

STREAM CORRIDORS AS INVALUABLE URBAN ELEMENTS: SUGGESTIONS FOR IMPROVEMENT OF PAVEH STREAM

Esmaeil Shieh & Ayyoob Sharifi

Abstract: *The study seeks to address the importance of urban stream ecosystems from the perspective of urban ecology, human health and social well-being in the context of urban planning. The case study area is Paveh stream in the City of Paveh. The data from the case study area were gathered from questionnaire, existing scientific and library studies and by conducting interviews with residents and authorities. Once the importance of the biodiversity of the stream had been studied based on the existing ecological data, the social importance of the stream and the linkages between human health, social well-being and the biodiversity of the stream ecosystem were addressed.*

Based on the results of the survey and other sources of information, it was discussed that urban stream ecosystems can be rich in biodiversity and function as ecological movement corridors for species. Urban stream corridors can thus be an important part of the urban green infrastructure. Also we can make the weather fine, extend green space, prepare peaceful environment for residents and bring the countryside effects of nature into cities through improvement of stream landscape. Finally, regarding the finding of this study some suggestions and implications are mentioned to improve the quality of the stream.

Keywords: *urban streams, urban planning, ecology, public health, Paveh*

1. Introduction

Water is not a common merchandise but an inherited resource which must be protected, defended, and managed sustainably (European Water Framework Directive) [8]. Many scholars all around the world have emphasized on the advantages of existence of nature in the city. In fact as Low et al (2007) state; the impact of humans on nature and the impact of nature on humans both matter.

Throughout history; urban planners and environmental designers have intuitively incorporated elements of the natural world and areas of green open space into their designs for cities in an effort to moderate the stress of urban life [7].

Riparian areas are key components of the natural systems that stabilize the climate, detoxify wastes, generate fertile soils, maintain biodiversity and provide respite from human-dominated environments. Riparian corridors not overly dominated by human activity are naturally dynamic. Protecting riparian areas allows ecological systems to be more resilient to natural and human-induced changes [9]. Such riparian environments naturally attract and support a wide range of wildlife. They also attract people, who seek out these areas for recreation or enjoyment of nature. Water in the landscape attracts people like no other natural feature [7].

Careful stewardship of riparian land cost-effectively achieves numerous ecological benefits: protecting water quality and aquatic habitats, providing terrestrial habitat, mitigation of floods and droughts, detoxifying and decomposing wastes, cycling and moving of nutrients, generating and preserving soils, and maintaining biodiversity. Protected riparian lands also provide for valuable aesthetic, educational and recreational opportunities [9]. Running water

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Esmaeil Shieh is with the Department of Architecture and Urban Planning, Iran University of Science and Technology, Tehran-Iran. E-mail: es_shieh@iust.ac.ir

Ayyoob Sharifi is a M.Sc. Graduate from the same Department. E-mail: sharifigeomatic@gmail.com

ecosystems, i.e. rivers, streams and brooks, are highly variable environments of which the physical, chemical and biological features are tightly linked with the properties of the surrounding catchment area. Urbanization increases the proportion of impermeable surfaces and thus changes the hydrology in urban catchments by increasing the speed of the surface water flow and fluctuation extremes [12].

Urban streams represent a special challenge to river managers because they are often highly degraded and subject to multiple impacts. At the same time, they may be greatly valued by the people that live in the surrounding suburbs [6]. The knowledge that nature is present near one's home can be a powerful factor in residential satisfaction [10]. There is evidence to suggest that people may derive the greatest psychological benefits from having contact with nature in the city when their place of residence is in close proximity to natural vegetated areas, particularly areas that contain trees.

Studies have shown that natural treed areas in close proximity to one's home can result in lower levels of stress. Even having views of trees from one's home - compared with having views dominated by buildings - has been associated with significantly increased neighborhood satisfaction [7]. Curving river scenes are the most preferred category due to their high degree of mystery [10]. Kaplan (1977) showed that rivers and riversides by their nature were appreciated by people when they provide both a sense of orderliness and a sense of involvement and mystery.

In fact water environments are greatly valued in urban areas as environmental, aesthetic and recreational resources and hence are important community assets. Any type of activity in a catchment that changes the existing land use will have a direct impact on the quantity and quality characteristics of the water environment [3]. Modern urbanization management should take into account the formation of urban landscapes as a special type of spatial and functional organization of natural-anthropogenic territorial complexes (NATC) in the borders of cities and urban agglomerations [5]. The influence of natural properties on the planning structure of cities, the use of these properties for the creation of a healthy living environment for city dwellers, and the enrichment of the architectural and planning organization of populated areas compose the subjects of many special research works [5]. Water can also have a negative impact on human activity. This includes flooding, drainage, erosion and sedimentation. These problems are exacerbated in urban catchments by altering natural watercourses and increasing impervious areas. Urban run-off is typically highly polluted with pathogenic and organic substances that are a public health threat [13]. The development of water resources requires the conception, planning, design, construction, and operation of facilities to control and utilize water for a variety of purposes [13].

Flood mitigation is an example of the control of water so that it will not cause excessive damage to property or loss of life and inconvenience to the public. Water supply is an example of the utilization of water for beneficial purposes. Pollution threatens the utility of water for municipal and irrigation uses and seriously despoils the aesthetic value of natural watercourses [13]. People seem to be innately drawn to water and areas of natural beauty. Not surprisingly then, park and recreational areas are often centered on scenic water features, such as lakes or rivers. Streams and rivers have the great potential of designing trails and greenways alongside them and creating a green corridor.

Greenways and trails offer unparalleled benefits to city. It is rare to find an initiative that balances both environmental protection and economic growth. No other conservation initiative provides so many ecological, economic and quality of life benefits to the communities that create them. The benefits of greenways and trails include: Scenic Quality, Outdoor Recreation, Convenient Access (because of linear form), Water Quality, Air Quality and Forests, Wildlife Habitat, Alternative Transportation, Real Property Values, Expenditures by Residents, Stimulate Reinvestment in Once Blighted Areas, Tourism, Public Cost Reduction and Intrinsic Value.

Environmental preference research offers a valuable tool for involving the community in planning decisions. This approach may be useful in implementing changes in large natural areas such as river corridors where diverse constituent groups need to be a part of the decision-making process [10]. An environmental preference research has been done in this study to involve community in decision making.

2. Delimitation and Characterization of Study Area

The stream is passing through the city of Paveh, Paveh is located in west of Iran in a region so-called Hewraman. Hewraman is best known for its unique arrangement of cities and villages built along the mountain slopes of the region. Paveh is a mountainous city with over 35,000 inhabitants, and is surrounded by hills and mountains. As a result of being located in a region with such geographical and topographical characteristics, the buildings of Paveh have been built on the foot of mountain and in fact most parts of it still have characteristics of a traditional settlement. In this study, Paveh stream is examined principally in the City of Paveh but it is recognized that the land use of the entire catchment area affects the studied part of the stream. The stream flows in the valleys of Shaho mountains and eventually flows into Sirvan which is one of the main rivers in west of Iran. As is typical for urban streams, Paveh stream experiences large fluctuation extremes, because runoff waters rapidly flow into the stream, During high-water levels, the stream can attain widths of several meters and it is thus

appropriate to call it a stream (although the concept creek could also be appropriate).

The main land use in catchment area of stream belongs to gardens and agricultural lands and in past times (up to 30 years ago) must of people have lived in these gardens in summers. Rapid urbanization in the 1980s brought buildings into the stream valley, which for decades had been an area for single-family traditional garden housing. As residents answered in questionnaire

the quality of stream's water had been rich in past and they have used its water as drinkable water, but it has been in its poorest quality during last decade mainly due to lack of sewage system in city and discharges from households that has been built during past decade. The “misfortune” of the stream is this point that the sewage of traditional and historical part of city flows into it.

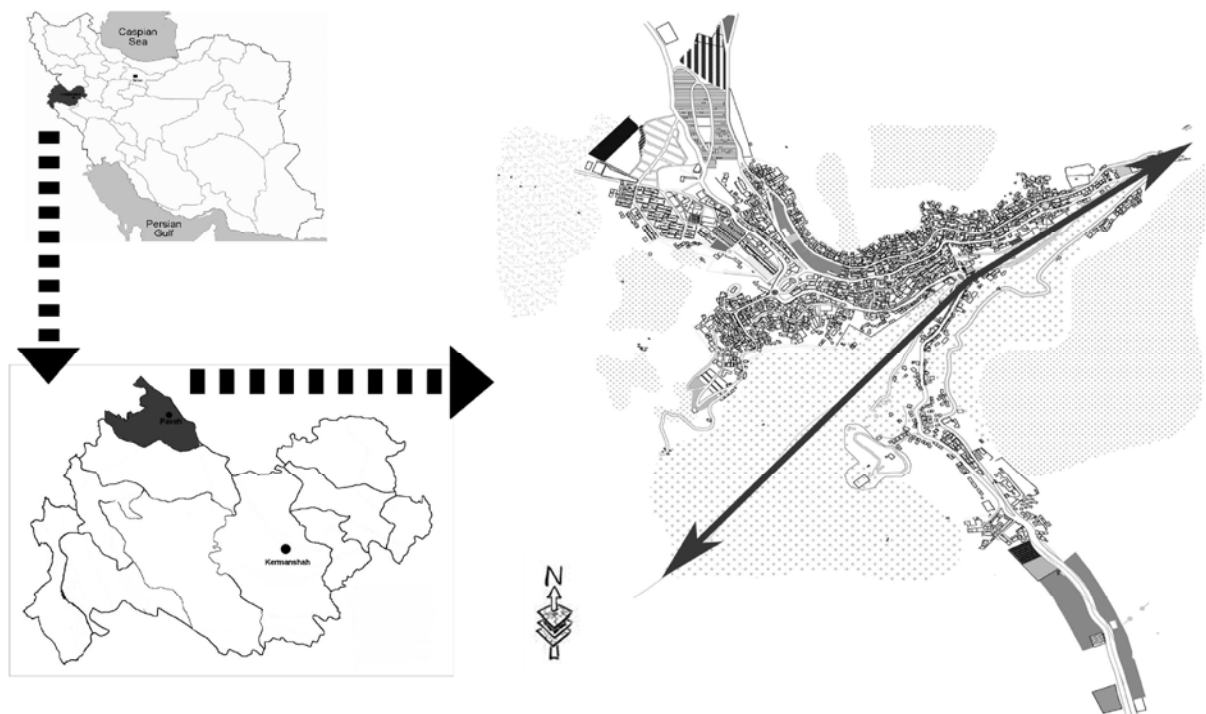


Fig. 1. Location of study area



Fig. 2. part of the stream corridor affected by ill-planned developments

In recent years the municipality of city has constructed walls in both sides of stream in the part of river which is located between the main square of city (Molavi square) and the city water reservoir (Hewli). Due to existence of some schools, teaching organization of city and new houses that have been built in that area this corridor is the pathway of many people. But the main problem is that they have constructed that channel without taking into account its context and surroundings and this has led to unaesthetic sceneries that can demolish the quality of corridor and natural features of it. The other main concern comes from the road that is in the buffer zone of stream and there are plans to develop it. But unfortunately it seems that all this developments are taking place without taking account the ecological matters and rules and in fact they are unsustainable developments. Already, these actions have resulted in the cutting down of many beautiful old trees and also redirecting of the stream. Survival of this corridor needs emergency actions to be done. If not, these developments will lead to upsetting the ecological balance by depleting natural resources.



Fig. 3. Part of the stream corridor with high potential for developing urban parks, trails, bicycle tracks, etc.

3. Methodology

For purposes of the study, the following methods were used: review of ecological studies and inventories, interviews, a resident inquiry and a questionnaire which was answered by the people in

city. Once the importance of the biodiversity of the stream had been studied based on the existing ecological data, the social and recreational importance of the stream and the linkages between human health, social well-being and the biodiversity of the stream ecosystem were addressed. Relevant planning and environmental officials, representatives of local resident and environmental associations, and local residents and entrepreneurs related to the stream were interviewed. A resident inquiry was targeted to give more information on the ecological and social importance of Paveh stream. The purpose of this study was to obtain information on residents' perceptions of this urban stream corridor. In particular, the study looked at factors which influence preference, as well as attitudes toward participation in stream corridor improvement. Several known key informants familiar with planning near Paveh stream were first interviewed. These key informants were then asked to suggest associates who would be good information sources for the subject matter. The interview questions addressed issues such as what type of knowledge, values and opinions the interviewee had of Paveh stream, was the stream important to the interviewee, and if so, why; and how they believed the stream should be accounted for in current and future land-use plans. During the interview, the interviewer presented the outlined questions as well as questions targeted specifically at each interviewee to gather more detailed information for the study; the detailed interview questions are not presented here.

An interview situation is always unique; in another situation the same person could have answered in a slightly different manner. This should be considered in applying the case study findings to other urban areas, and the conclusions should be generalized cautiously [12].

Nearby residential area of the stream was selected and a questionnaire was delivered to 115 randomly chosen households situated in that area in December 2007. In this survey, residents were asked about their perceptions of their nearby stream corridor by rating items on a five-point Likert scale. A response value of "5" represented the highest or most positive response while a "1" represented the most negative assessment or lowest response. Respondents were also asked about how frequently they used the streams in addition to questions about their maintenance and residents' background such as their age, gender, and length of residence in the area.

4. Results

As residents mentioned Paveh streamside was, in about 20 years ago, mainly a lush and livable streamside grove surrounded by gardens and agricultural grounds, in which the stream meandered. Although Paveh stream has since suffered from several land-use changes in its catchment area, studies and interviewed people have shown that the Paveh stream

ecosystem still has value as an ecological corridor and as a home for several species and biotopes scarce in west of Iran, species like squirrel which residents complained that they barely see it since the new developments have taken place in stream corridor. One of the respondents said that he misses days when nightingales were singing in every place near the stream. They also asserted that the diversity of birds has decreased since land use of streamside has changed.

The following findings from the respondents provide a background for the analysis in this paper. 36% of the respondents were men and 64% were women. The age profiles of the respondents were as follows: 15–29 years old (25%), 30–49 years old (37%), 50–59 years old (22%), and over 60 years old (16%). In terms of length of residence in the survey area, 2% of

respondents had resided there for under 5 years, 17% from 5 to 10 years, 32% from 11 to 20 years, and 49% for over 20 years. Mean ratings of the items indicated that many residents felt that the nearby stream corridor was fairly a nice place for strolling and resting (mean = 3.28), and also that accessibility to the streams was not good (mean = 2.18). Residents had a relatively great interest in the stream corridor (mean = 3.9) and most of them felt that the stream corridor was an important element of their environment (mean = 4.25).

Many of respondents expressed that the stream corridor was not well used (mean = 2.12), it was also shown that litter and pollution of the water, and safety (from crime) were their main concerns, rating 2.11 and 2.39, respectively.

Tab. 1. Distribution of 100 participants across the various categories of the three design variables: sex, and age.

	15-29		30-49		50-59		Over 60		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Woman	7	7	11	11	11	11	7	7	36	36
man	18	18	26	26	11	11	9	9	64	64
total	25	25	37	37	22	22	16	16	100	100

Tab. 2. Mean score of the importance of stream attributes for the total sample and for each sex category separately

	Women	Men	Total
How much do you think the stream corridor is a nice place for strolling and resting?	2.92	2.70	2.78
How much do you think the accessibility to the stream corridor is good?	2.25	2.14	2.18
Do you have interest in stream corridor?	3.81	3.95	3.90
How much do you think that stream corridor is an important element of your environment?	4.22	4.27	4.25
How much do you think that stream corridor is well used?	2.11	2.13	2.12
How often do you use stream corridor for recreational purposes?	2.06	1.94	1.98
How much do you agree with the new rehabilitative actions that have been done for revitalization of stream?	1.81	2.08	1.98
How much do you agree with constructing a road alongside stream to let automobiles in stream corridor?	2.25	1.95	2.06

Tab. 3. Mean satisfaction scores for the total sample and for each sex category separately

	Women	Men	Total
How much are you satisfied with the condition of litter and water pollution (sanitary of stream)?	2.08	2.13	2.11
How much are you satisfied with the safety (for crime) of streamside?	2.42	2.38	2.39
How much are you satisfied with the nature and scenery of stream corridor?	3.75	4.05	3.94
How much are you satisfied with the illumination of stream corridor at night?	1.67	1.80	1.75

Thirteen percent of the respondents had participated in some kind of maintenance activities and 80% of the respondents expressed desire to participate in such activities.

Most of respondents (88%) felt that the stream corridors should have as high a biodiversity as possible. The results show that residents use stream for recreational purposes just sometimes (mean = 1.98), also the results indicate that they are satisfied with the nature and scenery of stream corridor. Only few respondents agreed with the new rehabilitative actions that have been done and construction of road alongside

stream, (mean = 1.98 and 2.06 respectively). Most respondents was not satisfied with the illumination of stream corridor at night (mean = 1.75). Respondents were sensitive to the impacts of development on the river ecosystem, expressing the opinion that new development should not occur too close to the river.

Almost all respondents of the questionnaire and several interviewed local residents noted that the stream environment is appealing and affects their quality of life in a positive way. They stated that stream makes the area feel less urban, enlivens the landscape and brings them the positive characteristics of rural life in

the middle of urban context. As Lynch suggested in *Image of the City*, the concept of 'edge' is crucial to understanding spaces in the city. The edges, whether formed by landform, vegetation or structures, or a mixture of elements, play a major part in creating in our minds the image of a place [2]. Paveh stream is a distinct edge in the city. The memories related to the stream indicate that the stream has shaped the local identity in the area. The recreational value of the stream corridor is important for several reasons. The water element as such is appealing and calming, due to the sounds of the stream and the singing of birds. The stream was also regarded as a desirable environment offering silence, ease and relaxation away from urban noises and stress. For many residents and recreational users the stream and the streamside green space provide aesthetic values, and for some its mere existence is important. However, most respondents raised the issue of the untidiness and unsanitary condition of the stream and stream banks. Although the stream has been an important aesthetic element to many local residents, its values have been neglected in developments that recently have occurred in stream corridor.

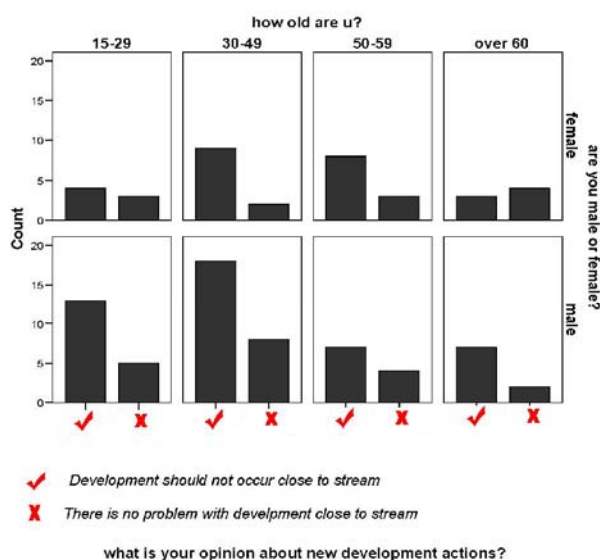


Fig. 4. Distribution of participant's opinions with regard to new development actions

5. Discussion

Everyone living in an urban society needs access to, and should be afforded the benefits of, contact with nature in the city [7]. Moreover, it is necessary to ensure that people will experience the place as being a satisfactory setting for their activity or activities. In part this involves using the characteristics of the existing places and understanding their role in how people experience place [2].

If people do not like the look of natural open spaces designed for them, they may well be less inclined to

use or value them. This results in such habitats not being properly cared for [7]. Residents' relatively low degree of satisfaction with status quo and the way stream has been used during the last decade showed that the improvements made to the streams were not appreciated by local residents. The results further suggested that any such future stream corridor improvements would not be substantially supported by nearby residents and this brings the need to reconsider previous plans, make necessary amendments to them and consider residents preferences in revised plans. In the survey results of this study, a large number of respondents gave positive responses with respect to the participation factor. Many people were anxious about litter, water pollution, and lack of measures leading to crime prevention. The most popular kinds of maintenance activities were cleaning the streams and illuminating it at night, and while it may be easily suggested that a large part of residents' anxiousness would be relieved by promoting these maintenance activities, consideration of growing concerns toward streams and the general aquatic environment in a given area is also important.

This study has found factors such as recreational use, participation, nature and scenery, sanitary management, safety, high diversity and illumination at night as being important factors relating to public perception of urban stream corridors.

In the environmental (physical-ecological) context, land-use decisions in the Paveh stream catchment, have led to unsustainable development in stream corridor. In addition to considering the effects of land use changes over space, we also need to consider how places change over time, focusing not just on immediate effects but also on long-term changes. In contemplating any land use change, one must consider how changes in the structural pattern of the landscape - the arrangement of vegetation, rivers, ridgelines and so forth - will later affect the functioning of habitat within the broader landscape, because by changing landscape structure in one small place we will be changing the way the entire landscape of which it forms a part functions [7]. It is obvious that the current improvement plan for the stream does not see it as a part of a broader ecosystem, and also there is not enough attention to the future consequences of this plan. A range of questions need to be asked, including how will the proposed modification affect the movement of animals along corridors? And how will the modification reduce the size, or change the shape, of habitat patches, thus affecting the value of habitat areas for particular plant and animal species? [7].

There is an urgent need to take statutory actions in order to stop depleting of invaluable natural resources in stream biotope. Unfortunately, the city has no clear policy program for an integrated conservation policy, which is also reflected in the fact that environmental and socio-cultural aspects have been substantially neglected in the urban development policy of Paveh.

First it seems obligatory to define a buffer zone for stream and ban any building construction and nonconforming development within that buffer zone. The other point which needs more consideration is the channel that has been built recently, this channel and flood control measures have destroyed the natural environment of stream corridor, and public accessibility to the water and have caused unaesthetic scenery that will affect residents' interest in corridor and the role stream corridor plays in city.

The next matter which is important and should be taken into account is the recreational role of stream. Regarding the effect of river landscape, (Kaplan, 1977: 285) comments that "even unspectacular rivers provide a source of enjoyment and tranquility for many who use only the riverbanks, view the river from afar, or who only know that it is there and available." Trails for strolling, spaces for relaxation, and good scenery were called for by residents living in the city. Stream restoration was substantially supported by residents.

The plan for the stream should conserve and improve this streamside greenway and upgrade the Pavah stream so that it becomes a more attractive stream for the purpose of serving as a streamside greenway linking various areas in the city. To avoid conflicts between recreational use and biodiversity, separating spaces intended for recreation from those designated for natural preservation is one method that may be suggested. The balance between naturalness and recreational use may differ according to the location of a given stream corridor. If the stream corridor were located in a central business district or near a symbolic landscape, then intensive recreational spaces would be more important. On the other hand, on the fringes of urban areas, natural conservation and the role of a biological corridor would be more important [1]. In fact, considerable future changes in planning and landscape management decisions, as well as in restoration efforts, should be taken into account. This, however, is dependent on how much value the planners and political decision-makers in the City of Pavah see in the Pavah stream corridor. The importance of an urban stream ecosystem in providing ecosystem services, such as recreational services, was evident in the present study. In the international context, urban streams can be used in planning as landscape elements that can positively affect human health and social well-being by offering potentially favored places for residents in which to unwind and relax, the sound of water moving in the stream is regarded as pleasing by the residents. Moreover, since urban residents are becoming increasingly disconnected from nature, urban stream ecosystems could provide local residents with opportunities for meaningful interactions with the natural world [12]. This in turn would be an effective measure to increase the social interactions that people will have during their strolling alongside the stream. In addition to all the aforementioned benefits of stream, the proposed trail would be an effective way of

encouraging residents to increase their physical activity that in turn would have a lot of positive effects on health condition and socio-psychological status of them.

6. Conclusion

Cities are themselves patches of nature that have been severely modified by humans. They are the places where human society and the societies of the more than human world interact most vigorously. The result need not be disastrous for urban nature [7].

Urban stream ecosystems can be rich in biodiversity and potentially function as ecological movement corridors for species. Urban stream corridors can thus be an important part of the urban green infrastructure. In general, aquatic natural elements, such as small urban streams, can potentially to increase the ecological, social and health values of the area. An urban stream can function as an important recreational element within the local green space network [12]. Sustainable urban environments need to be – and can be – places where people can interact with nature, and gain the physical and psychological benefits such contact [7]. Moreover, As well as being a great place for people to make contact with the natural world, the park incorporated with stream also provides a home for small mammals, birds, reptiles and insects (Ibid: 76).

This study has attempted to identify residents' perceptions toward Pavah stream corridor. In order to protect the traditional landscape from insensitive development, planners need to know how existing residents view their natural surroundings. High preference and concern on the part of residents toward the stream corridor in question have shown that revitalization and restoration of stream corridor is supported by residents, and also that stream corridor has a great potential for greenway and recreational use in the urban areas. It was found that situation of illumination at night, safety from crime and cleanliness of Pavah stream are of high importance and can affect residents perception of environmental quality. So there is an urgent need to design a sewage network and refine home sewage in order to stop further deterioration of sanitary condition of stream. The social and health values of stream ecosystems may decrease if the stream sides are dirty and stream surroundings are regarded as unsafe [12].

The other important conclusion is that compatibility of newly developed parts (channels etc.) with the natural context of stream is vital and should always be taken into account. Engineering is not enough. Engineers have an important role but, working under local democratic control, they must learn to co-operate with community groups, landscape planners, scientists, ecologists, geologists, landscape designers and architects [11]. It was found that the topography, distance from hills and mountains, as well as surrounding land uses were also important contexts in the rating of nature and scenery.

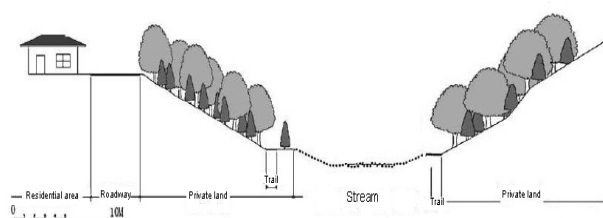


Fig. 5. Schematic view of the proposed plan

In turn, the following five points are important planning strategies: (1) making or enhancing the stream buffer; (2) the improvement of stream areas for ecological purposes including maintenance plans concerning biodiversity; (3) making or obtaining new green spaces or parks along the streams; (4) connecting the streams to other larger natural areas like hills, green areas, etc.; and (5) acquiring and maintaining water quantity [1].

To realize these goals and strategies, public participation in greenway planning is essential.

In addition, here we mention some implications of this study that could be generalized to other plans concerning urban streams and stream corridors:

- Full respect of natural conservation regulations and measures in the development plan of urban streams.
- Interventions of municipality authorities for compulsory purchase of invaluable lands within stream corridor and annex them to urban public lands as a safeguard against speculation.
- Incorporating resident viewpoints in preparing plans for improvement of urban elements, and shift to participatory urban planning and engaging residents in decision-making process.
- Impact assessment and evaluation of the consequences of plans on the region as a whole and especially the city where the plan would be implemented, this requires applying adequate evaluation methods as essential tools for balanced urban planning.
- Conservation and restoration of aesthetic aspects of urban streams.
- Providing recreational services such as urban parks, trails, bicycle tracks, etc. alongside the stream to encourage resident's interaction with nature, improve their health condition and well-being, and enhance their social interaction with each other, all of those will result in improvement of urban quality of life.
- More emphasis on the natural elements in the change of designations of restored stream corridors.
- It is important that locally indigenous plants and trees be used as much as possible when areas of habitat are established, restored, and improved. As Low et al (2007) state using locally indigenous plants helps conserve the flora of the area, and such plants are generally easier and less expensive to

grow and maintain. In many parts of Iran, it is a common trend to plant evergreen coniferous trees like pine, so regarding the mentioned benefits of indigenous plants and trees, this trend must be reversed.

- As Low et al (2007) state, the most important characteristics of a successful watercourse corridor (or any corridor) are its width and its connectivity (ability to connect areas of habitat). Wider corridors and those with a greater degree of connectivity typically allow better-functioning corridors. So these two important notes must also be considered in improvement plans.

- Development of a green passage for pedestrians with only limited number of commercial units to provide facilities for the passage users. In addition these units can be a good market to introduce craft activities of the city to residents and especially to tourists.

- All efforts must be done to fully benefit the current topography of the area.

- Paying enough attention to sewage system in order to prevent its leakage into the water flow of urban stream and also to maintain the freshness of water.

Incorporating these important issues in planning for streams can bring back the degraded streams and waterways to an ecologically healthy condition and be a remedy to many years of neglect and abuse.

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