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# Using Sustainable Landscape Design Criteria in Order to Regeneration of Urban Seasonal Rivers' Bed

By Ali Reza Sadeghi[1], Ferial Ahmadi[2]

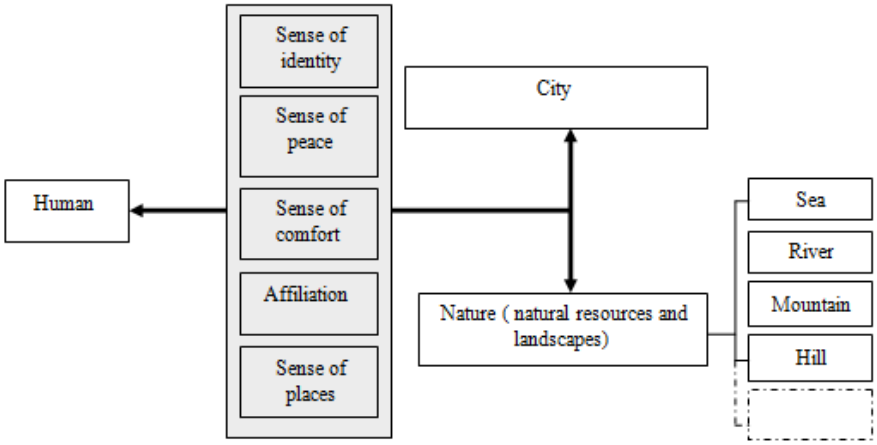
**Abstract**
The present research has been conducted in order to preserve the Shiraz Khoshk River landscape as a dynamic ecosystem; moreover, to regenerate the quality of the riverbed through the implementation of landscape design criteria. Process recommendations to regenerate of the Khoshk River through landscape design are based on descriptive analysis of library research and case study, as well as observation and interview procedures with survey studies. Recommendations have been based on the study and analysis of multiple primary factors, including environmental, cultural, physical, and social features. Subsequent suggestions for designing a sustainable landscape have been provided, and have been focused on repair and protection of the landscape, and ecological and aesthetic principles. Emphasis has been placed on protection and improvement of the natural landscape and the diverse bionetwork of the region, the removal of inappropriate applications and bio- environmental pollutants, and the design of a suitable habitat for migratory birds.

*Keywords: Urban Seasonal River, Sustainable Landscape Design Criteria, Landscape conservation, Shiraz Khoshk River*

## 1. Introduction

Since many years ago, cities as people's best desires, have made a familiar relation with their citizens, by making a logical contact with the surrounded nature. (Graph1). However, nowadays spread and immediate growth of urban living in one hand and people violating natural limits and landscapes in the absence of right policies and management, the lack of proper culture in the field of natural resources protection as a great wealth and an element of identity, disorganizing the balance of their consisting elements on the other hand, have made the destruction of cities possible. It is obvious that enjoying the exciting manifestations of nature is special to human beings, and people are the main inheritors of resources, beds and natural landscapes left from their ancestors. But, now, the question is whether human beings who have been only born in nature and find their identity and comfort in these natural landscapes should only call any precious resources left from their ancestors "inheritance"? Should not they redefine this valuable inheritance with respect to the present time and consider it a great wealth not a mortal inheritance? A perpetual treasure that increases, they shouldn't leave it unthoughtfully and observe its gradual death.

[1] Assistant Professor of Urban Design, Department of Urban Planning & Design, Faculty of Art and Architecture, Shiraz University
[2] Assistant Professor of Landscape Architecture, Department of Architecture, University of Mazandaran




*Graph 1: Dynamic and continuous interaction with the city as a whole, with nature and natural resources and landscapes, create an intimate relationship between the town and man provides*
*Source: Authors*

Beautiful natural manifestations such as rivers, mountains, bushes and like that can be in circulation across city structures and embody life in cities are left without any plan. They can function not only as urban signs but also in an alive and dynamic ecosystem framework. They can equilibrate the ecological and bio- environmental structure of cities and transform to visitors' memories. Memories that result in formulation of citizen' identities and are considered as an important factor in knowing city.
So, in the present research, in order to achieve improvement of the natural environmental quality of Khoshk river as one of the most prominent natural landscapes of Shiraz and change into a live and dynamic ecosystems in the city, descriptive – analytic procedure with some library research, case study and observation – interview procedures with survey studies have been applied. At first, in order to access the theoretical basis of the study, definition of environmental quality, natural landscape and sustainable natural landscape principles have been studied and analyzed; then, documents such as aerial pictures, maps and ecologic and climate features are studied to know more about environmental, cultural, physical and social conditions of Khoshk River. Finally, suggestions for improving quality of environment in the bed of Shiraz Khoshk, have been presented with emphasis on people's priorities through providing questionnaires, observations and taking pictures from the region with respect to the rules of sustainable landscape design aspects.

## 2. Regeneration and Quality of Natural Environment

Natural Regeneration is an ecological process of self-organization that occurs in stages. It is also a long-term process, which can be enhanced or accelerated through human intervention. Natural Regeneration usually outperformed other restoration techniques in terms of cost-effectiveness, consistently providing a positive benefit-cost ratio. Further, Natural Regeneration is more ecologically sound than other restoration options – provided site conditions are adequate. Thus, Natural Regeneration must be

promoted, both in the eyes of the public as well as through the removal of disincentives and the introduction of appropriate incentives (FAO, 2015). On other hand. "Quality" is a concept which has been used in many fields related to human life. Usually defined as the degree of perfectness of objects and phenomena**.** (Golkar, 2001, pp38-65) However, quality is a relative concept, with a meaning beyond its usual definition. The concept of quality has two different aspects; i.e. it is a vague and simultaneously obvious concept. On the one hand, quality is the main properties of the object, and on the other hand it is a whole system containing the sub qualities of the object. The sub qualities are useful in understanding the difference between properties, where as the complete qualities help differentiate the objects. (Pakzad, 2006, P78) But since whatever the surrounding environment and there will be a person in relation to the elements and can be natural, synthetic or combination they are formed, is called, can be environmental quality as the main part of the wider concept of "the quality of life" such as the main qualities of health and security combined with some aspects like the comfort and attractiveness. In fact, environmental quality includes abstract recognition and the values which differ among individuals and groups. Comprises the qualities of its constituents, but it is something more than the set of elements; it is the perfect recognition of the place. The elements which are from the environment, (nature, open space, infrastructure, built environment, facilities and natural environment resources) each has its own specific properties and a relative quality. Therefore, a high- quality environment offers a sense of wealth and satisfaction to the people through physical, social or symbolic indices. (Kamp, 2003, pp5-18)

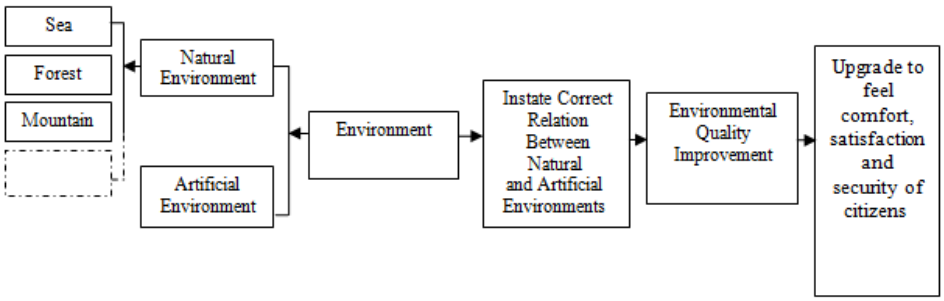
It's clear that, environments are mainly divided into natural and artificial categories. Therefore, manmade landscapes and natural resources are the constituent elements of the physical environment.

Natural Environment

The natural environment is the environment in which the least human intervention is required to maintain its naturally occurring state. Forests, plains, mountains, meadows, seas and gulfs are all part of the natural environment.

Artificial Environment

An artificial environment is an environment based on the concept of human ideas and culture. (Kasaian, 2003, p20)




*Graph 2: Instate correct relation between natural and artificial environments lead to Environmental quality improvement*
*Source: Authors*

Nowadays, changes in the climate, reduction in biodiversity and increased pollution, largely caused by the growth of technology taking place without consideration to the environment, are contributing to the destruction of the Earth's natural heritage. A lack of logical interaction between the city and the natural world combined with poorly designed technology and infrastructure is resulting in a degradation of the quality of the environment and ultimately the standard of human life. It is evident that well-designed landscapes, sympathetic to the needs of living beings, together with high quality natural resources, benefit not only the environment but the welfare and satisfaction of citizens.

## 3. Sustainable Landscape Design Criteria and Principles in Natural Beds

"Nature, despite its consistence and stability, has been considered to be among the most susceptible and vulnerable ecosystems of the world. In the recent years, due to some factors including development of cities, establishment of roads, irregular operation of resources and tourism in mountains, some issues such as climatic changes, soil erosion, flood, destruction of native plant coverage and its replacement with non-native plants have occurred" (Behbahani, Shafiei, 2007, 41), but since nature "is what human has no interference in making it" (Andrews, 2003) natural landscape could be considered as a landscape "which has not been effected by human activities and has remained entire and original so that all organisms and its elements have the freedom to change and move. Natural landscape may merely include one of the nonliving elements or organisms or both, a place which has been under control of natural currents and free from human interferences for a very long time. In fact, natural landscape is an indication of interactions of forces which have created it. Its bed has been spread before humans presence and coming into existence. Despite the fact that it is almost impossible to find a place on the earth that has not been under effect of humans' presence, any place which is abandoned and away from human activities could recover its natural landscape. The word "semi-natural" is used to describe landscapes affected both by natural forces and human activities (Ferdinand, 2004).

In contrast to this view, another point of view defines natural landscape in a close relation with human being and brings forth the question "is it possible to change the environment intentionally in a way to make it more useful and sufficient for humans and other organisms of the world?" (Mack Hurg, 2007, 52). In fact, "in order to be natural, landscape somehow needs human interference; meanwhile, in order to get valuable things and considered products from nature we have to operate in compliance with it not against it" (Bell, 2007, 309). Therefore, "natural bed has been always the place of constitution of civilizations with high cultural values. Doubtlessly, any type of disturbance in this bed also imperils the nature of signs appeared in it. In a broader form, in case the relation established between natural visage and cultural visage of any region is disturbed, the values hidden in both directions are imperiled" (Behbahani, Sharifi and other colleagues, 2003, 57). "Hence, supposing that we have been living in the nature and using it for thousands of years, it would be nonsense if we consider nature and natural disorders as completely independent and separate from us… union with environment would be more interesting and effective when we understand natural patterns and

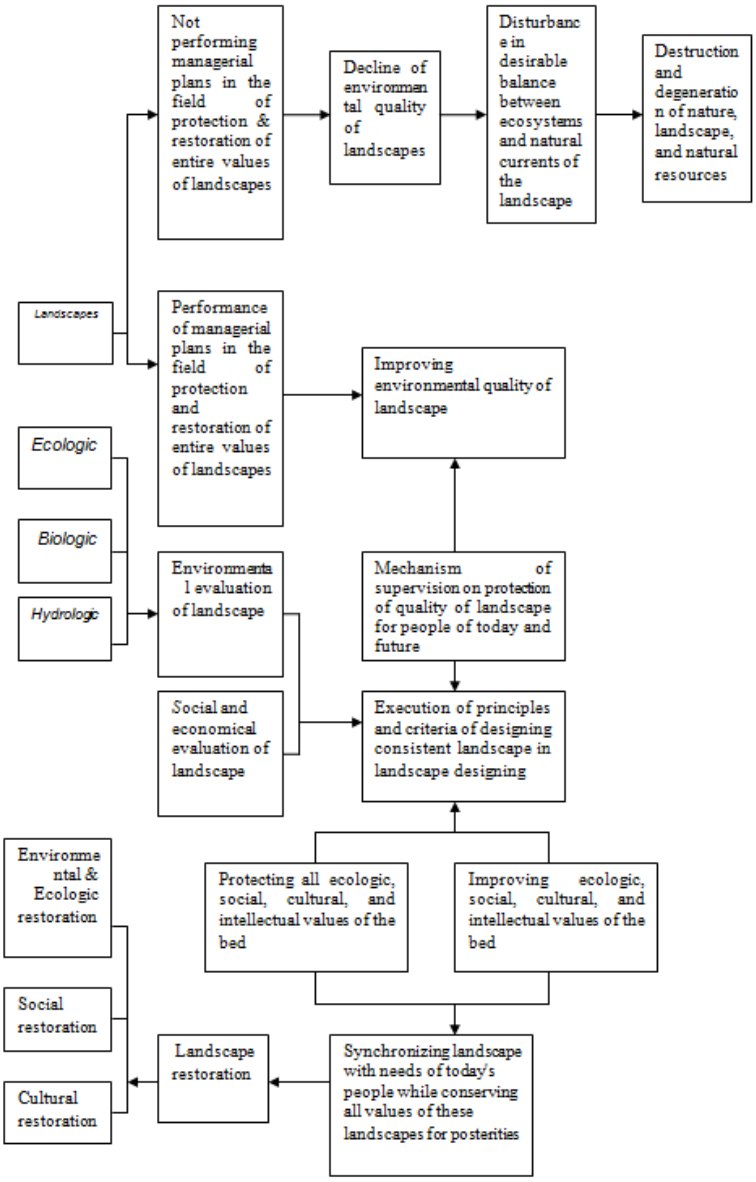
processes better" (Bell, 2003, 266) in order to achieve the principles of stable designing to protect natural ecosystems' health in natural bed.

In regard to principles and criteria of designing stable landscape, there are different views. "Theoreticians like Thompson and Steiner, introduces the two principles of creativity and ecology as the fundamental principles of stable landscape and points out that inspiration from ecologic specifications of nature has a firm relation with culture. Sime Wen also defines ecologic design in close relation with designing landscape as "any form of design which minimizes environmental destructive effects through its combination with environmental processes" (Behbahani & Moftakhar, quoted from Herman, 2005, P.89). Therefore, by entering the concepts of ecology and consistence in heading of objectives of landscape designers, besides promoting aesthetic satisfaction and advancement of healthy biologic, ecologic, and functional landscapes, their responsibility in regard to development of compatibility of developed and constructed environments in the landscape in the same direction with principles of consistence would be expanded" (Behbahani & Moftakhar, quoted from Benson & Roa, 2005, P. 91). "Therefore, designing consistence landscape based on observance of ecologic and aesthetic principles becomes possible. This attitude more recognizable the role of designing consistence landscape in making balance between request for using the environment and the ecologic power" (Behbahani, Moftakhar, 2005, P.91). Consequently, according to all the mentioned points in regard to importance of natural landscapes based on high productive, protective, motivation and attraction powers firstly we have to try to protect all ecologic, social and economic values based on principles and criteria of consistence and then we have to do our best in applying principles and criteria in compliance with exclusive values of bed in order to not only protect the development and promotion of social, economic, and environmental powers of these landscapes, but also to synchronize them with today needs of tourism and local community while preserving these great resources of wealth for the posterity. It is evident that this important matter is possible only provided that the landscape designers have a precise knowledge of ecologic, social, economic, and cultural values through ecologic evaluations of landscapes. To do so, the principles and criteria of sustainable landscape designing in natural landscapes have been presented in table No. 1. In this table, these principles have been presented based on 3 general aspects of consistence (environmental, social, and economic consistence) in two protective and development groups.

**Table 1.** Sustainable Landscape Designing Principles

| Aspects of consistence | | Remarks | |
|---|---|---|---|
| Environmental Consistence | Protective | Reducing contamination through protecting natural bed against all acoustic, water, air, and optic pollutions<br>Protecting biologic diversity, place of vegetation and animal life of the region<br>Protecting the bed against environmental pollutions (domestic and industrial wastewater and wastes, etc) | |
| Environmental Consistence | Development & Improvement | Using proper plant coverage compatible with the bed's natural conditions in order to protect soil from erosion, decrease water evaporation, and increase soil permeability<br>Omitting operations and activities incompatible with natural environment (hunting in most natural regions provides the cause of habital disorders.<br>Expanding managerial and educational plans in the fields of environmental conservation and natural bed<br>Compatibility of design and development in natural landscapes with natural boundaries of the bed (landscape design shall be performed in compliance with natural boundaries and ranges of the bed.) | |
| Social Consistence | Protective | Protecting all social values of the bed (social activities performed in natural bed during ages should be protected) | |
| | Development & Improvement | Tourism | Developing tourism within limits of natural capacity of the region.<br>Providing facilities and services required for tourism including recreational, security, and welfare services and facilities (it is evident that these services should be compatible with natural resources of the region).<br>Providing the ground for expansive recreational experiences in compliance with local capacity and power of landscape in order to motivate tourists to frequently appear in these landscapes |
| | | Local Communities | Respecting native cultural values (conventions, cultural ceremonies, etc) of the region<br>Providing all services and facilities required by the local community in order to give continuity to presence of such local communities in landscapes |

*Source: Authors*




*Graph 3: Sustainable Design of natural landscape provides the ground for ecologic, social, and cultural restoration of these landscapes*
*Source: Authors*

## 4. Khoshk River, Shiraz, Iran

The Khoshk River is a seasonal river that passes through the city of Shiraz in a northwest to southeast direction. The river originates in the Shool and Kalestan mountains (2,990m high). After joining the Nahre-Azam and Tang-Sorkh rivers, the

Khoshk River ends in Maharloo Lake. It is essential to note that the path of the Khoshk River has been denatured into a direct line by the stone walls built on its sides, contributing to an increase in the linear speed of the river water. The discharge of the river significantly decreases in dry seasons of the year, especially in the summer (Safigholi 2002, 1-3).

The river bed is composed of sandstone and loam. The location of the river in a modest semi- dry climate leads to a lack of dense plant life on the bed of the river. Therefore, most of the soil in this region is devoid of protective coverage, leading to high erosion of the wall and the bottom (Kamishirazi 2000, 9). The river is rarely dredged, and it is frequently a place for controlled tipping, buried waste disposal, etc. In recent years, the building of the Saheli subways and the decrease of the bed width has led to the limitation of tension of storm water streams and the river insurrection. (Safigholi 2002, 3-4) Territoriality factors of the river are shown in table 2.

**Table 2.** Territoriality Factors of Khoshk River Basin.

| Territoriality factors | | |
|---|---|---|
| Climate | Annual average of rain | 382.7 mm |
| | Annual average of temperature | 17.3 °C |
| | Average relative humidity | 42.5% |
| | Annual average of evaporation | 2263mm |
| | Number of freezing day | 51.4 |
| | Average of erosion in water pond | 4 |
| | Sea level height | 1500m |
| Physiography | Area | 900.3 km² |
| | Perimeter | 188.07 km |
| | Main waterway length | 67 km |
| | Maximum height | 2995 m |
| | Minimum height | 1495 m |
| | Basin average slope | 31.8 % |
| | Longitude | 52.12.30 to 52.41.30 |
| | Latitude | 29.34.37 to 29.58.07 |
| | Main waterway slope | 0.88% |
| Natural vegetation | Trees | Pine – spruce – fruits tree |
| | Bushes | Lawn – aromatic flowers- water meadows |

*Source: Authors*

It is worth mentioning that the body of the river consists of three main parts:

- Watershed areas and their seven underground ponds.
- The main path, the greater part of which passes through the center of Shiraz (this route is divided into three domains: up, middle and down)
- Maharloo Lake, which is a dwelling and comfortable end of the watershed region (Khaleghi 2002, 6)

In table 3, the present situation of the main river, which is going to be investigated in this research, is shown.

**Table 3.** Analyzing Natural landscape Features of Khoshk River Basin

| | sequence | threats | opportunities | Weak points | Strong points |
|---|---|---|---|---|---|
| Up | Malli Abad bridge | Lack of efficient management<br><br>Serious erosion in the bed & sides of the site due to lake of suitable littoral wall<br><br>Lake of out skirts to protect natural limits<br><br>Torrential path<br><br>Uncontrollable growth of construction<br><br>Not paying attention to hydrolic principles in the region | Conservation of the region (protecting the variety of plants & animals)<br><br>Increasing opportunities to attract visitors both from inside and outside the country<br><br>Improving the management in the region in order to develop ecological potentials of the site | Inappropriate activities existing near the site (lots of industrial , constructive, …activities)<br><br>Inappropriate uses such as existence of a hospital near the complex which causes pollution<br>Sensitive natural environment<br><br>Lake of instructional & cultural plans to improve environmental protections by visitors and those who use natural environment of the river | Accessing the river easily through main and subordinate streams of the city<br><br>Natural, historical and cultural attractions (gardens as well as culturally and historically valuable monuments) near natural grade of the river<br><br>Creating attractive natural scenes as memories and visitors mental image in rainy seasons<br><br>Migrant birds living in the region and creating various recreational experiences in citizen's and visitor's memory |
| | Chamran water and soil dame | | | | |
| | Shahed bridge | | | | |
| | Chamran pedestrian bridge | | | | |
| Middle | Namazi bridge | | | | |
| | Bagh Safa bridge | | | | |
| | Bazzar bridge | | | | |
| | Hor bridge | | | | |
| Down | Ali Ebne Hamze bridge | | | | |
| | Emam Ali bridge | | | | |
| | Pirnia bridge | | | | |
| | Salman bridge | | | | |

*Source: Authors*

Finally, the problems faced with the watershed of the Shiraz Khoshk River, including severe storm waters, erosion, sedimentation and soil destruction, are caused by some environmental and human-related properties particular to this watershed. Briefly, these are as follows:

1. The unplanned expansion of the city of Shiraz and the formation of new towns in the north, northwest and south: expansion of these towns has increased the runoff coefficient.
2. After rain, all the material present on the river bed is moved by the water. Having joined the sediments coming from the heights and broken trees in the water, it is then deposited behind the bridge at Pol-e-Kamani and the stone skeleton of Ali-ebne-hamzeh. The bridge serves as a natural dam and the water severely overflows its banks, creating a flash flood.
3. The devotion of natural realms to man-made applications.
4. The storm waters in the watershed of the Khoshk River result in the raising of the level of ground water in the south of Shiraz extending to the city centerfrom and bringing 40 million $m^3$ to the lake yearly. Due to water rushing back, the low altitude of Shiraz relative to Maharloo Lake, and the size of the population using the water, its nutrition level has suffered, causing health problems, a decrease in the economica fortunes of the city and other social problems such as water elevation in the south

regions (Safigholi 2002, 181-85).

## 5. Summary

A review of weak and strong points, threats and opportunities in this region shows that the Khoshk River is facing problems such as extinction of some plants and animals, erosion, serious noise and environmental pollution caused by excessive use of cars, inconsiderate positioning of factories and the carrying out of industrial activities, all of which are incompatible with visitors' needs. These problems cause a reduction in the quality of the environment and hence in the presence of visitors. So in order to access the visitors' preferences for and opinions on organizing and improving the quality of the natural landscape of the river on the basis of sustainable natural design principles, a questionnaire was developed. The questionnaire led to the following results.

- Noise and environmental pollution caused by high presence of cars near the river are the main factors in the reduction of quality in the river environment, so the majority of visitors want fewer cars to be used near sequences, and they would like these places to be changed into active and dynamic realms which are safe from noise, water and pollution.
- Recreational activities such as watching the river and migratory birds in certain seasons of the year, walking, doing sport activities, instigating social interaction with others, meeting friends and resting in the green spaces around the river are the main reasons for the presence of visitors in this area. It is essential to note that the majority of people believed that environmentally threatening factors have led to a decline in their desire to visit this area.

Visitors prioritization of environmentally threatening factors in the Khoshk River area is given in chart 1.

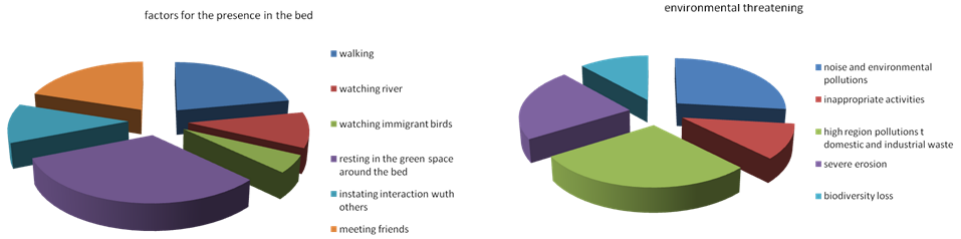



*Chart 1: Visitors' point of view*
*Source: authors*

- Furthermore, there is a need to install nightly lighting effects to provide visitors with safety, to design benches and other facilities suitable for people of any age and all social ranks, and to maintain respect for visitors' cultural and environmental beliefs.

## Conclusion

The natural bed of Khoshk River and its natural limits are the best natural potentials of Shiraz and if they are organized and rehabilitated according to people's

present needs, not only it can equilibrate the city bio- environmentally but also it can provide visitors with spiritual and mental comforts in a public realm and a social, alive and dynamic situation.

With regard to the important fact that quality of this river bed, because of the presence of severe noise and environmental pollutions which are caused by excessive use of cars, un thoughtful position of factories and industrial activities near the natural river bed, accession of urban waste to the river, has lost, suggestion for designing to improve environmental quality of the river bed based on sustainable natural landscape principals are presented in table 4.

**Table 4.** Suggestion for organizing the natural bed of Khoshk River

| **Suggestion for design in the natural bed of Khoshk River to improve quality of environment** |
|---|
| Protecting and improving the natural landscape and life variety in the site. |
| Covering land surface with trees and ever green shrubs to protect soil and water and preventing erosion. |
| Conserving old gardens and urban parks around the river. |
| Bio- environmental instructions for protection. |
| Saving water for torrential occasions by water and soil dams. |
| An appropriate design that matches the main and natural parts of the river bed (considering width and natural limits) which is also based on culture and traditions of the region. |
| Design and developments that match the form and structure of the land (slope and topography). |
| Improve training programs for sustainable exploitation of natural ecosystems and biological species of river. |
| Making outskirts and rehabilitating side of the river. |
| Creating appropriate, various and safe realms for citizen to come often to the natural landscape. |
| Improving economical, social and recreational activities (such as holding national and cultural celebrations, theaters, concerts and so on) in the site and out skirts of the natural site of the river. |
| Removing incompatible uses (hospitals, factories &…) which are located near the river limits and pollute the river bed by producing water waste and polluted wastes. |
| Improving environmental quality of river with organizing urban equipments. |
| Organizing and developing green space of the sides. |
| Providing suitable situation for more migrant birds coming to the place. |

*Source: Authors*

We hope, considering the proposed suggestions and pragmatics in natural bed of Khoshk river, will provide environmental quality improvement and cause the presence of more visitors.

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