and away the most commonly used transportation system in the area – is undergoing two significant changes: the installation of bypass and transversal highways. The bypass, currently most visible on highway C-1410 in the vicinity of the municipality of Súria, establishes a direct means of travel to destinations that are well beyond the Corridor itself, particularly the Pyrenees. From this perspective, the bypass's physical separation from older and more local roadways has had a positive impact. Local officials claim that town streets previously used by commercial trucks and other long-distance travelers are now safer and more “livable” because of the relocation of such vehicles.

The long-term impacts of this bypass system, however, are still difficult to estimate. Careful thought must be given to anticipating and offsetting the possible negative effects of the bypass. Will Súria grow increasingly isolated from commercial activity and visitors from outside of the corridor? What new functions must pre-existing roadways take on if further bypass highway construction is imminent? Can the old roads be integrated in a way that safeguards their upkeep and facilitates a stronger connection to urban areas and other places of interest? How can the older road networks be maintained in a satisfactory condition?

The effects of new transversal highway developments, intended to facilitate movement across the spokes of what has historically been a series of radial roadways going to and from Barcelona, is even less clear. Despite this uncertainty, it is important to ask the following question: How might transversal systems facilitate new opportunities for intra-regional trade, tourism and other forms of interaction among medium- and small-sized cities in the region of which the Cardener



River corridor forms part?

INTRA-REGIONAL ACCESSIBILITY FOR CORRIDOR RESIDENTS AND BUSINESSES

How will the transportation needs of those who live, work and play in the corridor change over time? Do feasible transportation plans for the future satisfy the anticipated needs for access to employment, social services and recreational resources in and across the Cardener's municipalities? The Manresa-Súria bus service provides



a platform for realistic consideration of level-of-service improvements along an existing route. It can as well provide a measure for the expansion of transit services to outlying communities.



INTER-MODAL CONNECTIONS TO BARCELONA

At this juncture corridor stakeholders are not calling for aggressive measures to increase tourism by visitors from other parts of Catalunya, Spain or Europe. It is well to note that currently the corridor possesses few elements to support tourism (such as hotels, serviced tour routes, restaurants, adequate way-finding devices and adapted cultural or historic sites). Perhaps a modest brochure campaign at the Montserrat visitor center would be an appropriate beginning initiative.



Regardless of questions surrounding the desire for increased tourism, the movement by residents and visitors between Manresa and Barcelona on the passenger rail line is significant. It seems prudent to ensure that this existing regional connection is maintained and even improved. To better serve those groups that travel from the Cardener River corridor to Catalunya's capitol for personal and professional reasons, planning interventions should be focused on improving the connection between corridor bus service and regional passenger rail service to Barcelona.

SIGNAGE AND WAY-FINDING

While fostering tourism from outside the Cardener River Corridor may not be a priority for its economic development, an important task remains in improving the signs that guide both residents and visitors through existing and planned transportation networks. In addition, one of the proposals put forth in this report entails the phased development of a series of river pathway networks that can reinforce the historical, cultural and ecological identity of the corridor. Such networks would offer a tangible focal point for conservation, recreational and educational initiatives. Realizing this vision requires thoughtful design and deployment of signs or other way-finding devices that allow residents and visitors to interact with, and navigate easily through the pathway system. These devices may also add significant value to current and future efforts to make previously inaccessible historic or cultural landmarks throughout the corridor more available to the public. A systematic, hierarchical approach to establishing such signage extending from the regional to the local is proposed.

At its apex the hierarchy of signs and symbols would promote regional awareness of the Cardener River corridor's existence for all travelers. It would, as well, offer self-guided tours to visitors. The next level of way-finding signs would address the corridor's own residents. Its goal would be to increase their appreciation of their river while promoting intra-regional access to jobs, social services, and recreational sites. Finally, the way-finding hierarchy would facilitate the movement of residents and visitors to and along the river and its neighboring environments. The following Way-finding Intervention Matrix outlines a detailed series of the objectives, actions and visual examples that could help to inform the implementation of such a signage system.

TRANSPORTATION INITIATIVES

In light of the issues discussed in this section, following are a number of initiatives that merit consideration:

A regional council should be established to work closely with the Generalitat de Catalunya in the development and implementation of transportation plans. This will help to ensure that transportation investment decisions financed at the Catalunya the trends witnessed and priorities consistently and accurately inform levels expressed locally in the Corridor.

- In the long term, a council made up of area mayors and/or technical representatives from each municipality served by the bus route should operate the organization responsible for providing bus service throughout the Corridor. The presence of such a council will help to ensure that bus service decisions are made with the needs of all municipalities in mind.
- Consideration should be taken to establish a custodial system whereby private and public agencies become responsible for the maintenance of access routes as well as the activities taking place on their land. This Adopt-a-Route program would ensure that private and public agencies take advantage of the economic opportunities available through a network of access routes, and also that critical ecological resources are cared for. Such a program would include provisions for collecting and filtering waste and

industrial by-products on-site. An enforcement system that is commonly understood by the stakeholders involved as well as the general public is critical to the maintenance of the watershed.

- New access routes should adopt a standard design feature that enables users to identify paths that are interconnected, as well as distinguish public from private trails. This feature, to be agreed upon by local planning agencies together with their communities, should not, however, lead to a standard “path” to be applied regardless of site characteristics. Instead, communities should develop “typologies” and “responses” that reflect the specific characteristics of sites. It should be particularly encouraged, for example, that businesses that “adopt” their section of an access route use that route to tell something about themselves (either through text, materials used, off-route amenities such as rest stops, bridges, art installations, etc). The means of conveying this information would be subject to approval by local planning agencies to ensure such unique materials are not harmful to the ecosystem.
- Additional pedestrian bridges are recommended to connect uses on both banks of the river. At the same time, pedestrian access must be improved on existing bridges through reconstruction or renovation. Bridges of this kind that span the river, as well as nearby roadways, should be as transparent as possible to minimize the visual impacts of these structures and to allow views of the river and the surrounding environment. Such bridges should be graceful in their structure and clearly express their function as a pedestrian bridge, rather than take a form associated with a vehicular crossing.
- New roads within 30 meters of a water body must ensure that construction will not interfere with the natural systems of the water’s edge, including erosion of the land, destruction of wildlife habitat, or unnecessary removal of native flora. New routes should be designed to catch and passively filter run-off from adjacent industries or agricultural uses.
- No new surface parking lots will be developed along the river.

Objectives	Actions	Visual Examples □
REGIONAL SCALE		
<p>Promote regional awareness of the Cardener River Corridor's existence (geared at people that travel on regional, national, international scale)</p>	<p>Install a series of signs ("Entering, Approaching Cardener River Corridor") – representative of symbols and design of corridor-specific signage hierarchy (see Corridor scale) – at strategic points on major transportation systems (Ex. Highways A-18, C-1411, C-241b, C-25, C-1410)</p>	
<p>Provide clear and visually distinctive information that guides travelers to Corridor</p>	<p>Explore opportunities to post similar images in strategic visitor-oriented locations of Barcelona (airport, train and bus terminals, hotels, etc.)</p>	
CORRIDOR SCALE		
<p>Engage Corridor residents in opportunities that heighten their sense of belonging to, and moving through, the corridor as a place increase their ability to access the workplace, social services, and recreational sites</p>	<p>Establish a hierarchical system of networks and connections by developing a system of symbols through a proposal and community review process grounding the design of such way-finding symbols in cultural, historical or ecological resources with which community members identify organizing an advisory committee to examine key locations at which signs should be posted launching a corridor-wide public education campaign geared at raising awareness about the implementation and use of new signage system</p>	
<p>Engage Corridor visitors in opportunities that heighten their sense of traveling through the Corridor as a common place allow them to easily navigate through the Corridor in an efficient manner</p>		
RIVER WALK SCALE		
<p>Facilitate the movement of residents and visitors in close proximity to the Cardener in ways that promote a clear sense of location and interpretive interaction with the river and nearby resources</p>	<p>Incorporate elements into signs adjacent to river that give pedestrians constant orientation to river-walk system in its entirety, and provide information about the significance of nearby cultural, historical and ecological resources</p>	

Signage Matrix

Existing lots will be improved to remedy for water runoff and enhanced with planting. Parking surfaces should be permeable and reflect the microclimate that they are sited in.

- Integrate recreational and interpretive routes that provide opportunities to experience the environment by bicycle, on foot and by car. The character of such paths should respond to the mode of transportation envisioned for each particular segment, taking into account travel times and distances between significant points of interest or urban centers. Such an established system of corridor trails and scenic opportunities should also cut across the valley in directions perpendicular to the flow of the river.

Economic Development

The Cardener River corridor has experienced many changes in its economic base over the past decades, shifting away from textile production and heavy industry to more service based economies like high-tech services. In addition, the region is on the cusp of a potentially significant shift in its population and its economy, with the growth of a commuter community in Manresa and the limited years of operation of the potash mine in Súria. These shifts give the municipalities along the Cardener the opportunity to critically consider the nature and direction of their development.

LESSONS LEARNED FROM SIMILAR COMMUNITIES IN THE USA

In considering these decisions, there are valuable lessons to be learned from communities in the US that have experienced similar shifts in their economic base.⁵ . First, it is important to develop a group of widely shared visions within the community. This can be carried out through charettes, community meetings and surveys. In the Cardener, planners may be able to tap into existing networks and organizations like churches or recreational groups to encourage stakeholder participation. Second, it is helpful to create an inventory of local resources, highlighting both strengths and weaknesses of an area. The goal of the inventory is to build on local assets when devising a development strategy, to emphasize what you have, not what you don't have. The Masias and Colònias along the Cardener represent a rich cultural and historical resource that the municipalities and businesses could use in their development efforts.

Other recommendations include minimizing the need for new regulations by pursuing alternative avenues like public-private partnerships and memorandums of agreement to reach community goals. Part-

ner with public land managers who have an existing wealth of local knowledge and experience.

Recognize the role of non-governmental organizations. While there may not be a highly developed group of non-profit organizations that are active in the region, governments may be able to invite participation from those that do exist and encourage new ones to form.

Financial mechanisms are also important considerations to achieving complex public goals. In Crested Butte, Colorado, for example, the town used proceeds from a 2.25 percent real estate transfer tax to finance the acquisition of open space and conservation easements on lands important to the community.

CONSIDERING TOURISM

As the Cardener region is currently exploring opportunities to encourage and foster tourism, there are several considerations that communities in the US have found useful in determining whether or not to develop tourism, and how to do so. First, it is important that tourism be regarded as part of a strategy for economic development. Will tourism contribute to a larger strategy for economic diversity? Will the region have to assume a large fiscal burden in order to develop tourism as an industry? Are the types of proposed tourism compatible with protecting community's natural resources? Would tourism in the area encourage meaningful and desirable employment? While the Diputació and the municipalities have indicated that tourism in the Cardener would be viable in the near future only if it became part of a wider regional effort, it is also important to consider the long-term implications of such a strategy.

INDUSTRIAL DEVELOPMENT

Virtually every town along the Cardener—Manresa, Sant Joan de Vilatorrada, Callús and Súria —spoke about the desire to develop industrial zones in their municipality. These are important goals, but it is also important to weigh the environmental, social and economic benefits and costs that are generated by different industries. These considerations are particularly critical given the goals articulated in the Action Plan of the Diputació, the Blue and Green Line Projects and the goals of the watershed planning approach. Thus wherever possible, the municipalities can encourage value-added industries that are not resource and land intensive, that reduce environmental costs and that provide social and economic benefits to the community and the region. While the future of economic development along the Cardener is largely unknown at this point, the municipalities can play a large role in encouraging and fostering the kind of development they would like to see.

The following principles are measures, which each municipality could implement in order to direct their desired form of development:

Environmental considerations: Encourage industries to recognize their responsibility to protect the natural environment and the living history of the landscape.

The municipalities could provide financial incentives for the private sector to creatively re-use and to conserve historic facilities. The Masias and Colònias could house a variety of activities including hotels, educational institutions, high tech companies, research and development, and office space. Such reoccupation would also maintain the design and character of their historic setting. The municipalities could also re-use older infrastructure for new purposes – for example, the existing canals could provide opportunities to develop small-scale hydropower.

The municipalities could encourage environmentally sensitive site planning through the implementation of green infrastructure like open space, walking paths, parking lots with reduced impervious surfaces, and also encourage design guidelines that prevent encroachment on areas that are prone to erosion or are too close waterways. In addition, the municipalities could concentrate industries that are resource intensive and depend heavily on large transportation nodes in the industrial zones of Manresa and Sant Joan de Vilatorrada. This part of the River Corridor is relatively flat and has little watershed activity so that development would not interfere with the flow of secondary and tertiary level waterways.

Compliance with environmental goals and standards can also be encouraged by inviting industries to sign a statement of commitment to environmental protection. Rather than establishing an antagonistic relationship of “regulator” and “polluter”, the municipality could forge a partnership based on mutual trust that would work toward reducing or eliminating pollution problems in various industrial sectors.

The municipalities could also directly encourage and solicit sustainable businesses to locate in their industrial zones. These might include: alternative energy companies that produce alternative energy technologies and/or sell energy directly to the market; pharmaceutical companies, organic agriculture production using greenhouses and/or hydroponic production; and recycling or re-use industries.

INSTITUTIONAL: COORDINATE ECONOMIC DEVELOPMENT EFFORTS ON A REGIONAL SCALE.

A demonstration of this coordination could take place through an Eco-industrial park, with a closed loop supply chain – the outputs of one firm would be an input to the next – thus encouraging responsible business practices, reducing waste, and cutting costs.

Another means of encouraging watershed thinking is by developing creative financing schemes. For example, municipalities could encourage individuals to “adopt” or contribute to specific features such

as a new walkway or road. This is a popular strategy used to help finance riverwalks in urban areas in the US. Another model would be to create a Cardener Watershed Trust Fund, which the municipalities could establish and manage by earmarking a small percentage of property taxes and construction permit revenues each year (the amount to be determined by consensus among municipalities.) These funds could also be matched by an annual contribution from the Generalitat de Catalunya and the Diputació de Barcelona. Each fiscal year, the Fund could help finance improvement projects in the Watershed (to be determined by consensus) and could grant money in response to requests for proposals from community groups and non-profit developers. A fixed portion of the Fund could go toward educational programs and the remaining Fund could be re-invested.

Ecological Restoration

ISSUES

While each town has a unique vision of its own, Manresa, Sant Joan de Vilatorrada, Callús and Súria have shown a common desire to enhance the diminished quality of the natural environments of the Cardener corridor. A number of issues emerged from our site visit and the discussions with the Mayors and personnel of these towns..

An integrated approach is essential to manage common water resources. The town-by-town initiatives demonstrated a lack of coordination among the valley's four municipalities. While each recognized the importance of the Cardener corridor, so far little attention seems to have been devoted to forming an integrated and coordinated approach to the river corridor planning.

EXPLOITATION OF RIVER RESOURCES WITHOUT PAYING ATTENTION TO ITS FRAGILITY

Mining is a major activity in the valley. The present practice of potash mining does not account for the fragility of the surrounding environment. Both visual and ecological impacts were evident. On one hand, run-off from the mining process probably finds its way into the river, causing pollution and sedimentation, while on the other hand, the tailing mountain might be seen by some as a visual and physical opportunity to demonstrate the integration of human exploitation of natural resources and ecological integrity. In addition, a number of agricultural industries, such as pig farms, located along the corridor are causing further pollution and the gravel facilities on the riverbank also causing sedimentation.

ENCROACHMENT OF FLOODPLAIN

In a number of locations, in particular along Manresa and Sant Joan de Vilatorrada, the floodplain has been encroached and houses have been built. Although the floodplain here does not seem to hold much significance in controlling floods because the river's flow is managed by an upstream reservoir, the retention of floodplains is important for



enhancing the river environment. These floodplains can be utilized to create buffers of various sorts, in particular, riparian zones and vegetation to filter the runoff from surrounding agricultural and urban lands, discharges from the industries, and to prevent sedimentation of the river.

Meanwhile, there are a number of initiatives that are already in place to address some of these issues. One such initiative is the Green River Project that has emerged in response to the declining quality of the river ecosystem.

THE GREEN RIVER PROJECT

The Green River Project is based on a coordinated and integrated approach to river corridor planning. The plan looks at two major rivers, Llobregat and Cardener, as well as other adjoining small rivers. The primary objectives of the plan are to improve the overall health of the rivers and their surroundings and to improve public access to the riverside, in order to change the current image as a degraded areas.

The activities proposed by this project are:

- Riverside promenades as new urban public spaces in Manresa and Sant Joan de Vilatorrada
- Urban riverside in Sant Joan de Vilatorrada by making both urban and riparian pathways
- Re-naturalization of the junction of Riera de Fonollosa with the Cardener River area – river rehabilitation.
- A recreational area and interpretative path are proposed – parks and land art etc.
- Restoration of riverside vegetation that include forests, bushes, and grassland – stream restoration is proposed
- Local ecological path and some local bush-cleaning interventions

This initiative provides the foundation on which our restoration proposals have been built.

OVERARCHING PRINCIPLES

The strategy for the ecological restoration of the Cardener River corridor has evolved in response to the need to build co-existence between human and natural elements and to restore natural health to the river corridor for their mutual benefit. Thus, our plan for the ecological restoration is based on the following overarching principles:

ECOLOGICAL AND AESTHETIC INTEGRITY WITH RIVER AS A NUCLEUS

Treat river and the surrounding ecosystem as a single entity: the corridor needs to recognize the fact that even a little damage to a part will jeopardize the health of the whole corridor ecosystem. So the ecological restoration should expand beyond the river and its edges to the entire watershed as also indicted in Section 4 A & B. In addi-

tion, any human activity should be regarded as an integral part of the natural fabric of the river corridor. To do so will provide positive ecological and aesthetic experiences to the valley's residents. This principle points to the conservation of the existing topography and native vegetation when building new developments and/or rehabilitating existing ones along the river corridor.



MITIGATION AND MANAGEMENT OF WATER QUANTITY AND QUALITY IN THE CARDENER WATERSHED TO SUPPORT A HEALTHY ECOSYSTEM

Another similar notion of ecological integrity is to improve the water quality and to manage the water quantity of the Cardener and its watershed. To support healthy ecosystems all the watershed's streams and lands must be considered together.

THE RIVER AS A DEMONSTRATIVE PLACE

It is essential to develop an understanding that humans and nature are interdependent and their coexistence depends on how this interdependency is being played out. The goal is a regime of *give and take that is fair and balanced*. The community invests in maintaining the ecosystem. In return, the ecosystem provides them with clean air, clean water, and enjoyment. Such a regime can be realized only if there is a clear understanding of this interdependency among the Cardener corridor's residents. Therefore, the corridor's residents need a means to interact with the river to develop this understanding.

NATURAL MATERIALS AND PROCESSES WORK BEST IN THE MITIGATION AND HEALING OF RIVER ECOSYSTEMS:

Utilizing the strengths of natural processes instead of employing expensive and complex engineering can most effectively restore a river. There is an abundant growth of reeds along the banks of the Cardener River. The natural capacity of these plants to cleanse water can be harnessed by creating riparian areas and vegetation buffers along the river floodplains. Such a natural remediation process includes forming meanders, vegetation of native species, and creating sequences of pools and riffles along the river channel

GOALS

With these overarching principles in mind, any proposal must focus on improving the overall ecological health of the corridor through the community's understanding and participation.

- To improve the overall health of the Cardener river ecosystem by
 - bringing aquatic and terrestrial plant, fish, and animals back to the river by restoring its water quality and protecting the upper stretches
 - retaining natural landforms and vegetation

- creating wetland and vegetation buffers for the natural cleansing of river water quality.
- protecting streams and the surrounding land that fall within the watershed of the corridor
- rehabilitating tailing mountains of Súría
- To promote environmental design principles in the new developments in the towns
- To provide public access which help develop understanding of the river ecosystem among residents
- To encourage the community to participate and invest in the management of the watershed by monitoring the river water quality and by establishing a recreational park and walkways.

INTERVENTION

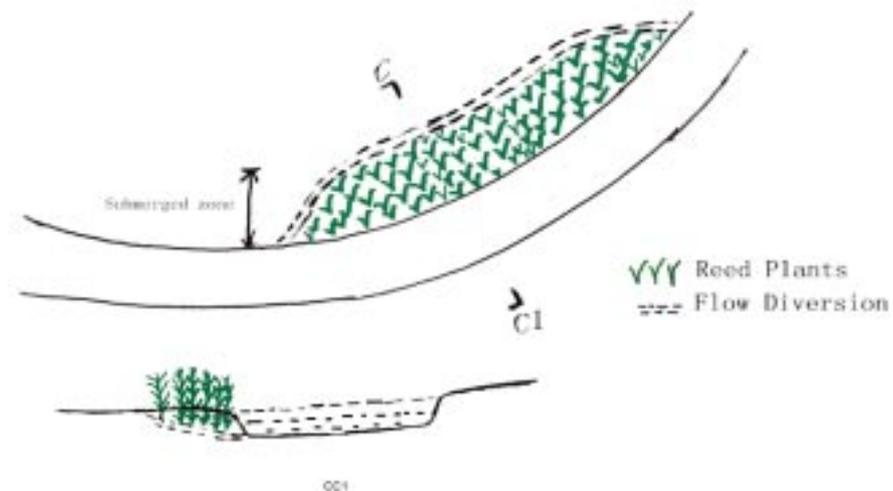
CREATE RIPARIAN AREAS AND VEGETATION BUFFERS ALONG THE EXISTING FLOODPLAIN

Here, the riparian areas refer simply to a strip of land as thin as a few feet along floodplains on which reeds or other native aquatic plants grow often in submerged conditions. The roots of reed plants house a large number of microorganisms that purify water through biochemical processes.⁶ Additional riparian areas should be created in a number of locations along the river to allow natural water purification of agricultural and urban runoff. These areas will also help to prevent sedimentation of river water by controlling erosion and retaining sediments. In addition, riparian areas provide habitats for birds, fishes and other wildlife.

Establishing such riparian areas is also appropriate for a number of locations along the river: at the ends of canals and in Callús and south of Súría. In the canal ends the canal water will help to maintain the water level of the riparian area while the reed beds will help to purify it.

CREATE MEANDERS AND POOL-RIFFLE SEQUENCES:

Another way to cleanse the river water is to create meanders and pool-riffle sequences in the river channel. The former treats water by



controlling the time of travel of water pollutants into the river system while the later improves quality through aeration.⁷ The pool-riffle sequence also provides a variety of habitats of fish and invertebrates, spawning beds, and areas for sediment deposition.⁸ This type of intervention is very beneficial for enhancing natural water cleansing capacity where the river runs straight. For example in the stretch south of Antius and north of Callús. This stretch could be developed for fishing purposes in a later phase when the river water quality had become fit for creating sound habitat for fishes.

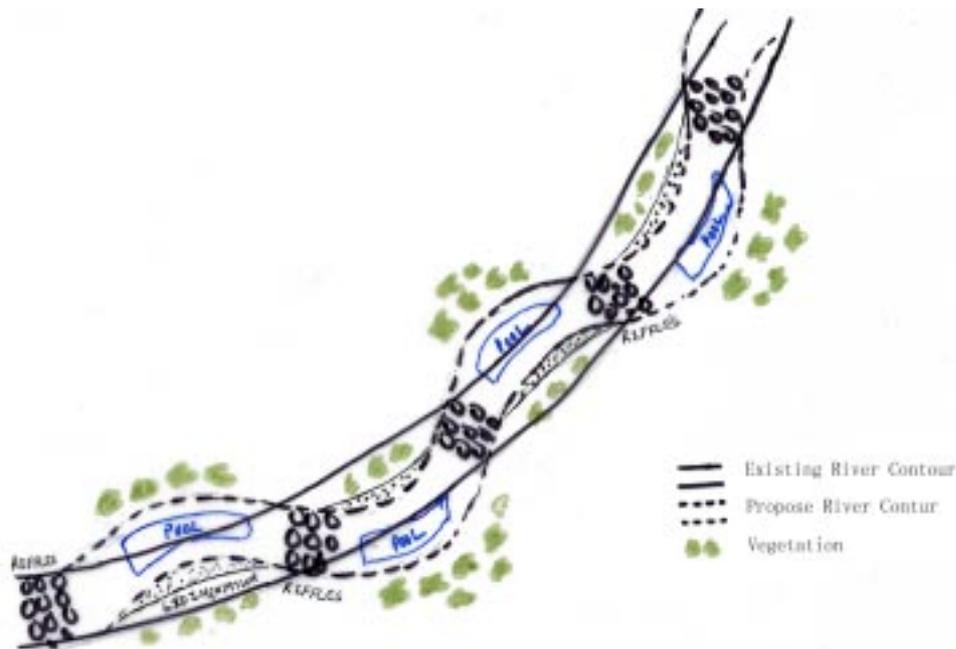
REVEGETATE AREA WITH NATIVE SPECIES TO IMPROVE THE VALLEY'S BIODIVERSITY

The river banks and the surrounding land having little existing vegetation cover and in areas indicated in Green River Project should be revegetated with native species to improve the corridor's biodiversity. To rehabilitate the tailings mounds of Súría will require a major effort. For this, the following activities are proposed:

- Plantation of salt resistant native plants: Poplar and Amorpha are very effective salt resistant plants.⁹ [Sushila what plants are told about in the note? Populus alba? Amorpha fruticosa?] Although short-term measures may include the planting of non-indigenous species, the long-terms goal should be to use indigenous plants so that the mining site can be restored to blend with the surrounding plant populations.
- Develop a local nursery with trained staff, to supervise native habitat restoration.

CARRY OUT REGRADING AND BUSH CLEANING WHERE NECESSARY TO IMPROVE THE CHANNEL NETWORK AND NATURAL RIVERBANKS

The entire channel networks supporting the Cardener river ecosystem should be considered for this purpose. Vegetation growing wild along the riverbanks as indicated in the Green River Project, and in other areas as necessary, will be selectively cleared and enhanced





with additional plants to prevent erosion and to promote wildlife. The clearing and planting must be coordinated with the pathways and viewpoint development.

PROVIDE PUBLIC ACCESS TO RIVER THROUGH TRAILS/PATHS AND RECREATIONAL PARKS



Another essential element of Green River Project is to provide river access for the Valley's residents so that they may assume an active stewardship. A variety of bicycle and walking paths are proposed. The proposed paths will follow the river's edge at either the top of the bank, at the sides of the slopes, along the lower ridges or use existing dirt roads. In some stretches, paths should be connected to provide "looping". These paths can provide easy entry and exit ways by connecting to major roads.

Another way to enhance interaction between people and the river is by creating riverside parks and recreation activities. Such parks are proposed for Callús and Manresa. Other proposed activities include maintaining and improving fishing activities in Callús and Manresa.

IMPLEMENTATION, MONITORING AND PHASING

The ecological restoration plan will be implemented as an extension to the Green River Project. The effective implementation of the ecological restoration plan requires a coordinated and integrated approach of all three towns. Central, too, will be the active participation of the corridor's residents.

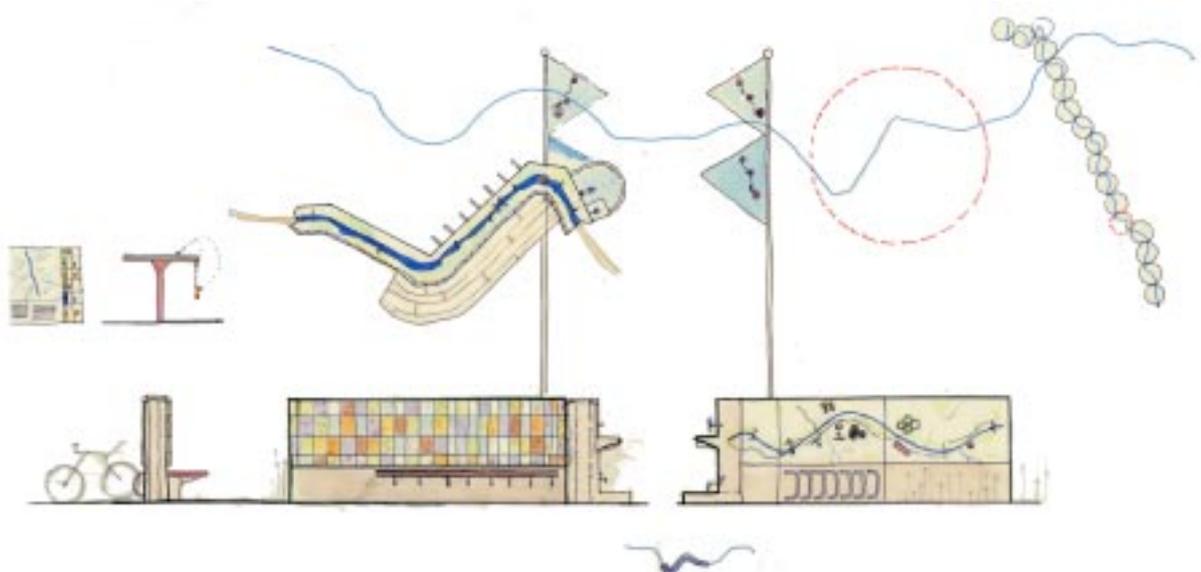
Education

In the experience of many U.S. watershed organizations education and outreach have proven the single most important interventions for the improvement of rivers and streams. Education and outreach succeed because they change the expectations and behavior of residents, and they so effectively by engaging the community in watershed activities. A typical process begins by making the river and its many elements visible. The visibility goal easily leads to many forms of citizen involvement. Together sustained watershed visibility and citizen involvement lead to the sharing of many visions for the watershed and to coordinated efforts by public agencies and public-private partnerships.

MAKING THE RIVER VISIBLE:

At present the Cardener River and its flood plain are often hidden from view to motorists travelling along nearby roads and highways. Its citizen users are few: fishermen and gardeners. It has, however, many invisible users: towns and industries that draw upon its water and discharge wastes into it. Along its margins roads and farms pass their runoff on to the river. At the same time the river serves as a corridor for birds and wildlife, and as a home to a gathering of fish, plants, flowers and trees. The first step in an education initiative is to make all these actors and their processes visible. The common methods are:

- Designing and employing a consistent series of signs so the signs themselves carry the message of a watershed- and have a library and materials for teachers and interested citizens. It should also run workshops on land and water management and wildlife study. Antius has been suggested as an appropriate place for such a learning center.
- Convene the town planners for the corridor municipalities on a regular basis to encourage the coordination of their development plans.
- Build a model of the workings of the watershed from the data gathered by the monitoring program.
- Solicit, gather, and publish stories by citizens of their lives within the valley.
- Make connections to existing newspapers and other media, and give them news of the River and the corridor.
- Establish a charitable fund for the improvement of the watershed.



It is the American experience that such steps, taken in whatever order and ways that local conditions allow, result in an active citizen constituency for a river and its watershed. What emerges from these activities is not one vision but a gathering of many visions that have enough in common to sustain continued efforts for environmental improvement.

Notes

1 In the recent report, *New Strategies for America's Watersheds*, Commission on Geosciences, Environment and Resources, 1999, the authors describe how the US Environmental Protection Agency has widened the interpretation of this concept as a "watershed protection approach" which can be "used as an integrated holistic problem-solving strategy used to restore and maintain the physical, chemical, and biologic integrity of aquatic systems, protect human health and provide sustainable economic growth." (p.15.) This approach also: "acknowledges linkages between uplands and downstream areas, and between surface and ground water, and reduces the chances that attempts to solve problems in one realm will cause problems in others. Watershed management is an integrative way of thinking about all the various human activities that occur on a given area of land (the watershed) that have effects on, or are affected by, water. With this perspective, we can plan long-term, sustainable solutions to many natural resource problems. We can find a better balance between meeting today's needs and leaving a sound resource legacy for generations to come" (p.1.)

2 Water quality benefits of brownfield redevelopment and other smart growth strategies: Literature Review, figure taken from Trust for Public Land, 2000.

3 See <http://www.epa.gov/owow/watershed/why.html>

4 For more detailed information on each of these steps, refer to the US EPA report, "Protecting and Restoring America's Watersheds: Status, trends and initiatives in watershed management."

5 See Howe, Jim et al., *The Conservation Fund and The Sonoran Institute, Balancing Nature and Commerce in Gateway Communities*,

6 Best Practices Database, 1996-2001. Environment Recovery of the River Besos Basin, Catalonia. The Together Foundation and UNCHS.

7 National Research Council *Restoration of Aquatic Ecosystem*, 1992. Rivers and Streams, Chapter 5. Science, Technology, and Public Policy. Washington, D.C. National Academy Press.

8 Engen et.al (Eds). 1995. *Hydropolis: The Role of Water in Urban Planning*. Backuys Publishers, Leiden; Also, refer to Annex.

9 Kahl et.al, *Landscape and Urban Planning Journal*, 2000

Design and Planning Intervention



PROTOTYPES

POSSIBLE TOWN INTERVENTIONS

4

PROTOTYPES AND DESIGN INTERVENTIONS

This section illustrates a range of prototypical design patterns inspired by the Cardener River study area, which are then applied to specific design interventions for selected municipalities. The riparian prototypes highlighted here are *Urban Edge*, *Industrial Zone*, *River Walk*, and *River and Canal Bank*.

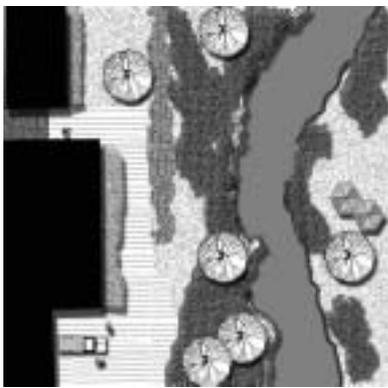
These patterns inform the interventions elaborated on sites within the municipalities of Manresa, Sant Joan de Vilatorrada, Callús, and Súria. The sites were chosen based on input from the Diputació, comments from the mayors of the municipalities, guidelines established by previous plans, a watershed analysis of the Cardener River, and various site observations.

The final interventions reconfigure and distil all this information to highlight the individual qualities of the Cardener's relationships with each town.

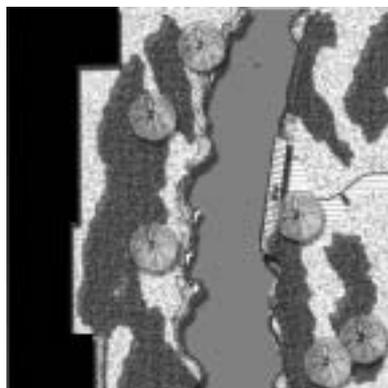
Prototypes

URBAN EDGE PROTOTYPES

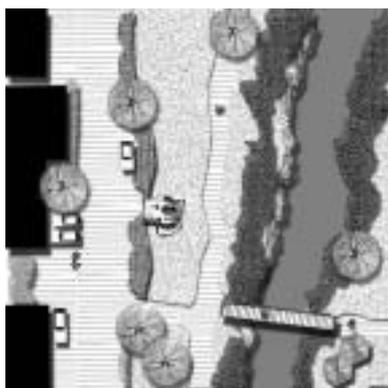
The informal urban edge conditions are inspired by the treatment of the river edge at the new community center located in Sant Joan de Vilatorrada. The area between the river and the community center has been successfully articulated as a secondary active space. It uses a simple palette of materials, permeable drivable surface, and appears to have low maintenance demands. The buffer integrates the gardens inside the community center through an informal sequence of events. The location of the parking area activates the edge and facilitates river access.



- The road buffer can be planted with the same grasses as the grasses along the river./
- A natural grass and planting buffer zone can filter the run off along road./
- Activities can occur between the two grass buffers including small pull-off points at key view corridors./



- Natural buffer of grasses along river edge with plantings that soften and green the building façade./
- Natural grasses and trees that reflect the locations microclimate along the building will filter non-point source run off from site./
- The planting palette should reflect the varying building heights and the microclimate along the river corridor/



- Wider buffer zones offer potential sites for community gardens, recreational facilities, or park space along river edge./
- The Activity Zone is located in between the grasses along the river and the plantings along the building façade./
- The surfaces and design will vary depending on the activity/

INDUSTRIAL ZONE PROTOTYPES

The industrial prototypes and planning guidelines below are designed to create an urban condition in industrial and commercial areas. Rather than allowing sprawling buildings on large lots, they provide for cohesive growth through a system of shared services, infrastructure, and formal unity.

CHARACTERISTICS

- 1.0 Frontage 50m/
- 1.1 Lot Size 50x60m/
- 1.2 Lot Area 3000m²
- 2.1 Max. Bldg Footprint 25x35m/
- 2.2 Max. Bldg Area 875m²/
- 2.3 No. of Floors 3/
- 2.4 Max. Bldg Height 12m/
- 2.5 Max. Total Bldg Area 2625m²/
- 3.1 Bldg Setback from River 25m/
- 3.2 Bldg Setback from Road 10m/
- 4.1 Max. Lot FAR 0.9/
- 4.2 Max. Lot Coverage 30%/
- 5.1 No. of Parking Space per Lot 26/

VARIABLES

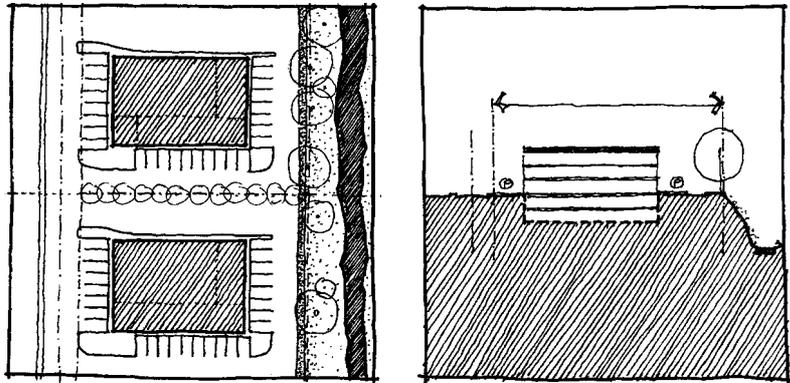
- 1.0 Occupancy a.Retail b.Commercial
c.Light Industry

MATERIALS

- 1.0 River Walk Stone (any)
- 2.0 Bldg Façade any
- 3.0 Parking Crushed Stone

RIVER EDGE

- 1.0 Grade Very Steep
- 2.0 Vegetation Minimal



Box Building

CHARACTERISTICS

- 1.1 Frontage 45m/
- 1.2 Lot Size 45x60m/
- 1.3 Lot Area 2700m²
- 2.1 Max. Bldg Footprint 45x30m/
- 2.2 Max. Bldg Area 1350m²/
- 2.3 No. of Floors 1 (2, with Mezza-/
nine)/
- 2.4 Max. Bldg Height 8m/
- 2.5 Max. Total Bldg Area 1350m²/
- 3.1 Bldg Setback from River 40m/
- 3.2 Bldg Setback from Road 12m/
- 4.1 Max. Lot FAR 0.5/
- 4.2 Max. Lot Coverage 50%/
- 5.1 No. of Parking Space per Lot 14/

VARIABLES

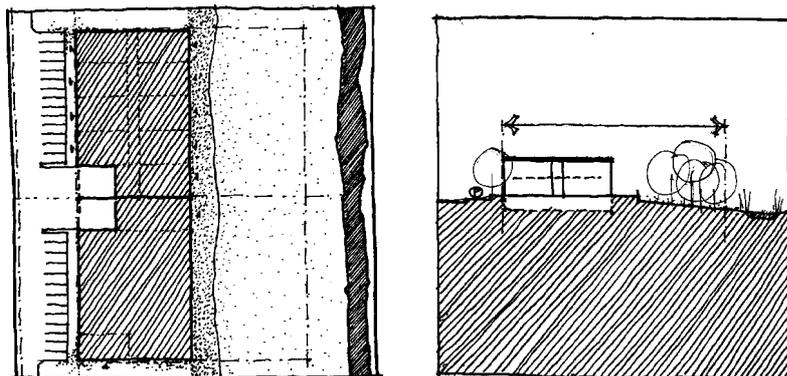
- 1.0 Occupancy a.Retail
b.Commercial c.Light Industry
- 2.0 Tenant a.Multiple Tenants
b.Single Tenant

MATERIALS

- 1.0 River Walk Stone Pavers
- 2.0 Bldg Façade Glass/Metal
- 3.0 Sidewalks Stone Pavers
- 4.0 Parking Asphalt

RIVER EDGE

- 1.0 Grade Flat/
- 2.0 Vegetation Cattails/Wetlands/



Paired Blocks

CHARACTERISTICS

- 1.1 Frontage 25m/
- 1.2 Lot Size 25x60m/
- 1.3 Lot Area 1500m²/
- 2.1 Max. Bldg Footprint 25x30m/
- 2.2 Max. Bldg Area 750m²/
- 2.3 No. of Floors 3/
- 2.4 Max. Bldg Height 12m/
- 2.5 Max. Total Bldg Area 2250m²/
- 3.1 Bldg Setback from River 15m/
- 3.2 Bldg Setback from Road 25m/
- 4.1 Max. Lot FAR 1.5/
- 4.2 Max. Lot Coverage 50%/
- 5.1 No. of Parking Spaces per Lot 8/

VARIABLES

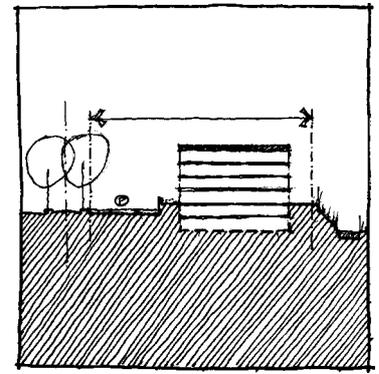
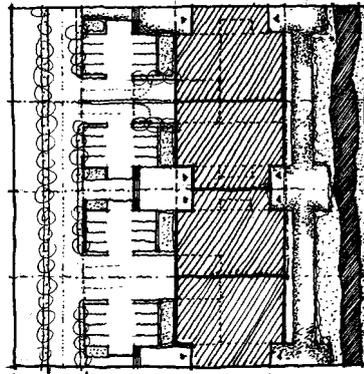
- 1.0 Occupancy a.Retail
b.Commercial c.Light Industry
d.Residential (above grade)
- 2.0 Treatment @ Sidewalk a.Trees
b. Advertising Wall/
- 3.0 Bldg Treatment @ River Walk/
a.Glazing b.Wall/
- 4.0 Between Parking Lots a.Trees/
b.Open/

MATERIALS

- 1.0 River Walk Wood Planks
- 2.0 Bldg Façade Any
- 3.0 Sidewalks Stone

RIVER EDGE

- 1.0 Grade Steep
- 2.0 Vegetation Cattails



Compact Urban

CHARACTERISTICS

- 1.1 Frontage 50m/
- 1.2 Lot Size 50x25m/
- 1.3 Lot Area 125 m²/
- 2.1 Max. Bldg Footprint 20x35m/
- 2.2 Max. Bldg Area 700 m²/
- 2.3 No. of Floors 2/
- 2.4 Max. Bldg Height 9m/
- 2.5 Max. Total Bldg Area 1400m²/
- 3.1 Bldg Setback from River 35m/
- 3.2 Bldg Setback from Road 0/
- 4.1 Max. Lot FAR 1.13/
- 4.2 Max. Lot Coverage 50%/
- 5.1 No. of Parking Spaces per Lot 14/
(on-street)/

VARIABLES

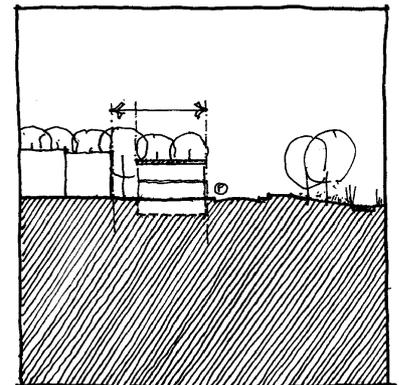
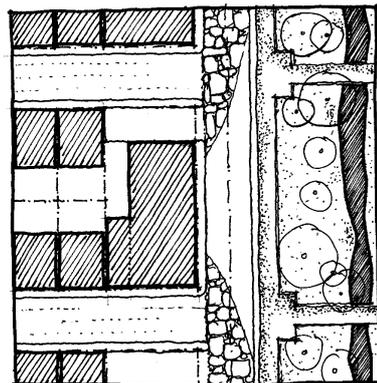
- 1.0 Occupancy a.Light Industry/
b.Commercial/
- 2.0 Truck Access a.Rear b.Side/
- 3.0 Entry to Bldg a.Parallel to River/
b.Perpendicular to River/

MATERIALS

- 1.0 River Walk Rammed Earth/
- 2.0 Parallel Street Stone (any)/
- 3.0 Bridges Timber/
- 4.0 Bldg Façade Stone/

RIVER EDGE

- 1.0 Grade Gentle
- 2.0 Vegetation Trees + Reeds



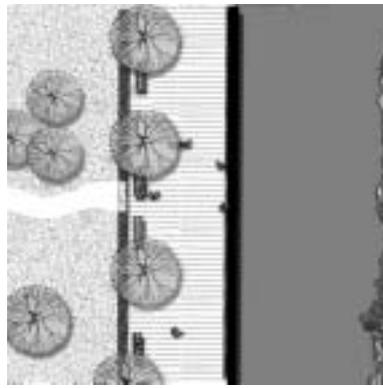
Paired Blocks



RIVER WALK PROTOTYPES

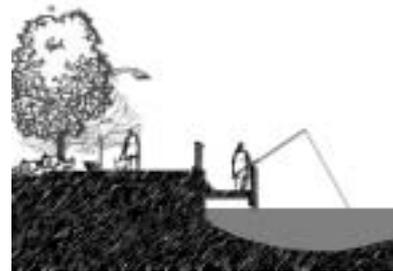
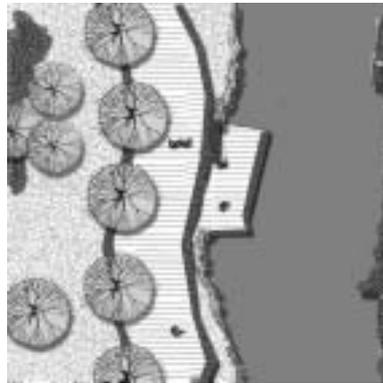
The following prototypes represent the typical conditions that the River Walk can express as it meanders along the landscape. The images reflect what the path could look like at various points throughout the corridor. Each prototype maintains a buffer zone between the path and the river.

- Formalized design for urban area with high activity
- Formal Lighting and furniture layout
- 5-7 meter wide path
- Durable, sophisticated materials
- Numerous links and access points to amenities & services
- Accessible to all (wheelchairs, strollers, bicyclists, and pedestrians)



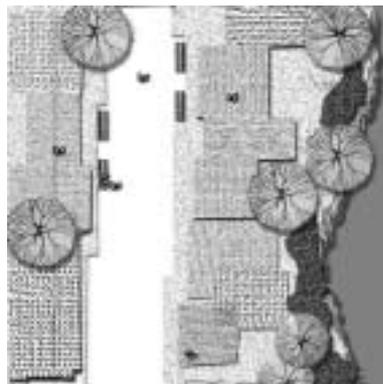
River Promenade (the most urban conditions)

- Designed for high activity and use
- 4-5 meter wide path
- Combines natural and finished materials (including wood)
- Multi-level fishing/observation decks that stretch over buffer zone and water edge

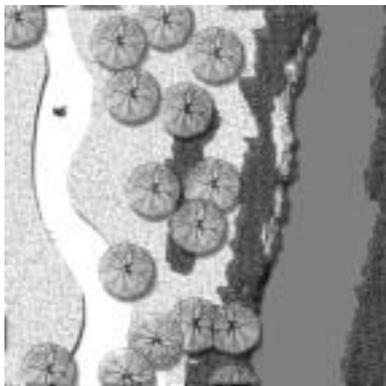
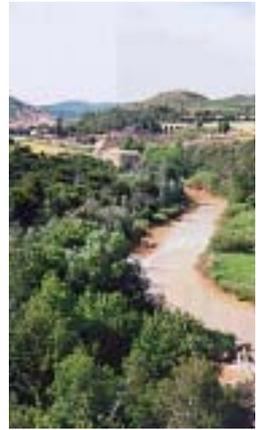


Board Walk/Transitional Walk (the semi-natural urban condition)

- 3-5 meter wide path
- Various simple, natural materials (including gravel and other permeable materials)
- Multi-use for garden plot owners and farmers and path-users

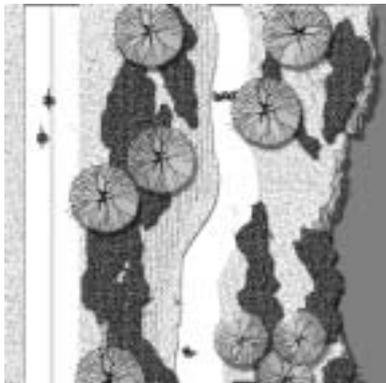


Garden Walk (incorporated along community gardens)



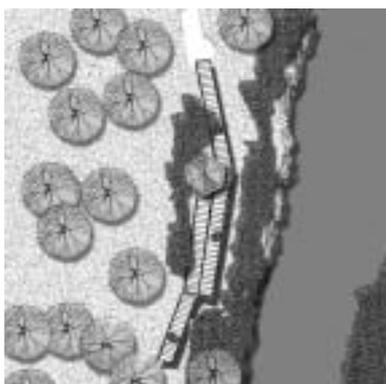
Nature Walk (within undeveloped natural areas)

- Takes the most organic form, following river form and landscape conditions/
- 3-5 meter wide/
- Simple, natural materials/
- Minimal programming/
- Takes advantage of secondary roads to make better use of what already exists and link existing landmarks to new facilities/
- Provides a series of vantage points (i.e. if an adjacent landform provides views of village, the nature walk will provide users with access to these locations)/



Fitness Walk (where high level of recreation is anticipated)

- 2-3 meters wide lower path for less aggressive use closer to rivers edge); 4-5 meters wide/ higher path for active use/
- Dual system with separation of activities (such as biking and horse riding separate from pedestrians)/
- Like the nature walk, it can accommodate level changes due to topography/



Sensitive Area Walk (for sensitive soil or vegetation conditions)

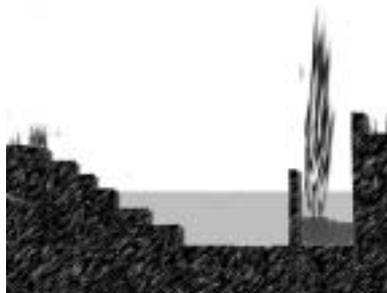
- Designed for particular areas that cannot withstand typical path construction/
- Cantilevered or post and beam construction will keep walkway elevated above sensitive area/
- Will provide elevated views of landscape/



RIVER AND CANAL EDGES

The river and canal edges throughout the Cardener Valley provide an opportunity to improve the health of the river through simple steps. In several areas, such as where steep embankments occur between road and river, vegetation and simple buffers can help prevent erosion and treat runoff. Between large agricultural areas and the river, vegetation may help treat pesticide-carrying runoff. In less intensive farming areas, the crops themselves may act similarly. Finally, the canals provide opportunities to create small zones for water treatment, such as in the proposal for the canal at Antius. They also provide an opportunity to allow human contact with the water. The following examples suggest how different interventions may be used to mitigate the impacts of stormwater runoff, erosion, and other pollutants on the river and canals.

- Canals may be used to treat water, hold runoff, and prevent erosion.
- Dividers may be added to allow water to flow and treatment to occur.
- Different plantings and edge treatments can respond to urban and rural conditions.



Canals



Steep areas

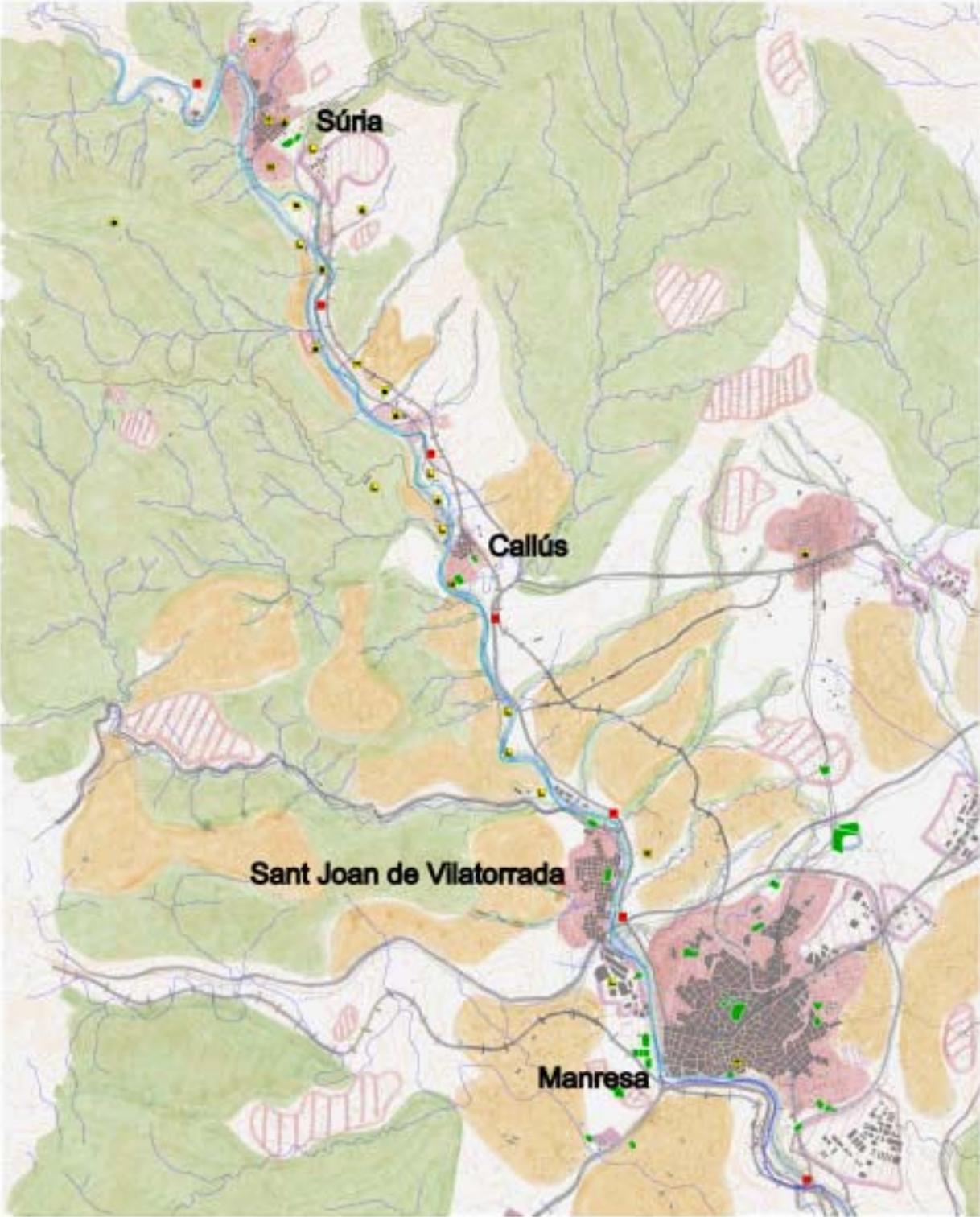
- Development along steep embankments should be avoided whenever possible.
- However, when they cannot be avoided, erosion should be prevented through dense plantings, terracing, and gabions.



Developed areas

- Berms and dense plantings can mitigate conditions such as proximity of industrial development or commercial agriculture to the river bank.
- Runoff is detained along the berm and water filtered through the plants.

Possible Town Interventions





MANRESA

URBAN RIVER EDGE OF MANRESA

Sports and leisure opportunities for all ages characterize the interventions in this area. Priority is also given to ensuring safe access across the road.

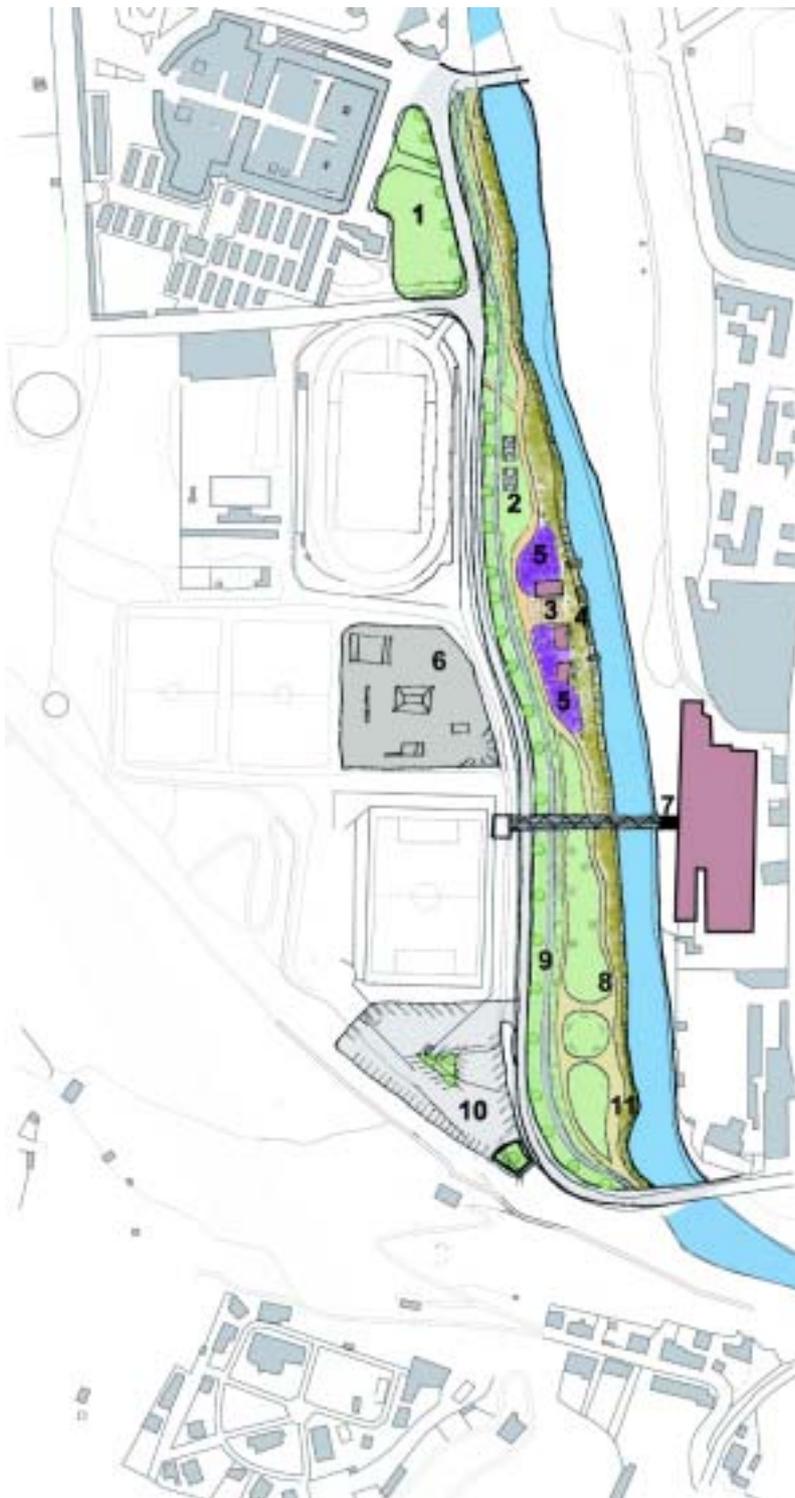
West of the road, existing activities (track, football field) are enhanced by the development of a skate park and additional open space.

East of the road and along the river, fishing docks formalize currently informal activities. In addition to the docks, preparation and storage areas provide better amenities for fishermen.

The river's natural edge is preserved by offsetting the trail, as well as by providing the fishing docks as alternatives to the river banks.

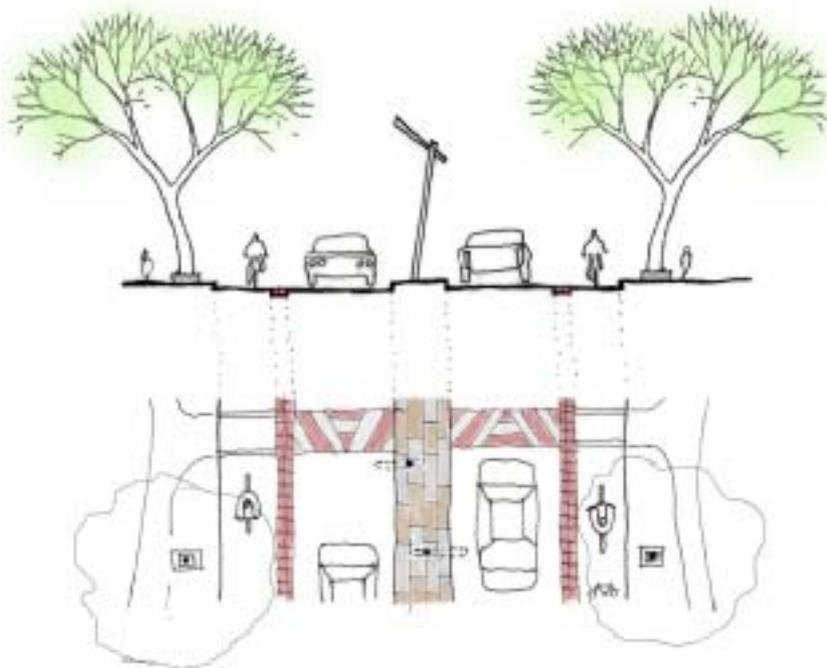
Manresa Urban River Edge

1. Proposed Open Space
2. Recreation Courts
3. Fishing Services
4. Fishing Decks
5. Botanical Area
6. Skate Park
7. Pedestrian Bridge
8. Pedestrian Path
9. Bicycle Path
10. Parking
11. Natural River Edge



The road between the sport and fishing activities currently acts as a barrier to safe pedestrian crossing. The addition of a bikeway, a walking path and landscaping elements improve the hierarchy of road elements, making the entire system safer and more comfortable to all users.

Access to the site is improved for both drivers and pedestrians. Parking lots are designed to serve users of both the sports center and the park. A bridge across the river connects pedestrians directly to the urban area of Manresa.



PASSEIG DEL RIU URBAN EDGE INTERVENTION

The road could be reduced from 4 lanes of traffic to two lanes of traffic and a bike lane on each side. As a result, reduced speeds will encourage the use of the pedestrian walkway and bicycle path for leisure and commuting purposes. The use of various paving materials helps separate the uses and act as traffic calmers. Brick or concrete pavers between the bicycle lane and the traffic lane will also act as a safety buffer. In the median, street lamps on a scored concrete curb will help beautify this corridor and make it unique. Large canopy trees provide shade, scale, and remind users of the adjacent natural element of the Cardener River.



C-1410 road with tree planting

SANT JOAN

Sant Joan *Urban River Edge*

1. Community Center
2. Reconnected Canal
3. Proposed Park
4. Community Service / Government Building
5. Grasses
6. Community Garden
7. Permeable Street
8. Recreation Node
9. Farmers Market
10. Proposed Community Facility
11. Dirt Bike Track
12. Pedestrian and Mo-ped Path
13. Picnic Area
14. Existing Pirelli Factory



SANT JOAN RIVER EDGE BACK YARD

Interventions in this area seek to integrate the river into the urban fabric as a “back yard” instead of a left over space. A back yard, in this context, is a space that is well-connected to the rest of the city, but serves city dwellers’ recreational needs by combining natural elements, multiple-use spaces, and occasional programming.

Natural grasses, critical to the proper functioning of riparian systems, are easily maintained for people, while providing habitat for birds, amphibians and other river-edge species. Revegetating the river banks also creates a natural buffer that slows the movement of water into and out of the stream bank.



Streets connect the water edge to the rest of the city in a series of corridors, or fingers. As the streets come within a certain distance from the water, the pavement changes to a rough, water-permeable texture. Permeable hard surfaces – interlocking pavers, for example – support a variety of uses while allowing water to filter slowly into the soil. Areas that are paved in this way can be arranged to act as transitions between unpaved areas and impermeable asphalt pavement. While able to serve as parking lots, these transition areas also provide space for multi-modal circulation. That is, the texture of the pavers slows motorized vehicles to a point where pedestrians and bicycles can share the space freely.

The intermediate zone — defined in part by pavement — can also accommodate seasonal festivals, social activities, weekly farmers markets, and spill-over activities from cultural centers and other parks. Outreach material, such as colorful flags and posters of coming events, remind daily users of the multiplicity of ways that this space can be used throughout the year.

Pedestrian and moped bridges built across the Cardener help the opposite shores of the river to act as one park. Increasing access in this way also provides additional commuter routes across the river, and creates a unified seam between the cities of Manresa and Sant Joan.

INDUSTRIAL AREAS

Interventions in service entrances, parking lots, loading docks are simple, inexpensive, and designed to protect both the river and existing uses. Permeable pavement replaces impermeable asphalt in a band between the river and the buildings, slowing runoff without restricting normal vehicle use. Closer to the river edge, natural plantings protect water quality and provide habitat for riparian species.



Industrial River Edge

1. Proposed Open Space
2. Existing Industrial Buildings
3. Semi-Permeable Buffer
4. Pedestrian Path

CALLÚS



CALLÚS DEVELOPMENT

Callús Rambla:

- Developed into an active extension of the main street
- Permanent vending space for a local market (to sell local produce and crafts)
- Connecting the River Promenade to the social fabric of the city
- Linking the existing school, playing fields, swimming pool, and gardens (horts) to market activities, public amenities, and perhaps an Community Education Center.

As the Nature Walk gets closer to the town center, it should transition into a more formal River Promenade where people can have numerous access points to existing streets and amenities. A monitoring station positioned at the intersection of the River Promenade and the extension of the Ramblas creates a transitional node, while providing individuals with place to gather and view the river.

As the River Promenade passes to the south of the monitoring station, it should transition into a Garden Walk. At two locations along this path, new fishing docks can be constructed to provide direct access to the river. Elevated docks that prevent sensitive ground cover and riverbanks can be constructed to cantilever over the river's edge or use post and beam construction to provide residents with environmentally-sensitive, easily maintained fishing spots.

The potential to create a riparian zone along the river's floodplain exists along the Garden Walk. By growing reeds and other native aquatic plants in submerged condition, these zones can filter agricultural and urban runoff, collect sedimentation from river water, and provide habitat for birds, fish and other aquatic species.

The Callús Rambla is an example of existing infrastructure with tremendous potential to strengthen the town's relationship with the river. It physically links Callús' main street to the River Promenade as it passes beside the school, swimming pool, and playing fields. Because of the proximity to the local gardens, the Rambla could be used as a local market where individual vendors could gather to sell produce and local crafts. Attractive, compact vending stations placed in a sophisticated pattern amidst the benches, light fixtures, and ex

Legend

1. Existing school and swimming pool
2. Existing Rambla with new vending stations, benches, and public amenities
3. Proposed wayfinding gateway
4. Proposed sculptured bench with wayfinding signage
5. Proposed public restrooms
6. Proposed picnic facilities
7. Proposed water fountain for childrens' play
8. Proposed playground equipment
9. Proposed parking lot
10. Proposed Community Education Center (Phase 2)
11. Proposed extension of the Rambla linking to the River Promenade

isting trees, can create a lively gathering space. A vibrant wayfinding gateway placed over the main street as it connects to the Rambla can welcome users to Callús, the Rambla, and the River Promenade.

Adjacent to the school, a vacant lot has great potential to accommodate public amenities such as public restrooms, picnic facilities, and parking. This area can serve as the link between the River Promenade and downtown Callús, bringing the activity of the town center towards the recreational zone, while creating an attractive, lively public space for residents throughout the valley.

The parking lot is situated with room for expansion as demand persists. Currently, it is shown immediately adjacent to the Rambla, but in future years it can grow to accommodate increasing needs. To prevent additional runoff and water contamination, the parking lot can be constructed with a mix of permeable and impervious surfaces that allow water runoff to be absorbed into the ground, rather than run



- 1 Existing school and swimming pool
- 2 Existing Rambla with new vending stations, benches, and public amenities
- 3 Proposed wayfinding gateway
- 4 Proposed sculptured bench with wayfinding signage
- 5 Proposed public restrooms
- 6 Proposed picnic facilities
- 7 Proposed water fountain for childrens' play
- 8 Proposed playground equipment
- 9 Proposed parking lot
- 10 Proposed Community Education Center (Phase 2)
- 11 Proposed extension of the Rambla linking to the River Promenade



ning into the river. Surrounding the parking stalls, landscaping and runoff swells can help to absorb and filter runoff.

Future Phasing of the Callús Rambla:

Educational Community Center:

- A small Educational Community Center for the region can provide the region's residents with technology training.
- The focus of the education should not be solely on technology training. Rather it should have an element of business incubation or local job-training/development so that students are not eager to leave the area with their newly-gained skills. The education should coincide with the development of regional trades.
- The proposed Educational Community Center can house social activities where both the older and younger populations can gather.
- Phased over time, the Center can meet increasing demands as needed.

El Cortés Green House:

- Utilizing the same filtration system as Antius to make existing canal the water source
- Lab research that focuses on reviving the native plant species in the region
- A commercial greenhouse where these plants are sold to the public. It will become a new source of revenue for area (an example of green industry that could spark others like it)
- Job Creation for diverse skill-levels
- River water treatment filtration system will also be used here on the stretch of the river to benefit the adjacent garden plots

In addition to the development of the Callús Ramblas, a number of Callús' historical colònias are promising places for development. The Cortés Colònia, for example, sits right next to an existing canal and garden plots. There is great potential to implement the water treatment process in this area to serve as a means to improve the valley's natural vegetation and economic development.

In the first phase of development, the greenhouse could be used as a research facility for bioremediation, the use of plants and natural processes to remove pollutants from soil and water. Plants grown in the greenhouse could be used throughout the river valley in the regions' efforts to clean and revegetate the Cardener. The plants grown in the greenhouse, for example, could be used to carry out the Green River plans' recommendations to revegetate certain areas along the river. Other applications for the research and plantings from the greenhouse could be reclamation of soil in areas surrounding the potash or salt mines, water treatment in selected areas of dense vegetation along the river, or water treatment in canals or other water bodies throughout the watershed. As in other areas along the river, meanders and pool-riffles can be used in sections here to enhance the natural water purification process and provide a variety of habitats for fish. As the velocity of the water flow slows down, sediment can settle, improving the water quality downstream.



The sustainable greenhouse will also increase the opportunities for economic development for the region by providing jobs with a wide range of technical skills. For example, the region's elderly population could be interested in volunteering or working at the greenhouse. The greenhouse may also foster intergenerational activities where elders and researchers can educate groups of camp children on the revegetation efforts. Such activities would help to strengthen the community's relationship with the Ecological Center camp at Antius.

In the second phase of this development, a commercial greenhouse could be developed to provide the general public with quality native plant species. During the first phase of the greenhouse, public support might be required to establish the center. During that phase, employees would be trained, creating a new skill-base in the region, albeit one that is directly related to existing agricultural activity. When the second phase begins, a newly trained labor force would be readily available. The revenue generated in the second phase would benefit the research and the restoration efforts of the entire region.

The physical relationship between the river path and the Green house (and perhaps the educational center phased into in the Callús Ramblas) builds a stronger relationship between the technological and natural worlds.

- 1 Existing El Cortés Colonia used for administrative and research space
- 2 Proposed greenhouse for cultivation of native plant species
- 3 Proposed commercial greenhouse extension (Phase 2)
- 4 Proposed cultivation area with irrigation system
- 5 Existing canal with proposed water treatment system
- 6 Existing garden plots which can benefit from water treatment system
- 7 Proposed parking area with permeable surface and landscaping to reduce water runoff
- 8 Existing secondary roads can be utilized as fitness and nature walks
- 9 Proposed water treatment along riverbanks

ANTIUS



Antius Ecological Center:

- 1 Proposed wayfinding gateway
- 2 Proposed exhibit and demonstration space in the existing colonia
- 3 Proposed canal water treatment system
- 4 Proposed research laboratory
- 5 Existing tower used for observation of natural systems
- 6 Proposed housing for researchers and camp children
- 7 Proposed commercial building (housing locally-owned shops, restaurant, and café)
- 8 Proposed outdoor pavilion within tree-lined courtyard (housing picnic facilities, educational playground, and demonstration areas)
- 9 Proposed areas for revegetation (also identified in the Green River Project)
- 10 Proposed parking area with permeable surface and landscaping to reduce water runoff
- 11 Connections to numerous existing trails

- A research center for local and visiting researchers
- An exhibit/demonstration space to raise local awareness of the region’s ecological and industrial history and its effect on the watershed (Audience: children and adults)
- A camp for kids to learn about the region’s watershed and ecological history
- A river water filtration system to visibly clean the water in the canal and this particular stretch of the river and serve as outdoor demonstration space
- A commercial component with restaurant, cafe, and local stores to attract residents of nearby towns
- A destination point along the river path

The historical Antius Colònia has tremendous potential to strengthen the relationship between the technological and natural worlds in the form of an Ecological Center. This is a place where education and research can merge to benefit the corridor’s residents, both young and old. Located alongside the river and canal, and nestled within natural vegetation, Antius makes an excellent site for the Center. The complex can consist of a research center, an exhibit space, overnight facilities for youth, and a commercial strip for a café and shops. A Nature Walk can link the Center to Súrria, Callús and other nearby attractions.

The Ecological Center can serve as a place for local and visiting researchers to study water quality and eco-industrial techniques. The exhibit space can serve as the demonstration space where researchers educate the public (children and adults) about the history of the corridor and the on-going restoration activities. School children can visit the center to learn about the efforts underway and what other efforts can be taken to improve the health of the corridor. For extended learning and experimentation, the center can support a youth



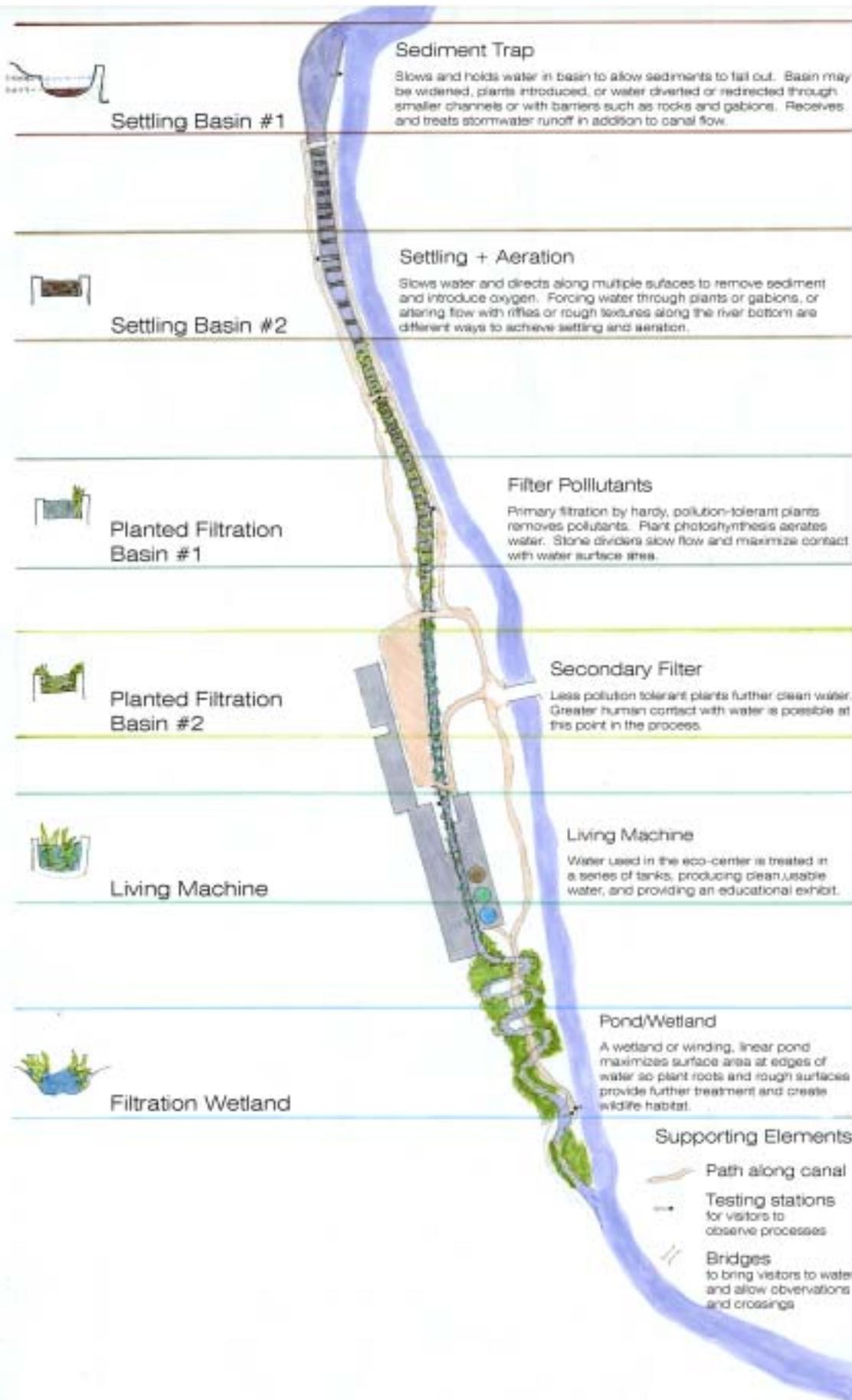
camp. Part of the Colònia's housing can be converted into camp accommodations, and the remainder can be used for research housing. To make Antius an attractive destination for all of the region's residents, it is important that it have a commercial component within it. We suggest providing a high-quality restaurant and café and several local shops that appeal to local residents.

River Water Treatment used in conjunction with the Green River Plan

A key element of the Antius Ecological Center can be the natural filtration/bioremediation system created in the canal that formerly powered the textile mill. The canal delivers the message of coexistence of industrial and natural processes, as well as the reclamation of a damaged landscape through contemporary development ideas. Minor interventions can be introduced to the canal to improve water quality, while demonstrating the various ways in which this can be done on a larger scale throughout the river corridor. The image provides examples of how the canal might be set up, as well as alternative approaches to bioremediation.

Similar ideas can be applied to the riverbanks, as well. For example, native plants can be planted along the river edge to filter pollutants from water and aerate it, while providing natural habitat for various fauna. In addition, this vegetation can slow the movement of runoff, particularly from nearby industrial development in Súria, allowing sediments to settle rather than enter the river. Shrubs, trees, and other plants can be planted along the steeper parts of the bank, such as between the river and the major road across from Antius, to further prevent erosion and polluted runoff. Finally, rills, gabions, and other interventions that introduce rough textures into the river can improve water aeration, creating a better habitat for fish, invertebrates, and other fauna. These meanders and pool riffles along sections of the river can enhance the natural water purification process and provide areas for sediment deposition.





Bioremediating the Canal at Antius

These principles, particularly as related to runoff mitigation and steep embankments, can be applied at a larger scale in areas of industrial development, such as in Súria. The use of plantings and gabions could especially soften the edge between Antius and the industrial park. These approaches are critical to the success of the Ecological Center, and can ensure that future development along the Cardener River responds with responsible approaches to land use.



Connection between Antius and Callús:

River Walk Access

- Links Antius with existing colònias and other new facilities
- Takes advantage of existing dirt (and secondary) roads to make better use of what already exists
- Utilizes attractive signage to provide users with more knowledge about their options and the region's attractions



As one travels away from the Ecological Center along the Nature Walk, they can encounter “Learning Posts”, or observation decks, located within the natural setting and constructed out of natural materials. Monitoring Stations can be located within these posts to encourage interaction with existing natural systems. They also will provide multi-use gathering space for observation, fishing, or picnicking. They can also provide the Ecological Center visitors and path users with resting places.

This image shows how the existing trail and secondary road systems can be enhanced to take advantage of the numerous historical landmarks in the valley. For example, as visitors leave the Antius Ecological Center (lower left corner), they can walk along the Nature Walk and connect to a pedestrian bridge that can would them across the river to another trail. This trail can lead them under the magnificent Torre de Bogadella and into the hills where they can stop for lunch at the existing restaurant and take advantage of the excellent views of the valley. They then can loop back to the Ecological Center or the river path if they so choose. The red buildings denote other historical colònias (some currently in use, some not) that could be accessed by the paths and incorporated into the cultural and historical path system as small retreat centers or new eco-industries. For example, in future years the building in the lower right could become a small conference or retreat center with an outdoor amphitheater nestled within the native vegetation.



- 1 The back of the existing Antius colonia
- 2 The existing El Guix Colonia
- 3 The existing XXX Restaurant overlooking the valley provides an excellent destination point at the end of the El Torre de Bogadella Trail
- 4 This existing building is a potential future site for a retreat center or eco-industrial use
- 5 Proposed amphitheater for performances
- 6 Proposed learning center and fishing dock, connecting Antius Nature Walk with the El Torre de Bogadella Trail
- 7 Connections to numerous existing trails leading into the upper highlands
- 8 El Torre de Bogadella

Future Phasing:

Retreat center outside of Antius if demand permits:

- Can attract small companies in Barcelona as a retreat/conference center in picturesque setting
- Can be a viable rehabilitation of existing colònias
- Can provide local food and hospitality services with additional jobs

There may be potential for a small retreat center in the rural landscape in future years. As the international trend of returning to nature continues, companies, organizations, and families located in Barcelona may find the picturesque landscape in the Cardener valley attractive for quick getaways. Using the handsome colònias and other historic buildings to house small hotels or retreat centers, could provide the valley's residents with additional revenue and job opportunities.



NORTH CORRIDOR DEVELOPMENT PLAN:

Landscape and Industry

The section of the corridor between Antius and Súria offers multiple possibilities to integrate a watershed approach with successful industrial and cultural development. The combination of existing potash mining operations and *horts* characterize the entire Cardener corridor - a landscape where industry and agriculture cohabit. From Súria's proposed zoning map, it is clear the main objectives is promoting successful industrial development to replace the mining operations while preserving the natural resources of their landscape. Our proposal seeks to juxtapose these intentions with our overall watershed approach to valley development and to propose a plan for an ecological and eco-industrial area from Antius to the Pla de Regeant. We feel this planned rather than 'organic' growth of development will serve to ensure that neighboring cultural facilities are not negatively impacted by economic growth.



We propose a three phase development plan for the area that ties commercial and landscape development to the ecological center of Antius in the south and the potash mining/tailings mountain in the north. The plan establishes "nodes" of activity along an expansive pathway system. The timing of these phases depends largely on the ability to establish a regional watershed approach and put the necessary institutional framework in place to leverage funds and manage the watershed activities. As we acknowledge these efforts are politically sensitive and alliances will be difficult to build, we conservatively estimate it could take at many as five years to begin phase 1 and 10 years to complete phase 1. We expect the physical interventions in phase 1 to become a rallying point for regional cooperation. Although these interventions are located in the municipalities of Suria and Callus, they demonstrate the effectiveness of working together to create a region that is ecologically responsible. Furthermore, when different municipalities combine their efforts, they create a region that can compete more vigorously against other regions in Catalunya. Allowing for a five-year gestation period, the second phase is expected to begin in approximately 15 years, ending in 20 years, by which time the second mine shaft will be nearing its terminus. After another five-year period of gestation, we expect the third phase to begin in 25 years, when the second mine has closed and be completed in 30 years. Thus our plan encompasses a time frame from five (2006) to 30 years (2031).





While the first phase is a strategic proposal, the following phases are intended to be adaptable and rely on continued interest and economic viability. In the first phase we propose three built interventions - firstly, an ecological/research center at Antius, which becomes an anchor for future development/preservation. Secondly, we propose a parking/interpretation center at the site of the existing industrial/commercial area adjacent to the southern mining area (shaft #2) providing an access point to the poplar grove from the main road into Súrria. And finally in the first phase, we propose an observation deck within the poplar grove. In addition to these built interventions we propose a pathway linking Antius to the grove, identify areas where natural remediation is necessary in the first phase (see map) to enhance the ecological health of the immediate area and to create a setting for future interpretive activities.

The second phase builds on the successes of the initial phase. After some 15 years, we expect the combined Antius/Pla de Regeant region focuses on establishing a seed for development at the mining train depot, providing a cross-valley portal to integrate a multi-use pathway system, introducing an agricultural/ecological research and development area, creating plant buffer zones, and rehabilitating the area north of Antius currently zoned for industrial and commercial development. The third phase further develops the by then defunct mining area in the north, establishes a landscape park on the potash mountain, allows for further commercial growth in the old north mine and southern industrial areas, and integrates the pathway system further.

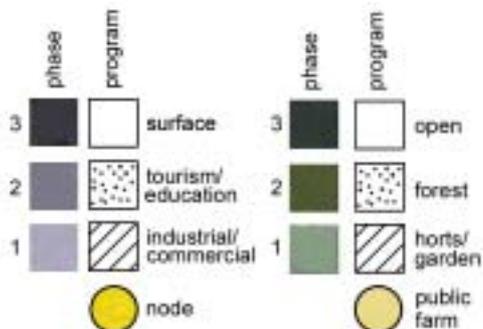
Phase 1: The first phase seeks to introduce an ecological sensitive approach to future growth and establish a pathway system. The system, composed of new and existing pathways, will begin to create connectivity at a human scale between the ecological center, landscape interventions, and commercial development areas. By reclaiming the southern zone of Súrria's new industrial area and focusing development of the northern zone, we hope to control sprawling growth and establish a human scale, urban commercial zone. The Antius/industrial pathway portal will help establish an ideological and visitor relationship between the two areas. The orchard area between the mines will remain protected land and act to draw visitors to the phase two and three mine interventions. Phase one involves revegetation of the orchard/community area and the length of the banks of the river.

Phase 2: The second phase further develops the nodes and path way system. It begins to develop the mine train station area as a destination point in anticipation of commercial growth after the close of the mining operations. Pathways along the secondary river to Súrria meet at the river path crossroads to the north of the orchard, and the cross-valley portal links other pathway networks in the valley to the area nodal system. A café area by the southern mine and overlooking the orchards can provide a meeting point for employees, Antius visitors, educational programs, and leisure seekers. Phase two also includes plantings for a river buffer in the rezoned southern industrial area.

Phase 3: The final phase allows for urban development of the northern mine. The pathway link ties the center to the nodal system, and the tailings natural area provides a site for research and recreation.



- phase 3: tailings natural area
- phase 2: train station/urban center
- phase 3: urban center/pathway link
- phase 2: river path crossroads
- phase 3: path portal to station area
- phase 1: orchard way station
- phase 1: access to orchard area
- phase 2: commercial growth
- phase 1-2: commercial development
- phase 2: cross-valley pathway portal
- phase 2: industrial plant buffer
- phase 1: antius/industrial pathway portal
- phase 2: orchards/community gradens
- phase 1: antius ecological center
- phase 1-2: public agriculture/ research land
- phase 2: researcher residence



Process, Principles and Precedents

PROCESS

PLANNING AND DESIGN PRINCIPLES

BEST PRACTICE CASES

5

The Cardener River Study Plan grew out of a two-year investigation conducted by the Departament d'Urbanisme i Ordenació del Territori of the Universitat Politècnica de Catalunya and the City Design and Development Group in the Department of Urban Studies and Planning at the Massachusetts Institute of Technology to determine how the cultural resources of the Llobregat Valley could be used as a basis for regional development (Designing the Llobregat Corridor 2002). In the fall of 2000 the Diputació de Barcelona forwarded a proposal to MIT requesting the study of the Cardener corridor, which includes a 20-kilometer stretch from Manresa to Súria. The elements of that proposal have guided the subsequent MIT workshop research and report. The MIT group came to regard the Diputació and the four municipalities as its clients to whom the Study Plan should be addressed. The Diputació proposal also contained a request for a presentation of "planning methodology for river corridors" which is appended here under the title of "Principles" and in summary form in the third section of the report.

During the months from February through June 2001, Professor Joaquin Sabate and his staff prepared a thorough physical inventory of the corridor employing aerial and ground photographs and maps of the region. They also forwarded a complete set of maps, copies of the Diputació 2002-2003 Plan, the Green River Project and the Blue Space Project plans, as well as material covering the municipal initiatives of Manresa, Sant Joan de Vilatorrada, Callús, and Súria. In the future the Diputació should consider some additions to such background material when it undertakes similar studies. To comprehend the possibilities for tourism, economic development and environmental adjustments study groups need to be presented with highway traffic studies, demographic and business location trends, and data on water quality and flow. In addition, the Cardener corridor under study is but a fraction of a much larger watershed. More data on the current status and management of the watershed would improve the possibilities for corridor recommendations.

In June 2001, Professor Eran Ben-Joseph of MIT, a landscape architect and planner, selected ten MIT graduate students to conduct the study. He sought to compose a team with varied skills and interests, ranging from design to environmental management. He also enlisted the assistance of Visiting Professor Sam Bass Warner, an urban historian.

Between September 3-7 the 12 members of the workshop visited the corridor. The generous loan of studio space in Manresa by the Catalunya Society of Architects (Col·legi d'Arquitectes de Catalunya) proved extremely helpful. Together as a collective and later in small groups, the team traveled up and down the corridor. The Mayors of Súria, Callús and Sant Joan were kind enough to make individual presentations of their current conditions and future plans. The chief planner for the City of Manresa also presented his city's initiatives.

On September 6, the workshop divided itself into two teams. Each one made a preliminary report of their discoveries to the officials of the Diputació, and Prof. Sabaté of the Universitat Politècnica de Catalunya. This event proved a useful exercise because it enabled the MIT groups to test their reactions against those of their Catalan clients. To summarize the results of these presentations, one team stressed the possibilities of a union of environmental and cultural goals, while the other stressed the possibilities for economic development and institutional innovation.

In terms of future projects, it is important to recognize that had the Cardener site been in the United States, or had the MIT team been based in Catalunya, its members would have spent several weeks at the site. They would have made a special effort to interview local residents, businessmen, farmers, watershed managers, real estate developers, and municipal planners. But because of time constraints and long distance relations, this was not possible.

Upon return to MIT the team devoted the next weeks to three tasks:

A. It searched the literature for cases of Best Practice in the fields of watershed management, land use and urban design, regional ecology, building re-use, road networks, mining rehabilitation, river parks and ecological centers. The cases found were then posted on the Web for use by the workshop and the Diputació.

B. A team within the workshop drafted a list of the design principles that should be employed when considering river corridor planning. A summary of these principles appears in the Introduction to this report.

C. Guidelines for the next presentation of proposals were drawn. The particular topics to be prepared by three subgroups were:

- the future expansion of the four towns,
- maintenance of watershed integrity,
- heritage resources,
- path-linkage ideas for highways, roads, streets, and walkways.

On October 15 the workshop presented its draft Study Plan to its clients: Yolanda Alvarez and Josep Sole of the Oficina Tècnica de Cooperació (Diputació de Barcelona) and Prof. Joaquim Sabaté of the Politècnica. There followed a good deal of discussion about how Catalunya's circumstances might best be addressed in the workshop's suggestions.

The remainder of the fall semester (from October 15 to December 15) was devoted to the preparation of this Study Plan Report. The goal of the workshop was to build upon the existing town and regional plans by making suggestions for the most compelling next opportunities. The rationales for these suggestions appear in Section 3. In response, typologies and possible design interventions along the Cardener and within each town are presented in Section 4.

September

Site visit to Catalunya, Charrette, On site presentation, Cases, Frameworks



October

Area-wide Concepts + Site/Zone Design Explorations, Planning Frameworks, Midterm Review with clients

November

Plan Development, Experts Input, Role Playing, Synthesis, Alternatives



December

Specific Design Development, Report Generation



January

Publication Production

March

Public Presentation

Workshop Timeline

PLANNING MODEL

The following represents a general model of our process. It includes procedures used in the workshop as well as those which should be carried out by a planning team working in closer proximity with the physical setting.

While the process is presented as a linear progression, it is and always should be composed of interacting steps that contribute to, inform and affect each other.

- **Identification of Planning problems and Opportunities**
- **Establishment of Planning Goals**
 - Input –
 - Political process
 - Citizen and community
 - Government agencies
- **Inventory and Analysis –Watershed (Regional) and Local level ---- background information collected**
 - Site reconnaissance, inventory, impressions
 - Site Visits- input- first-hand experience of the locality
 - Interaction with the stakeholders, and production of preliminary ideas for review and discussion.
 - Preliminary program and concept development
 - Public workshop- charrette
 - Presentation
 - Debriefing - FEEDBACK >
- **Planning and Design framework development**
 - Information analysis
 - Expert input
 - Precedents
 - Best practices
 - Applied methodologies researched
- **Project's attributes determined and applied For River Corridor Planning:**
 - Natural Systems-Landscape Planning
 - Landscape Ecology
 - Watershed management/Watershed planning
 - Social/Cultural (planning mechanisms)
 - Historic preservation
 - Cultural Heritage Landscape
 - Narratives- Interpretations
 - Education
 - Management/stewardship
 - Economic development
 - Industrial cooperation - Incentives
 - Eco-tourism
 - Reuse
 - Tourism
 - Recreation
 - Marketing
 - Education

- **System Design**
 - Use
 - Circulation/Access
 - Places
 - Activities
 - Environmental mitigation restoration

- **Implementation mechanisms**

- **Planning and Design frameworks developed – Concepts, Options, Alternatives**
 - FEEDBACK >**
- *Specific Design Concepts Developed*

- *Review- Stake holders-Experts- Public Input*
 - FEEDBACK >**

- *Plan Refinement - Detailed design*

- *Presentation- Public Input*
 - FEEDBACK >**

- *Plan Modification-*

- *implementations- (Phasing) –*

- *Administration -*

- *Post evaluation*
 - FEEDBACK >**

The following list is a compilation of principles developed for the Cardener Corridor Study. They encompass various issues from general planning mechanisms to physical design implementations. While the list is presented in its entirety the essence of these principles are reflected in the report and the previous sections.

Planning Principles

DIVERSITY OF PROGRAM, PARTICIPANTS, LINKAGES AND NETWORKS

- Recognize and celebrate the region's collective past by taking advantage of existing resources, be they industrial, cultural, historical, or natural.
- Foster connections between the built environment, cultural heritage, and natural systems so that they are experienced together.
- Encourage mixed-use developments where appropriate to reinforce connections between residential, commercial and industrial land-use
- Develop and foster a diversity of multi-functional, multi-seasonal and "24 hour" spaces that can be used by people of diverse ages and interests.
- Creatively re-use existing structures. For example, conserve existing historic structures in poor conditions by leaving their foundations intact and incorporating them into the landscape.
- Enhance and develop further the existing trail network. Provide opportunities along the trails to access existing points of interest; new interventions should also connect to and enhance the existing network. The Cardener River provides a key opportunity to connect this network and act as a point of orientation and focus for the region.

ECONOMIC DEVELOPMENT

- Conserve and preserve the unique collection of cultural and historical resources in the valley. Articulate and interpret the region's rich history through the cultural themes of each town in order to attract both local and regional tourists.
- Encourage industrial development in a way that respects the river ecology and existing road networks.
- Encourage businesses and industries – including agriculture – to adopt and implement responsible environmental practices that are sensitive to the watershed. Coordinate existing pathways using well-designed and distinct signage that can be identified throughout the watershed.
- Use public capital to attract ongoing private investment into the maintenance of the watershed.
- Provide incentives for the private sector to re-use and to conserve historic facilities.
- Coordinate economic development efforts through initiatives such as an eco-industrial park shared by the municipalities of Manresa and Sant Joan or upgrading information

technology along the Cardener to revitalize existing industries.

- Encourage sustainable businesses to locate in industrial zones. For example:
- Businesses that promote renewable energy use, such as solar photovoltaic manufacturing industries.
- Agriculture and livestock-based production such as food and dairy industries, bio-gas production, and pharmaceuticals
- Organic agriculture production using greenhouses and/or hydroponic production
- Recycling and re-use industries
- Develop and encourage creative financing to accomplish public goals.
- Raise regional awareness of the river corridor through strategic visual and physical interventions and advertisements to attract tourism (if desired)

ECOLOGY AND ENVIRONMENTAL SENSITIVITY

- Land-use planning and development in the Cardener river corridor should adopt a watershed approach which adheres to natural, rather than political boundaries for regional planning.
- Manage and mitigate water quantity and quality in the Cardener watershed in order to support a healthy ecosystem.
- Natural resource and land management should balance the need for accessibility with the need for conservation along the Cardener River corridor, given the region's exemplary opportunities for recreation and tourism. Particular attention should be given to those areas under greatest development pressure.
- Explore a diversity of options for protecting sensitive environmental areas, including easements, zoning, set-asides, public-private land trusts, agricultural cooperatives, and economic incentives and policies.
- Limit development in critical watershed areas, particularly on the (northern) west side of the Cardener along Callús and Súria.
- Review new developments in order to identify potential negative impacts on the local ecology. Furthermore, initiatives should contribute or be sensitive to the ecological restoration of the region.
- Work cooperatively with farmers, industry and adjacent communities to explore solutions to agricultural and industrial waste challenges, such as waste disposal, management and elimination.
- Ensure that construction of new roads within 30 meters of a water body do not interfere with the natural systems of the water's edge, and avoid erosion of the land, destruction of wildlife habitat, or unnecessary removal of native flora. New routes should be designed to catch and (passively) filter run-off from adjacent industries or agricultural uses.
- Conserve the existing topography and native vegetation when building new developments and/or rehabilitating existing ones.
- Improve the channel network and natural riverbanks by re-grading where necessary.
- Design parking facilities to allow on-site drainage. Encourage use of high quality materials and adequate vegetation for shading when integrating parking into this sensitive environment. Siting of parking facilities should take into consideration not only the minimization of access roads necessary to serve them, but also the view from public rights-of-way.
- Re-vegetate riparian area and uplands with native species to improve the valley's bio-diversity.
- Develop a local nursery with trained staff, to supervise native habitat restoration. Encourage community involvement through a volun-

- teer network and complementary curriculums in public schools.
- Develop infrastructure that mirrors the region's goals for environmental sustainability:
- Initiate, develop and maintain a phased regional public education campaign to promote the concept of watersheds and environmental sustainability. This campaign should draw upon the river itself as an interactive learning tool. Its condition can be monitored both by simple observation techniques and scientific methods.

LAND-USE AND GROWTH

- Reuse historic and cultural buildings for a variety of contemporary activities. For example: hotels; educational institutions; housing; research and development facilities, production, and office space – while maintaining the design and landscape character of their historic setting.
- Encourage in-fill of housing and commercial activities within the existing urban fabric and discourage expansion of the urban built boundary.
- Protect strategic areas of agricultural land (“horts”) for self-sustaining farming.
- Create a multi-city master plan that defines land use specifically along river corridor.
- Remain sensitive to the scale of growth appropriate to the existing infrastructure.
- Connect existing public spaces to new access routes (particularly along the Cardener River).
- Determine targets for growth and wherever possible, preserve valued agricultural land.
- Design new industrial areas to contribute to the ecological integrity of the region – use high quality materials and pay attention to the scale of the surrounding environment.
- Preserve community character of the horts and provide support for protecting them. This agricultural land serves an important multi-functional purpose for local communities and forms a unique piece of the urban fabric along the corridor.
- Discourage building new facilities in the floodplain of the river.
- Require new facilities located within 30 meters of water body to treat all wastewater in-house (ie not released into their land through septic beds) and provide a second in-house water filtration facility to ensure the cleaning of the adjacent water body. New facilities located 30-100 meters from a water body must treat all wastewater in-house.
- Require local communities to consider the river in their master plans. Coordinate zoning across municipalities in order to concentrate growth in regionally beneficial and appropriate areas and to ensure continuity of green space.
- Coordinate regional industrial development between Manresa, Sant Joan and Callús.
- Consider financial policies and subsidies which would reflect and support the land use goals of the region. For example, implement revenue-sharing across municipalities and provide tax incentives for responsible planning.

TRANSPORTATION

- Consider opening the existing freight rail lines to passenger traffic at targeted times of day and year. Times between these targeted services could be reserved as part of tourist packages stopping at each

- town to engage new and existing cultural and recreational facilities.
- Consider providing a perimeter bus connection from Manresa's existing passenger rail station serving Barcelona to a future passenger rail station in Suria in order to serve the northern communities.
- Develop multi-modal transportation options for commuters, residents and visitors along the Cardener.
- Integrate a recreational and interpretive route(s) that would be available to experience the environment by bike, on foot, by rail, and by car.
- Coordinate plans for new highways with the Generalitat de Barcelona according to local residential and commercial development patterns.
- Ensure that expanded transportation networks continue to connect individual settlements within and along the river valley.
- Implement a hierarchical, uniform signage system that reflects the uniqueness of the Cardener River corridor and allows for easy navigation of the region by residents and visitors.
- Develop a multi-layer path system that provides for traffic on foot, bicycle, and automobile.
- Establish a system of trails and scenic opportunities that cut across the valley in directions that are perpendicular to the flow of the river.

COMMUNICATION AND EDUCATION

- Integrate a network of interpretive sites in the corridor utilizing both existing structure and outdoor locations. These would pull together the overall story of the place, and play a formal education role, as field learning venues for local schools.
- Initiate experiential watershed education programs through the school systems.
- Form partnerships with regional schools to include them in environmental and cultural heritage preservation efforts.
- Educate local community members through formal and informal measures: through programs at the future EcoCenter and through educational signs along the river path.
- Gather public involvement and support through annual events and public meetings in order to ensure the success of any planning intervention.
- Form a local Non-Governmental Organization to administer and organize river walk and inter-community events.
- Encourage a diversity of organizations (fishing organizations, hiking clubs, biking groups) to participate in the process of habitat preservation and management.
- Educate the valley residents and visitors about how they can reduce non-point pollution and use the river respectfully.
- Use existing festivals and town events to strengthen community identity and begin new traditions that tie together identity of corridor as a whole.
- Integrate educational programs with the University in Catalunya's research objectives.
- Commission artists and designers for infrastructure and land improvements.

General Design Guidelines

- Transform riverbanks into green corridors in each city and relate them to adjacent urban developments.
- Build additional pedestrian bridges across the Cardener to connect uses on either side.
- Improve pedestrian access on existing bridges through reconstruction or renovation.
- Provide consistent interpretive and directional signage throughout the Corridor.

- Encourage design that reflects the vernacular style of the region.
- Parking surfaces should be permeable and reflect the microclimate.
- Provide attractive and sensitive pedestrian lighting in identified locations that connect to urban activities along the river.
- Integrate paths into the infrastructure and circulation pattern for commuters.
- Integrate public art into locations along the river corridor.
- The natural banks of the river should be maintained and enhanced to promote vegetation and wildlife habitat.
- Views of the river should be provided at regular intervals by the selective thinning of vegetation at key locations.
- Enhance way finding (signs, design of intersections, vistas) in the river corridor. Establish design criteria at the regional level for the design of signage for transportation networks, cultural resources and historic landmarks, other sites of significance
- New buildings facing the river corridor should address the river with facades commensurate with the scale and significance of the site.
- The character of interventions, except in exceptional circumstances, should compliment the character of the surrounding landscape in terms of materials, scale and typology. Particularly, the scale of the intervention should be appropriate to the scale of the
- The character of paths should respond to the mode of transportation envisioned for each particular segment, taking into account travel times and distances between significant points of interest or urban centers. Incorporate the following elements into design of public spaces (where appropriate): water and soil remediation, river bank re-grading, community gardens, walking and bicycle trails, playing fields, new and recycled industrial buildings, site-specific art, demonstration and teaching centers of various sizes, discovery exhibits, facilities for maintaining the space, visitor centers, event halls, and cafes.
- Construct stream bank restoration along the existing floodplain and in areas indicated by the Green River Plan for various scenic and ecological purposes, such as to filter agriculture runoff, to prevent erosion or scouring of the foot of hill's ridge, to prevent sediment runoff from gravel factory and potash mines, to treat industrial and municipal discharges in some sections, to enhance or to create fish habitats.
- Continuous trails/paths should follow the river's edge at either the top of the bank, the toe of the slope, the lower ridges or both. Paths must be connected to provide "looping"
- Access- Overlooks, steps down to the water, should be placed at various locations along the river to mark points of access.
- The primary river edge pathway should be constructed with a typical width of 3-4 meters.
- No new buildings will be constructed within 50 m along the river corridor, with the possible exception of small water related activities.
- Vegetation along the natural riverbanks should be selectively cleared and enhanced with additional plants that will prevent erosion and promote wildlife, while still allowing some views of the water. A zone of natural wetland vegetation along the water's edge should be preserved and recreated to stabilize the banks.
- On-street parallel parking should be considered for roads that border the river in order to encourage use and reduce traffic speeds.
- Continuous rows of trees are recommended along both sides of the streets for roadways that parallel the river and that lead to the river and/or to river bridges.
- Streetscape details should be consistent, including lighting, signage, materials, and furnishings.
- No new surface parking lots will be developed along the river; existing lots will be improved to remedy for water runoff and enhanced with planting.

- Coordination of existing pathways should involve unique, well-designed signage with a high level of graphical quality that can be identified throughout the watershed to ensure that all communities have equal ability to take advantage of the economic benefits of the Cardener Watershed Plan.

Best Practice Cases

Industrial Reclamation

Reclamation of mining areas can take several forms:

- Restoration of the area to its pre-mining condition
- Restoration of the area to low maintenance native vegetation
- Developing the area for other purposes such as wetlands, recreational areas, urban development, etc.

The rehabilitation process comprises two stages:

- Landform design and the reconstruction of a stable land surface
- Revegetation or development of an alternative landuse on the constructed landform

HERNE HILL QUARRY, AUSTRALIA

The rehabilitation of Herne Hill Quarry, Australia involved a project in which only 6% of the 1,000 hectares of land owned by the mining company was quarried, while the rest of the land provided a buffer zone of natural surroundings. There have been ongoing rehabilitation programs since 1987, which are conducted simultaneously with mining operations.

SONDERSHAUSEN/HARZ, GERMANY

This project involved a potash mine revegetation process which utilized the following techniques: water-saving planting methodology; the use of hydrogel as a liner and sewage sludge as fertilizer; plantation of species; snow berry, amorpha, and poplar hybrid trees. The project resulted in successful growth of Poplar and Amorpha on a potash mine heap that had a low water content and high levels of salinity.

Redevelopment of Industrial Facilities

FORD ROUGE RIVER PLANT - DEARBORN, MICHIGAN

Ford Motor Company is working with “green” architect William McDonough, and landscape architect Julie Bargmann to rehabilitate its 1,200-acre, 90-year-old plant. McDonough has already designed a new 600,000 sf assembly plant, which includes the world’s largest “living roof”. The living roof, a layer of soil and plantings covering the entire roof of the assembly plant, insulates, mitigates runoff, and provides other environmental benefits. With the team’s landscaping proposal, the living roof will help Ford save millions of dollars through natural stormwater management.

The project will cost \$2 billion and be implemented over 20 years. Funded entirely by Ford Motor Company, it is a clear indicator of the increasing importance of sustainability, clean industry, and social accountability. McDonough has also completed projects for such global corporations as Nike and The Gap. According to Bargmann, the goal of the Ford project is to create a factory that “produces not only vehicles but clean water, air, and soil.”

Land and Water Reclamation

The following projects deal with rehabilitation, treatment, and reuse of damaged ecosystems and industrial sites, but they use design to interpret, focus attention on, and re-evaluate forgotten or destroyed areas, typically involving the work of artists and incorporating public education efforts. They also use natural systems to mitigate environmental pollution, while making the results visible.

LIVING WATER PARK - CHENGDU, SICHUAN, CHINA

The Living Water Park is a \$2.5 million project in a larger effort by the City of Chengdu to reclaim its polluted rivers. The effort was coordinated by an American artist and a landscape architect with Chinese designers, scientists, and engineers. The park draws water from the adjacent river and filters it through a 1,500-foot long system of fountains, settling ponds, flow forms, constructed wetlands, and fish ponds before returning it to the river. Aeration through sculptural forms and phytoremediation through plantings helps treat the water, so that it is clean enough to play in by the end of its course.

Visitors can see the filtration process, approach the river edge, sit in an amphitheater for events, and play in clean water. In addition, the design incorporates local traditions (through its overall fish shape, for example), and uses local vegetation and rare vegetation from sacred mountains of the region.

RUHRGEBIET, GERMANY

This site has a similar history to the Cardener corridor because of its industrial heritage. The 45-mile long, 10-mile wide area was sprinkled with abandoned coal, iron, and steel factories and mines. Through the imagination and local pride of several municipalities, it has developed into an extensive park system and a magnet for a diversity of activities. While the scale of this project is much larger than the Cardener Corridor, it did involve cooperation between municipalities and found creative ways to revive vacant industrial land, incorporate them with nature, and celebrate their history.

Some of the projects included in this park system are:

- Water and soil remediation, regrading of river banks, garden shows and community gardens, walking and bicycle trails, playing fields
- New and recycled industrial buildings; new and restored homes
- Site-specific art, scientific studies, demonstration and teaching farm, discovery museum, ranger station, visitor center, event hall, exhibition space, arena, cafes/commercial spaces, and office space

NORTHSIDE PARK, DENVER

A 1930's sewage treatment plant was desolate for thirty years until its potential as a river park was realized. Rather than absorb the enormous costs of demolishing the existing structures, many of the foundations were left in tact and incorporated artistically into the park. These low-maintenance structures provide flexible spaces for recreation and nature exploration, serve as historical reminders of the area, and allow for a financially affordable project.

Also incorporated into the park was the reclamation of the river and natural components. They regraded riverbanks and planted the area with natural species to improve the park's environmental health. In addition, the area was zoned light industrial to provide job base on surrounding sites. This is an example of creating a unique, attractive space, that serves the open space needs and employment needs of adjacent communities (not just a pretty space). The park also includes numerous playing fields and urban camping grounds.

AMD + ART - VINTONDALE, PA

This former coal mine in Appalachia is being reclaimed by a group made up of a land artist, a landscape architect, a hydrogeologist, and an historian, along with a growing group of supporting organizations and members of the public. The site is located near a popular regional hiking/walking trail in order to draw public attention to the water remediation process, which is often hidden from view. The water treatment process begins in a limestone settling pond, where the water is bright orange (from the acid mine drainage). As it flows through the pools in the Litmus Garden, its color changes, eventually coming out blue.

Alongside the pools, native plantings with colorful vegetation mirror the changing water colors. Another feature, the Emerging History

Wetlands, show the footprints of the original buildings on the site. The site includes an environmental education center, interpretive art, trails, and fields.

The project is funded by the state, US EPA, Office of Surface Mining, AmeriCorps, Wildlife Habitat Council, a local church, and arts and environmental organizations

Eco-Industrial Park

Eco-Industrial parks are based on the principles of industrial ecology where the waste from one industry becomes the raw materials for another, creating a “closed loop” of material flows. The parks are comprised of a cluster of industries which have an interdependent relationship. In addition to the environmental benefits of such a process, eco-industrial parks create linkages among local “resources” – government, unions, nonprofit groups, businesses, education institutions and communities.

KALUNDBORG, DENMARK

This project is situated in a small industrial town with 12,000 residents, and is home to the world’s first Eco-industrial park, which was created through the emergence of the industrial symbiosis of environmentally driven firms.

The following factors contributed to the success of this project:

- Consultative, open and flexible regulatory framework –
- goal setting through a dialogue between regulators and firms.
- No single coordinating institution– Industries coordinate themselves
- Alliances and contracts between industries
- Performance based regulations – focused on finding innovative ways to be environmentally benign rather than on fighting with regulators
- The industries complement one another
- The geographical distance was not too large
- The ‘mental distance’ between participants was small (they all knew each other)

Land Art:

The issue of land art is one worth exploring. The tailing piles at the mines along the Cardener River bring to mind such large pieces of landscape art as Rodin Crater by James Turrell, Double Negative by Michael Heizer, and Spiral Jetty by Robert Smithson.

Ecological Centers:

EARTH CENTRE, DONCASTER, ENGLAND

The Earth Centre in Doncaster, England exemplifies the kind of environmental tourism which incorporates economic, social and ecological revitalization. This project is particularly notable because of the history of the site. Located in a once wooded river valley, the site was ruined by 100 years of coal mining. In the 1990's, when Britain experienced widespread coalmine closures, the Doncaster region had severe environmental degradation and high unemployment. Located on a 220 hectares, two hours from London, the Earth Centre is now a forum for the exploration, demonstration and communication of sustainability. The project features a carefully integrated ecosystem, incorporating nature conservation, food production, buildings, woodland management, archaeology, energy efficiency and water management, in addition to a conference center, galleries, restaurants, residences, and recreational and cultural facilities.

Although the project continues to be a large undertaking, financed by the European Commission, English Partnerships, and English National Lottery Millennium Commission, there are elements of the project which could be applicable to the Cardener region. It is a model for sustainable development practices and represents a unique type of "tourist attraction." In addition to the environmental technologies used on the site, much can be learned from the conceptual design of the projects. For example, the plan to have one high profile project intended to reach a large audience, and several satellite centers which would be outreach and educational posts might be a good model for the proposed ecological center along the Cardener. The Earth Centre will also be able to evolve over time, which allows for flexibility and reflection in the design process.

River Parks and Pathways:

GUADALUPE RIVER PARK IN SAN JOSE, CALIFORNIA

This park was initiated as a flood control project, but was designed to incorporate wayfinding, access points that attract people, and public amenities that dot the riverside. In addition, the city improved the channel network and natural riverbanks. It has become a green corridor stretching throughout the city, while relating to urban developments along the river. Building development guidelines, orientation

and massing of the buildings, treatment of parking, setback restrictions, and commercial buildings' direct relationship to river's edge are required so that the park benefits from future development. The program also includes a children's discovery museum, a center for performing arts, and a park for festivals.

CHATTANOOGA, TENNESSEE

The Tennessee River Greenway and Riverwalk was a result of an intensive planning process in 1984 with a strong emphasis on citizen participation. Over 1700 townspeople participated in a 4-month long process headed by Chattanooga Venture, a non-profit organization focused on environmental, economic, and social improvement. This citizen task force called for a greenway path linked with housing, parks, businesses, and tourist attractions throughout metropolitan Chattanooga. The Greenways can also serve as walkways and bicycle commuting routes, thus increasing recreation and reducing automobile pollution.

The Greenway Park is comprised of 200 hectares of green space along the Tennessee River with a Greenway Farm. The Greenway Farm doubles as a conference center and a clearinghouse for information on outdoor activities in the Tennessee Valley. Currently, there are six greenways nearing completion with plans for an additional 75-100 miles.

Important factors that contributed to the success of this project include:

- Result of broad-based planning process
- Emphasis on environmental clean up raises community awareness about environment
- Spillover effects include electric city buses and demand for alternative energy vehicles. Greenway Farm in park doubles as conference center and a clearinghouse for information on outdoor activities in Tennessee Valley

JACOB'S LADDER TRAIL

Jacob's Ladder Trail is a 35-mile area along Route 20 in Western Massachusetts (proximity to Westfield River) which connects parks and state forests; offers recreational activities such as boating, hiking, fishing, cross country skiing and biking; and is witness to year-round cultural festivals and special events. Adjacent roads are lined with art galleries, studios, antique shops, country stores and Bed & Breakfasts. It was also designated as one of the U.S.'s Ten Most Outstanding Scenic Byways in 1995.

Pioneer Valley Planning Commission (PVPC) of West Springfield is the agency responsible for the Trail's implementation. It organizes Jacob's Ladder Trail Advisory Committee and is made up of community, state and regional officials, and local business representatives. The Commission secured over \$1.3 million from the Scenic Byway Program of the Inter-modal Surface Transportation Efficiency Act (1991) funds for planning, design and construction of activities on Trail. (The Scenic Byway Program provides planning, design and implementation of improvements in corridor maintenance, safety improvements, inter-modal use, recreation enhancement, historical preservation, and tourism amenities.)

Trail research effort included the following: data collection of average daily traffic counts, pavement inventory and distress, traffic accident incidence by corridor, bridge status ratings, bicycle route feasibility, land use analysis, sign system design, recreational and tourist promotion, cultural resources inventory, map products, and long-term byway maintenance.

In order to ensure the trail's long-term viability, The Pioneer Valley Planning Commission has taken the instituted a long-term corridor management plan that outlines guidelines for land use, landscape, cultural and historic preservation, and highway safety, and has establishing Jacob's Ladder Trail Scenic Byway, Inc. as formal, non-profit corridor management organization.

Lessons Learned:

In efforts to better identify successful projects, we determined that four key categories had to be integrated.

- Diversity of Program
- Environmental Sensitivity
- Unique Design Elements
- Comprehensive Development Process

Within these categories a number of key elements are required in designs that successfully incorporate the natural world into the daily lives of city-dwellers and visitors. They are as follows:

- The adaptive re-use of industrial landscapes and specific buildings.
- The incorporation of the built environment, cultural heritage, and natural and native systems.
- Mixed-use developments that reinforce relationships with commercial and industrial uses providing them with direct access to natural elements, services, and infrastructure.
- Diverse program made up of various intensities (i.e. a mixture of programmed and unprogrammed spaces), available for day and nighttime use, and oriented to all ages.
- Public support generated through annual events, active community participation, and regional governance that involves individuals from a variety of backgrounds.
- Creative financing that can be achieved through phased development, charging membership fees, allowing individuals to "own" (finance) specific elements, and fundraising at festivals and events.

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