Environmental Impact Assessment of Large Recreational, Sports, and Cultural Complexes On Urban Spaces Case Study: Hezar O Yek Shahr Recreational, Sports, and Cultural Complex District 22 of Tehran Municipality

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Abstract: Result of studies conducted and predictions made by World Bank and other international organizations indicate that two third of world population will live in the urban areas in the third millennium. Urban living in Iran has experienced a rapid growth during past 4 decades. Increased numbers of cities, wide spread migration from rural areas, and higher birth rate have significantly increased urban population. Higher disposable income and reduced work hours have improved social welfare. These changes have produced complicated and encompassing consequences in urban areas at national and local levels, including air and environmental pollution, densely populated urban areas, plus difficulties and inequalities in city and social services. Providing for social needs of various age groups in such circumstances and under heavy influence from world developments require extensive planning. A part of this planning includes provision of additional public recreational spaces. The complicated nature of urban living demands special focus on projects which may contribute to social welfare by increasing the available public areas including recreational parks. One such project is *Hezar O Yek Shahr* Recreational, Sports, and Cultural Complex in District 22 of Tehran Municipality. This project is being implementing on a 150 hectare divided into seven zones assigned for recreation, tourism, sports, education, cultural activities, and public services. This project is one of a kind in Iran and Middle East. *Hezar O Yek Shahr* project is already under development at a total estimated cost of about $2 billion. As an indication of the size of this undertaking, this project will require 993,000 cubic meters of earth removal and 404,000 cubic meters of filling. This complex will have various subdivisions for hotels, shopping centers, recreation area, water-park, and amusement center. The amusement park alone will have 83 attractions. It is estimated that 141961 visitors will visit this complex per day. Article 50 of Iran Civil Laws and article 172 of The 5th Iran National Development Plan require environmental impact assessment of any project to be undertaken by any large production, industrial, service, and infrastructural unit. In compliance with the legal requirements, the environmental impact of this large and significant project was assessment in this study by using Pastakia Matrix. This study examined the impact of 18 civil and infrastructural activities on environmental parameters in two phases of project construction and operations. The results of this study showed that the project implementation option had higher number of positive impacts. Consequently, the implementation of this project is preferable over non-implementation option. However, project implementation is supported as the final decision subject to implementation of certain management measurements.

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Introduction

Tourism has turned into an industry in many countries because of its contribution to national economy and national growth product. Income and profit from tourism is so high in some countries that rival petroleum income in Iran.

Tourism now ranks third in employment after petroleum and auto industries. Governments, authorities, and economic experts show keen interest in tourism development aiming for a larger share of international tourism market.

Tourism has turned into an important segment of economy during past several decades. World

Tourism Organization has estimated that international tourism will reach 1.6 billion arrivals by 2020. Tourism industry is expected to take a significant part of international gross products because of its global reach.

Recreation and entertainment centers play the same role industrial units had in nineteenth century. Recreation and amusement parks have cultural, economic, and social dimensions. They provide backward and forward linkage to city services and industries including recreational equipment producers, construction and architectural companies, transportation industry, and service industries such as banks and insurance companies. Large scale amusement parks have turned into *global villages* acting like crossroads for bringing people from different countries together.

Iran has experienced rapid urbanization in recent decades. Insufficient employment opportunities to attract the increasing flow of workers migrating from rural areas, petroleum based economy, and inability of active industries to compete in international markets as a base for increased production and further employment, has expanded the non-producing segment of economy to the detriment of national economy. The non-producing segment engages in the risky and speculative business of buying and reselling properties to push prices higher for personal gains.

The demand pull from this segment of economy has fashioned urban spaces in such a way that cannot provide the necessary products and services required by modern urban living. The outcome of this shortcoming is wider inequality and disregard for citizens' rights. The present circumstances require thoughtful space management to allocate urban spaces based on needs of society. Proper and efficient management of recreational spaces together with place marketing may improve living quality in urban areas and help expand urban economies.

Planning experience in Iran shows that urban planners have always lagged in urban development for several reasons including lack of integrated management approach, segment oriented view instead of space-place view, high population growth rate, high ratio of young population, elevated demands and expectations of citizens for city services, and economic changes.

Living quality and life satisfaction now have new meanings. Recreation centers and city tourism in metropolitan areas have to address residences' new multi dimensional demands. These demands stem from different definitions people have about recreation and entertainment. Understanding and paying attention to these differences can help urban planners in providing the required cultural and recreational spaces.

Tehran Municipality has undertaken *Hezar o Yek Shahr* project to create the largest recreational and tourism complex in the Middle East. This project is intended to address the extended culture changes that have occurred in Tehran in recent years. It will address the needs of young generation and shortage of recreational spaces. This project will meet a part of recreational needs of residence, improve economic conditions in Tehran, and create a sustainable source of income for City.

Hezar o Yek Shahr recreational and tourism projects will provide an amusement park in the Capital of Iran with extensive and diverse recreational and entertainment services that cannot be found anywhere in the Middle East. This huge undertaking is made possible with the initiative and participation of Tehran Municipality. It is intended to fulfill the cultural and recreational needs of Iranian people when visiting Tehran metropolitan. This project will be implemented in compliance with Islamic and Iranian values and principles. The main objectives of this project are to attract domestic investment funds, create employment, and provide recreational and entertainment spaces.

Three effective groups of factor should be considered in fulfilling the objectives of this project:

- Effective factors in project design
- Effective factors in project management
- Effective factors in project implementation

These three groups of factors should consider the following issues.

- Residences demand and their living style
- Investment potential of private sector in tourism development
- Required legal support from public sector and city management.

The following environmental factors should be considered in space relations of the project:

- The extent of using environment without harming natural resources and creating social, cultural, and economic problems
- The balance between development and prosperity of a district (for example, directing private and public investment funds toward city tourism industry and the related producing services for attracting international and regional investments, away from non-producing services in the intermediary and speculative business or irregular construction or industries that cannot compete in international market.)
- Potential employment and income opportunities, urban development and

prosperity, infrastructure and public service development

- Converting west entrance of Tehran into the most attractive recreational-commercial space

Implementation of this project will produce a cultural space with positive and/or negative impacts such as:

- environmental pollution
- qualitative and quantitative changes in city infrastructures
- traffic increase in the area and increased intercity traveling
- changes in land and property values
- zoning changes in district 22 and neighboring districts
- population change in the area
- life-satisfaction
- quality change in city management services, and
- changes in city revenues

This study takes an analytical and future oriented approach for evaluation of the potential environmental impact of this project as one of the most important consequences of its implementation.

Research Objective

The most important objective in evaluation of the environmental impact of this project was gaining assurance about compliance of planned policies, objectives, and activities of this project with environmental terms, criteria, laws and regulations set by Government.

An effective evaluation shall consider every critical and significant issue that may impact environment. The evaluation report should present various rational and acceptable options that have the lowest negative environmental impact, consider every condition that may improve the quality of environment, and create the highest level of confidence and assurance among decision makers and the public.

The environmental impact of this project is assessed by considering the following issues:

- Removing or recovering from potential environmental damages
- Increased public awareness
- Using public opinions in decision making
- Awareness about potentially dangerous environmental problems
- Predicting critical and permanent environmental impacts
- Striking a balance between long-term developmental objectives and the requirement to make resources available to the majority of people
- Propose developmental program in line with environmental protection
- Increased cooperation and coordination between public and private sectors
- Complying with and inclusion of environmental criteria in national development plans
- Identification of governmental responsibilities for environmental protection
- Striking a balance between population growth and environmental resources
- Maintaining the quality of renewable resources for maximum productivity with consideration given to keeping a proper life cycle
- Provision of healthy and active life for society
- Identification of correct methods of using environment
- Understanding critical environmental problems that need further studies, reviews, controls, and cares.

Environmental Impact Assessment

Environmental impact assessment (EIA) is the process of formal reviews and studies to predict the potential impacts on environment, human health and social well-fare resulting from activities and performances of a project. It is a systematic identification and assessment process to measure the consequences of carrying out a project, program, or plan on physical, chemical, biological, cultural, economical, and social aspects of the environment. Environmental impact assessment as a planning tool determines positive and/or negative impacts of a project on the environment.

Environmental impact assessment develops and implements an environmental monitoring system by the help of suitable environmental criteria in order to provide enough control over implementation and operations of a project to minimize its potential damaging impacts.

Tourism industry, like many other industries, may be harmful to environment if expanded without proper and logical planning. Economic losses may be suffered because of land price increases, workforce changes, overloading infrastructure, inflationary pressures, and economic gap between different parts of a country. Tourism expansion without proper plan may produce damaging consequences to the environment and historic heritage by producing negative cultural and social impacts, introducing changes in values, and promotion of social indecencies.

Negative tourism impacts are not limited to foreign tourism. Domestic tourism can also produce similar damaging impact if pursued without proper planning.

Tourism planning can decrease its negative impacts and create an opportunity for its sustainable development.

Sustainable tourism development is defined as tourism industry growth by attracting additional tourists through the available resources in such a way that it addresses the economic, social, and cultural needs of a society while observing the related laws and regulations, fulfilling tourists' expectations, and supporting social unity, cultural identification, environmental safety, economical growth, social welfare, and tourists enjoyment (Mansoori, 2002, p. 73).

A sustainable tourism program should be always flexible and support changes. New work procedures and approaches should never stand in the way of innovation, creativity, and experimentation. Such tourism program should adapt itself to environmental changes and fulfill tourists' new expectations and needs (Alvani, 1994, p.271).

The main objective of a sustainable tourism program should be the provision of rational approaches for utilization of natural and human resources. It means that such a program should prevent irrational use of resources. Sustainable tourism development should protect environment and natural resources as well as historical and cultural heritage of a society. It requires a well-defined set of policies to help the development of a tourism program that contributes to the overall development of the country (Mansoori, 2002, p. 73).

Key environmental variables of the tourism industry can be studies and analyzed from four points of view (Iran Tourism Organization, 2002, p. 4):

1) Physical impact on environment including the effects on soil, water, ecology, sound, and raining;
2) Natural impact on environment including the effects on plants, animals, and natural habitats;
3) Social and cultural impact including the effects on public health, employment, housing, and culture; and
4) Impact on national development programs including the effects on agricultural, industrial, and service development, plus the effects on land preservation and use

The following principles should be considered in environmental impact assessment in order to obtain a desirable outcome and provide for a controlled development of tourist recreational centers (Poorokhshoori, 2001, pp. 46-56 and Majnoonian, 1997, p. 4):

- Exclude geologically unstable areas (i.e. areas with high land erosion);
- Identify candidate areas for development;
- Minimize wind impact by considering height, shape, and position of buildings within the surrounding vegetation;
- Design facilities and services with the lowest possible impact on environment;
- Select environmental friendly materials and construction methods;
- Exercise total control over proper garbage and waste disposal; and
- Supervise sewage disposal to minimize environmental impact
- Provide utilities to lowland areas wherever possible.
- Position buildings, roads, and parking lots where there is the highest harmony with the surrounding area.
- Select the height and position in such way that they do not stand out to obstruct the natural view.
- Select construction material that conforms to local ecology.
- Design buildings that fit the local habitat.
- Procure construction material from outside the area. .

Tourism development without proper planning can damage social and environmental setting of the area in spite of all its benefits and advantages. Environmental impact assessment of a tourism project can prevent serious social and environmental consequences. A project shall not be approved unless it is changed to satisfy certain requirements. Environmental impact assessment should consider all environmental, economic, social, and cultural impacts. A highly profitable project may be unacceptable because of the problems it creates for environment and society. Such projects shall not be approved without revisions (Abdollah Zadeh, 2000, p. 95).

District 22 as Project Location

District 22 of Tehran Municipality is located northwest of Tehran at the downstream of Kan and Vardige Rivers. The area is surrounded by central Alborz Mountain on the north, Kan River on the east, Tehran-Karaj Highway on the south, and Vard Avard manmade forest on the west. District 22 neighbors districts 5 and 21 of Tehran Municipality.

Alborz Mountain embraces Tehran like an arc. It has been subject to urban development during past 30 years. Tehran has expanded throughout the foothills of ALborz up to 1800-meter elevation line. High slops and raggedness of the area above this line has prevented further city expansion above this elevation. The northern part of district 22 extends up to 1800-meter elevation line of southern foothills of

Alborz Mountain making it a suitable area for vegetation, plantation, recreation, and tourism.

District 22 is the largest Tehran municipality district. It was the first district with an approved plan with zoning for recreation, entertainment, and tourism before Tehran Comprehensive Plan was prepared. It had been decided that projects for this area should be limited to projects for recreation and tourism attraction. The first comprehensive plan devised in 1999 kept the original plan for this district 22 intact. The revised comprehensive plan of 2007 reconfirmed the same original plan for district 22 with an additional plan to reduce population from 675,000 to 400,000 (District 22 Comprehensive Plan, Bavand Consulting Engineers 1998).

Various projects have been completed in the area since 1999 including access roads to green land areas of Technology and Chitgar Parks, man-made lake at Azadi Stadium, Kan and Vard Avar Rivers, Khargoosh Darreh Park, and southern foothills of Alborz Mountain. The latter area was subject to residential developments before this plan. The present municipality management has been careful not to issue permits for residential development in the area leaving it strictly for public, recreational, and entertainment land use.

Figure 1: *Hezar O Yek Shahr* Project Position within district 22, Tehran Province, north central part of Iran and Iran.

Source: Google Earth

The proposed land for *Hezar O Yek Shahr Park* is located in west and northwest of Tehran stretching from 35.75 to 35.77 latitudes and from 51.17 to 51.20 longitudes. Tehran Park Project is located at North of Hemmat Highway, northwest of district 22 after Shahid Bagheri Residential Complex. The size of the project can be measured by the volume of earth removal and filling which are estimated to be 993,000 and 404.000 m^3 respectively. This park will have an estimated 141,961 visitors per day.

An important point of this project is its positioning. According to the studies conducted on Land Preservation Plans in the district, District 22 Comprehensive Plan, plus new Development Plans for Tehran, about 24 percent of land in Tehran are suitable for green zone (G). The land selected for this project is located in zone G with the potential for recreation, tourism, entertainment, and vegetation (Research Center for Environmental and Energy Studies, 1381/2002).

Hezar O Yek Shahr Project will include various subdivisions as listed below.

- Amusement Park
- Commercial Center
- Covered Water Park
- Five Star Hotel
- Four Star Hotel
- Three star hotel

The project design is fashioned after Islamic and Iranian architectural. The construction of this project will take 5 years with the first project to be the amusement park. Amusement Park has been organized into seven Diar (meaning land) and is expected to be completed within 2 years. The number seven was chosen because of its importance in Islamic teaching. The names of these diars were selected based on their usage and significance in Iranian literature. Next three tables provides additional information about this project.

Table 1: Project Subdivision

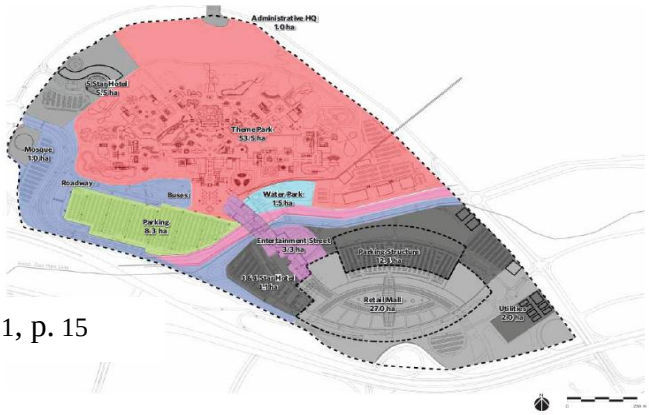
Subdivisions	Square Area (Hectare)	Capacity	Employment
Amusement Park	52.941	47941 Visitors	5000
Commercial and Shopping Centers	95.802	89815 Stores	5988
Water Park	6.851	6201 Visitors	650
Parking Lots		10000 Cars	

Table 2: Detailed Information of Hotels

Hotels	Rooms	Number of Guests	Number of Employees	Square Area
Three star	600	1200	600	1800
Four star	400	800	400	1200
Five star	300	600	300	900
Total	1300	2600	1300	3900

Table 3: Name and Description of Diars in Amusement Park

Diar	**Name**	**Description**
1	Afarinesh	The tail of earth and human creation based on Islamic and Iranian interpretation in attractive and different forms.
2	Afsaneh va Qesseh	A selection of Iranian myth and tails (such as Jamshid, Rostam, and Arash) and Islamic stories (such as The Prophet Nooh, peace be upon him)
3	Tarikh	An exploration into world and Iranian history
4	Asre No	A selection of materialistic and spiritual achievements in the new era.
5	Ekteshafat	Prediction of future and what can possibly happen
6	Majaraha	A variety of exciting and dangerous games with the help of new technologies based on myths.
7	Jaddeh Abrisham	A selection of the most important aspects and symbols of ancient civilizations enroute Abrisham Road.



Source: Forrec, 2011, p. 15

Figure 2: *Hezar O Yek Shahr* Project Site

Environmental Impact Analysis

Impact analysis is a versatile scientific tool for identification, collection, and organization of information about environmental impact of developmental plans. Environmental impact assessment of *Hezar O Yek Shahr* and option evaluation are the main part of this study. The data related to the current location and the its predicted impacts on different environments are analyzed. Qualitative-quantitative information and environmental impact predictions are presented in the same scale. The evaluation of different options will lead to selection of the best option.

Assessment Methodology

Developmental projects have different nature and therefore have different impact. The best approach for identification and evaluation of environmental impacts of developmental projects is using complex methods such as checklists, matrixes, and other similar methods. The evaluation team proposed different assessment techniques for this project based on various processes including decision making, impact identification, impact measurement, and impact interpretation. These processes provide easier, certain, definite, and realistic access to the results of this project. Evaluation team proposed a checklist for the whole project to be used with matrix method in consideration of different sub-projects and within the scope of the study.

The evaluation process was divided into four parts conforming to Warner and Preston study (1973) in order to prepare an objective oriented checklist for this project,.

1. Identification
2. Measurement
3. Interpretation
4. Conclusion

Objective-oriented Checklist with Patakia Matrix was selected for this study. It was chosen because of its versatility, independence, specialization, objective orientation, classification, flexibility, and reliability in its prediction of environmental impacts and how it compares the possible outcome of those impacts.

The following key questions were considered in prediction of possible environmental impacts of the project and its subprojects in order to obtain objective oriented and applicable results:

1- Does project implementation involve earth removal and filling?
2- Does project require service covering that may interfere with soil permeability?
3- Does project involve building construction?
4- Does project increase traffic and cause air pollution?
5- Does project consume water, uses insecticide, and produces sewage and waste?
6- Does project compete with vegetation growth and local ecology?
7- Does project cause biota increase or decrease?
8- Does project produce light and sound?
9- Does project pollute surface and/or in ground water sources?
10- Does project threaten human health?
11- Does project endanger human safety and/or produce human hazard?
12- Does project effect health, welfare, and security in local community?

The potential impact from different phases of construction and operation were classified. The environmental impacts of each class were grouped as negative, cumulative negative, non-recoverable negative or the like based on the negative impacts that they might have on environmental parameters. After analyzing and summarizing evaluation output,

the factors that may have the most critical impacts on environment were identified.

Pastakia Matrix method analyzes activity matrix against environmental parameters. This method was first proposed by Pastakia (1998) and uses certain standards as critical evaluation criteria.

This method identifies various activities of the proposed project and assesses their impacts on each environmental parameter including physical, chemical, biological, ecological, social, cultural, economical, and technical parameters.

Each environmental element was graded based on defined criteria and according to the prepared objective oriented checklists and prioritization of the identified impacts for the best use of this method. After assessment and mathematical calculation by using the related software, the range of environmental impacts were divided from highly positive to highly negative. Finally, a management and monitoring plan, plus approaches for reducing the undesirable impacts were prepared based on the tables and diagrams of environmental elements and predicted impacts.

Table 4: Pastakia Criteria

Criteria	Score	Description
A_1 - Impact Significance	4	National and/or international significance
	3	National or regional significance
	2	Regional significance but not within local terms
	1	Significant only for local conditions
	0	No significance
A_2 - Impact Range	+3	Impact with highly beneficial and positive changes
	+2	Certain local improvement
	+1	Local improvement
	0	No local impact
	-1	Negative local impact
	-2	Highly damaging impact
B_1 - Impact Period	1	No changes
	2	Temporary
	3	Permanent
B_2 - Recoverability	1	No change
	2	Recoverable
	3	Non-recoverable
B_3 - Cumulative Impact	1	No change - Impossible
	2	No cumulative impact
	3	With cumulative impact

Environmental Impact Checklist

Evaluation team identified and classified the most important construction and operation activities of *Hezar O Yek Shahr* Project based on the applicable guidelines and using checklist and matrix methods. This team identified the critical environmental factors that may be impacted by the project construction. Next, the environmental impact of those activities were predicted and studied. Table 6 provides a checklist of the identified and classified impacts of the proposed project on different environmental factors.

Table 5: Impact Range Classifications

Description	Range	Scores
High beneficial and positive impact and changes	+E	+72 to +108
High certain positive impact and changes	+D	+36 to +71
Medium positive impact and changes	+C	+19 to +35
Positive impact and changes	+B	+10 to +18
Minuscule positive impact and changes	+A	+1 to +9
No local impact and changes and/or Impossible	N	0
Minuscule negative impact and changes	-A	-9 to -1
Negative impact and changes	-B	-18 to -10
Medium negative impact and changes	-C	-35 to -19
Certain negative impact and changes	-D	-71 to -36
High negative impact and changes	-E	-108 to -72

The evaluation team discussed the resulting checklist, reviewed the predicted impacts, and classified projects based on their potential impacts during construction and operations. The classification of the subprojects was based on the nature of the impacts, the extent of the impacts, the application of project, and its intended audience.

Table 6 - Environmental Impact Checklist - Construction

Environmental parameters		Project activities									
		Equipping	removal &	ces s roa &	ng con stru	design & im	Tra nsp ort	age & Co	& Se wa	e & deb ris dis	em plo ym ent
Physical Environment	Microclimate										
	Land form		•	•	•	•					
	Soil quality		•	•	•		•	•	•		
	Surface water volume					•			•		
	Surface water quality										
	Underground water volume										
	Underground water quality							•	•		
	Air quality		•	•	•		•	•			
	Sound pollution		•	•			•				
Biological Environment	Vegetation type		•	•	•						
	Animal species		•	•							
	Areas under management of Environmental Protection Agency										
Social-cultural Environment	Population										
	Literacy & specialization										
	Social culture improvement										
	Views and perspectives	•	•	•	•						
	Security, health, and hygiene						•	•	•	•	
	Conveniences										
	Tourism and recreation										
	Historical-cultural and religious heritage										
	Living standard										
	Local-cultural identification					•					
	Police protection and social security			•		•	•				
Economical-technical Environment	Realization of Comprehensive Plan objectives					•					•
	Employment										•
	Property value			•	•						•
	Income and expenses					•					
	Services					•					•
	infrastructures					•					
	Regional economy					•					•

Number of impacts on each project	1	7	9	6	9	5	4	4	1	5

Table 7 - Environmental Impact Checklist - Operations

Environmental parameters		Project activities									
		Transport	Water consumption	Energy consumption	Employment	Sewage disposal	Garbage disposal	operation (water park, cultural center, hotels, & commercial	Tourists visit and activities (amusement Park)	Garbage & debris disposal	
Physical Environment	Microclimate							•		•	
	Land form										
	Soil quality						•			•	
	Surface water volume		•							•	
	Surface water quality										
	Underground water volume		•							•	
	Underground water quality					•				•	
	Air quality	•		•						•	
	Sound pollution	•							•	•	
Biological Environment	Vegetation type									•	
	Animal species									•	
	Areas under management of Environmental Protection Agency										
	Disease carriers							•			
Social-cultural Environment	Population				•				•		
	Literacy & specialization										
	Security, health, and hygiene improvement							•	•	•	
	Conveniences				•			•	•	•	
	Social culture improvement				•				•		
	Public participation							•	•	•	
	Views and perspectives							•		•	
	Tourism and recreation							•	•	•	
	Living standards							•			
	Historical, cultural, and religious heritage										
	Local-cultural identification							•	•		
	Police protection and social security							•	•	•	
Economical-technical Environment	Employment				•			•	•	•	
	Realization of Comprehensive Plan objectives							•	•		
	Green belt development		•			•				•	
	Infrastructures							•	•		
	Property value				•			•			
	Income and expenses				•			•	•		
	Services				•				•		
Number of impacts on each project		2	3	1	7	2	1	15	14	17	

Table 8 - Environmental Impact Classification - Construction

Environmental parameters	Impact type											
	inharmonious	Recoverable	Unrecoverable	Temporary	Permanent	Direct	Indirect	Without cumulative	With cumulative	Avoidable	Unavoidable	Beneficial
Microclimate												
Land form	•		•		•	•		•			•	
Soil quality	•		•		•	•		•			•	
Surface water quality	•	•		•				•			•	
Underground water quality	•		•	•			•	•		•		
Air quality		•		•		•		•			•	
Sound quality		•		•		•		•			•	
Vegetation type	•		•		•	•		•			•	
Animal species			•		•		•	•			•	
Habitats												
Disease carriers	•	•		•			•	•		•		
Population	•	•		•			•	•			•	
Literacy & specialization												•
Income and expenses												•
Security and hygiene	•		•	•		•		•		•		
Conveniences												
Property value			•		•		•	•			•	•
Tourism-industrial development			•		•	•						•
Commerce												
Services			•				•	•		•		•
Infrastructures												
Employment		•		•		•		•			•	•
Living standards												
Views and perspective		•		•		•		•			•	•
Social cultural improvement								•				
Public participation								•				
Local cultural identification												
Police Protection & Social Security		•			•	•		•				•
Conveniences												
Tourism and Recreation												
Total Impact	8	7	7	9	5	9	5	16		3	11	8

Table 9: Environmental Impact Classification - Operations

Environmental parameters	Impact type											
	inharmonious	Recoverable	Unrecoverable	Temporary	Permanent	Direct	Indirect	Without cumulative	With cumulative	Avoidable	Unavoidable	Beneficial
Microclimate			•		•	•		•			•	
Land form			•		•	•		•			•	
Soil quality			•		•	•		•		•		
Surface water volume		•			•	•		•			•	

Surface water quality												
Underground water		•			•	•		•		•		
Underground water quality			•		•		•		•	•		
Air quality			•		•	•		•			•	
Air pollution		•			•	•		•			•	
Sound quality			•		•	•		•			•	
Sound pollution	•	•		•		•			•		•	
Vegetation type												
Animal species	•		•		•		•	•			•	
Areas under management of Environmental Protection Agency												
Natural habitats												
Disease carriers	•	•		•			•	•		•		
Population	•	•		•		•		•			•	
Literacy & specialization												
Income and expenses			•		•		•					•
Security, health, & hygiene increase												
Conveniences			•		•	•		•			•	
Property value			•		•		•	•			•	
Tourism-industrial development			•		•		•					•
Commerce												
Services			•		•		•					•
Infrastructures			•		•	•		•			•	•
Employment			•		•	•		•			•	•
Living standards			•		•		•	•			•	•
Realization of comprehensive plan objectives			•		•	•		•			•	•
Green space			•		•	•		•			•	•
Tourism and recreation			•		•	•		•			•	•
Views and perspective			•		•	•		•			•	•
Social cultural improvement			•		•			•			•	•
Public participation			•		•			•			•	•
Total Impact	4	6	18	3	20	17	7	20	4	4	20	12

The evaluation team judged the impacts of water-park, hotels, cultural complex, and shopping centers on the surrounding environment to be close to each other and therefore put them into one group. The impact of this group as a special case was assumed to be the highest average of its members. Various parts (Diars) of amusement park were also grouped together. Maintenance activities and green space development were put into a separate group.

The resulting checklists were analyzed after identification and classification of environmental impacts. Table 10 provides the results of this analysis.

Table 10: Environmental Impact Analysis

Construction phase	Site Equipping	Earth removal & filling	Access roads	Building construction	Green space design & implementation	transport	Energy storage & usage	Water Usage & Sewage disposal	Garbage & debris disposal	employment	Average of impact ratio on environmental parameters
Impact score	1	7	9	6	9	5	4	4	1	5	32.6

Operation phase	Transport	Water consumption	Energy consumption	Employment	Sewage disposal	Garbage disposal	Tourist operation (water park, cultural center, hotels, & commercial	Tourist visit and activities (amusement Park)	Garbage & debris disposal	----	----
Impact score	2	3	1	7	2	1	15	14	17	---	32.11

According to this table, the total impact score of implementing this project on surrounding environmental parameters in construction period is 6 out of 32 and in operation period is 11 out of 32. About 50% impact increase represents increased impact on surrounding environment, which may include positive and negative impacts.

Table 11: Impact on Each Environment - Construction

Environmental parameters	Project activities										Total Project impact
	Site Equipping	Earth Removal & Filling	Access Roads	Building Construction	space Design & Implemen	Transport	Energy Storage & Consumption	Water Usage & Sewage Disposal	Garbage & Debris Disposal	Employment	
Physical environment		4	4	3	2	3	3	3	-	-	24
Biological environment	-	0	0	1	-	-	-	-	-	-	5
Social-cultural environment	1	1	2	1	2	2	1	1	1		13
Economic-technical environment	-	-	1	1	6					5	13

This table shows that the project activities during operations have the highest impact on social-cultural environment. Economic-technical and biology environments receive the next highest impact. Physical environment ranks third on impact received from the project during operations. Social-cultural and economic-technical environments show the highest positive impact. Green space development has the highest positive impact on physical environment.

Table 12: Impact Analysis of Classification in Different Phases

Project phase	Number of projects and activities	Negative impact on environmental parameters & elements	Cumulative impact on environmental parameters & elements	Non-recoverable impact on environmental parameters & elements	Indirect impact on environmental parameters & elements	Beneficial impact on environmental parameters & elements
Construction	10	30.8	30.0	30.7	30.5	30.8
Operation	9	34.4	34.4	34.18	34.7	34.12

This table shows that the negative project impact is higher during construction than during operations. The higher negative impact is attributed to earth removal, leveling, and site equipment. The beneficial project impact is significantly higher during operations versus construction period.

The evaluation team assessed the project and analyzed the checklists by considering the interactions and overlapping between various activities in different subprojects. The result of analysis showed that this project had long-term beneficial and harmonious impact to the surrounding social, economic, cultural and technical environments. These impacts are recoverable.

Impact Matrix and Evaluation Results

In order to understand the final result which is required for "go/no go" decision, the related scores were entered into a matrix with entries for impacts on physical, biological, social, economic, cultural,

environmental prolusion, and developmental plans. The numbers representing positive or negative impact on different options were summed up and multiplied by the related factors. The sum shows the project impact on each environmental factor. The total algebraic sum is used in the final decision making.

Special attention should be made to the negative numbers in the table in order to decide on what approaches to take to reduce the impact. These numbers shall be used in project management and monitoring. Project management shall improve positive impacts and reduce negative impacts obtained from the matrix.

Project Implementation Option

The next tables and bar diagrams show the result of the analysis performed on the impact of project activities on different environmental parameters during construction and operations for project implementation option.

Table 13: Impact on Physical-Chemical Environment (P/C) - Construction Project Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	R			
2	-1	2	2	3	-14	-B	Transportation impact on air quality	P/C	1
2	-1	2	2	3	-14	-B	Transportation impact on sound quality	P/C	2
2	-1	2	2	3	-14	-B	Transportation impact on traffic	P/C	3
1	-1	3	3	1	-7	-A	Ground and concrete works impacts on water drainage	P/C	4
1	-1	3	3	1	-7	-A	Ground and concrete works impacts on land form	P/C	5
2	-1	2	2	3	-14	-B	Ground and concrete works impacts on air quality	P/C	6
2	-1	2	2	3	-14	-B	Ground and concrete works impacts on noise production	P/C	7
1	-1	3	3	1	-7	-A	Ground and concrete works impacts on surface water	P/C	8
0	0	1	1	1	0	N	Ground and concrete works impacts on soil characteristics	P/C	9
0	0	1	1	1	0	N	Access road impact on surface water	P/C	10
2	-1	2	2	3	-14	-B	Construction material unloading impact on noise production	P/C	11
0	0	1	1	1	0	N	Access road impact on soil characteristics	P/C	12
1	-1	3	3	1	-7	-A	Sewage disposal impact on soil characteristics	P/C	13
2	-1	2	2	3	-14	-B	Construction work impact on noise production	P/C	14
0	0	1	1	1	0	N	Construction work impact on air quality	P/C	15
1	-1	3	3	1	-7	-A	Construction work impact on land form	P/C	16
0	0	1	1	1	0	N	Construction work impact on surface water	P/C	17
0	0	1	1	1	0	N	Construction work impact on soil characteristics	P/C	18

Table 14: Impact on Biological-Ecological Environment (B/E) - Construction Project Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	R			
1	-1	3	3	2	-8	-A	Deforestation impact on land ecosystem	B/E	1
0	0	1	1	1	0	N	Deforestation impact on water ecosystem	B/E	2
1	-1	3	3	2	-8	-A	Ground and concrete works impacts on vegetation habitat	B/E	3

1	-1	3	3	2	-8	-A	Ground and concrete works impacts on plant concentration	B/E	4
2	-1	3	3	2	-16	-B	Ground and concrete works impacts on animal behavioral pattern	B/E	5
0	0	1	1	1	0	N	Ground and concrete works impacts on animal habitat	B/E	6
0	0	1	1	1	0	N	Construction work impact on land ecosystem	B/E	7
0	0	1	1	1	0	N	Construction work impact on water ecosystem	B/E	8
1	-1	3	3	2	-8	-A	Transport impact on vegetation habitat	B/E	9
0	0	1	1	1	0	N	Transport impact on animal habitat	B/E	10

Table 15: Impact on Social-Cultural Environment (S/C) - Construction Project Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	R			
2	-1	2	2	3	-14	-B	Impact of supply & transport scraps, construction materials, equipments, machineries, and personnel on local traffic	S/C	1
2	-1	2	2	3	-14	-B	Impact of noise prolusion on local community	S/C	2
2	+2	2	2	3	+28	+C	Impact of employment and construction on people and local community participation	S/C	3
2	+1	2	2	2	+14	+B	Impact of employment and construction on local population density	S/C	4
2	+1	2	2	2	+12	+B	Impact of project hiring on local employment	S/C	5

Table 16: Impact on Economical-Technical Environment (E/O) – Construction Project Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	R			
3	+2	2	2	2	+36	+D	Impact of transportation and equipment on economy	E/O	1
2	+2	2	2	2	+24	+C	Impact of employment on income	E/O	2
1	0	1	1	1	0	N	Costs involved in changing land zoning	E/O	3
3	-2	2	2	2	-36	-D	Construction costs	E/O	4
2	-1	2	2	2	-12	-B	Impact of demand for energy	E/O	5
3	+2	2	2	2	+36	+D	Impact of material and equipment procurement on economy	E/O	6

Table 17: Impact on Physical-Chemical Environment (P/C) – Construction Project Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	R			
2	-1	3	2	3	-16	-B	Impact of operation process on air quality	P/C	1
2	-2	3	2	3	-32	-C	Impact of operation process on sound quality	P/C	2
2	-1	2	3	3	-16	-B	Impact of operation process on surface water quality	P/C	3
1	-1	3	3	2	-8	-A	Impact of operation process on underground water quality	P/C	4
2	+1	3	2	2	+14	+B	Impact of green land on air and sound quality	P/C	5
2	-1	1	1	1	-6	-A	Impact of spillage and accidents on air and sound quality	P/C	6
2	-1	3	3	3	-18	-B	Impact of spillage and accidents on surface water	P/C	7
2	-1	3	3	3	-18	-B	Impact of spillage and accidents on soil characteristics	P/C	8
1	+1	3	2	2	+7	+A	Impact of green land on soil characteristics	P/C	9

Table 18: Impact on Biological-Ecological Environment (B/E) – Construction Project Implementation Option

Criteria	Activity impact on environmental parameters	Code

A_1	A_2	B_1	B_2	B_3	ES	R			
2	-1	3	3	2	-16	-B	Impact of operation process on land ecology	B/E	1
2	-1	2	2	3	-14	-B	Impact of operation process on water ecology	B/E	2
1	+1	3	2	1	+6	+A	Impact of green land on land ecology	B/E	3
0	0	1	1	1	0	N	Impact of green land on water ecology	B/E	4
1	+3	2	2	2	+18	+B	Impact of green land on land	B/E	5
2	-1	3	3	2	-16	-B	Impact of operation process on vegetation habitat	B/E	6
2	-1	3	3	2	-16	-B	Impact of operation process on animals	B/E	7
2	-1	2	3	2	-14	-B	Impact of spillage and accidents on vegetations	B/E	8
2	-1	2	2	2	-12	-B	Impact of spillage and accidents on animals	B/E	9
2	-1	2	3	3	-16	-B	Impact of spillage and accidents on water ecosystem	B/E	10
2	-1	2	2	3	-14	-B	Impact of spillage and accidents on land ecosystem	B/E	11

Table 19: Impact on Social-Cultural Environment (S/C) – Operations Project Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	R			
2	+2	3	2	3	+32	+C	Impact on future development plans	S/C	1
2	+3	3	2	3	+48	+D	Impact on service provision	S/C	2
2	+2	3	2	3	+48	+D	Impact on communities	S/C	3
2	+1	3	2	3	+16	+B	Impact on hygiene indexes	S/C	4
2	+2	3	2	3	+32	+C	Impact on security and safety	S/C	5
3	+2	3	2	3	+48	+D	Impact of guest services on tourism growth	S/C	6
2	+1	3	2	3	+16	+B	Impact of shopping and convenience services on public welfare	S/C	7
3	+2	3	2	3	+48	+D	Impact of recreational services on public temperament/happiness	S/C	8

Table 20: Impact on Economic-Technical Environment (E/O) – Operations Project Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	R			
3	+2	3	2	3	+48	+D	Impact on employment	E/O	1
2	+1	3	3	3	+18	+B	Impact on property and land prices	E/O	2
2	-1	3	2	2	-14	-B	Impact on community energy consumption	E/O	3
2	+2	3	3	3	+36	+D	Impact on different economic-technical activities	E/O	4
2	+2	3	2	3	+32	+C	Impact on shopping centers on local economy	E/O	5

Table 21: Number and Range of Impact – Construction Project Implementation Option

Environments Impact range	Economic-technical (E/O)	Social-cultural (S/C)	Biological-ecological (B/E)	Physical-chemical (P/C)	Total score
E	0	0	0	0	0
D	2	0	0	0	2
C	1	1	0	0	2
B	0	2	0	0	2
A	0	0	0	0	0
N	1	0	5	6	12
-A	0	0	4	5	9
-B	1	2	1	7	11
-C	0	0	0	0	0
-D	1	0	0	0	1
-E	0	0	0	0	0

Diagram 1: Impact Number and Range - Construction Phase Project Implementation Option

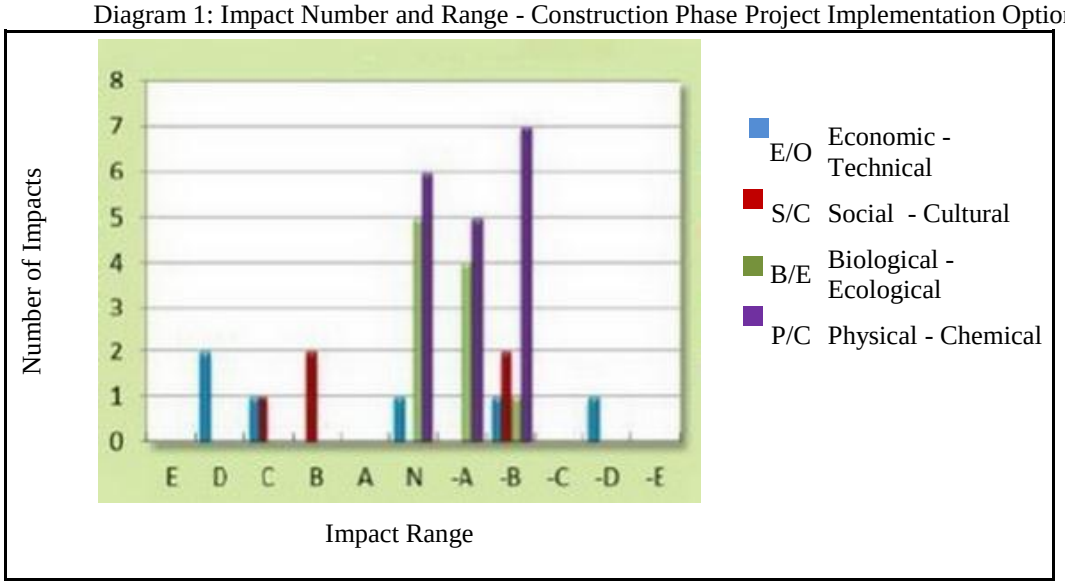
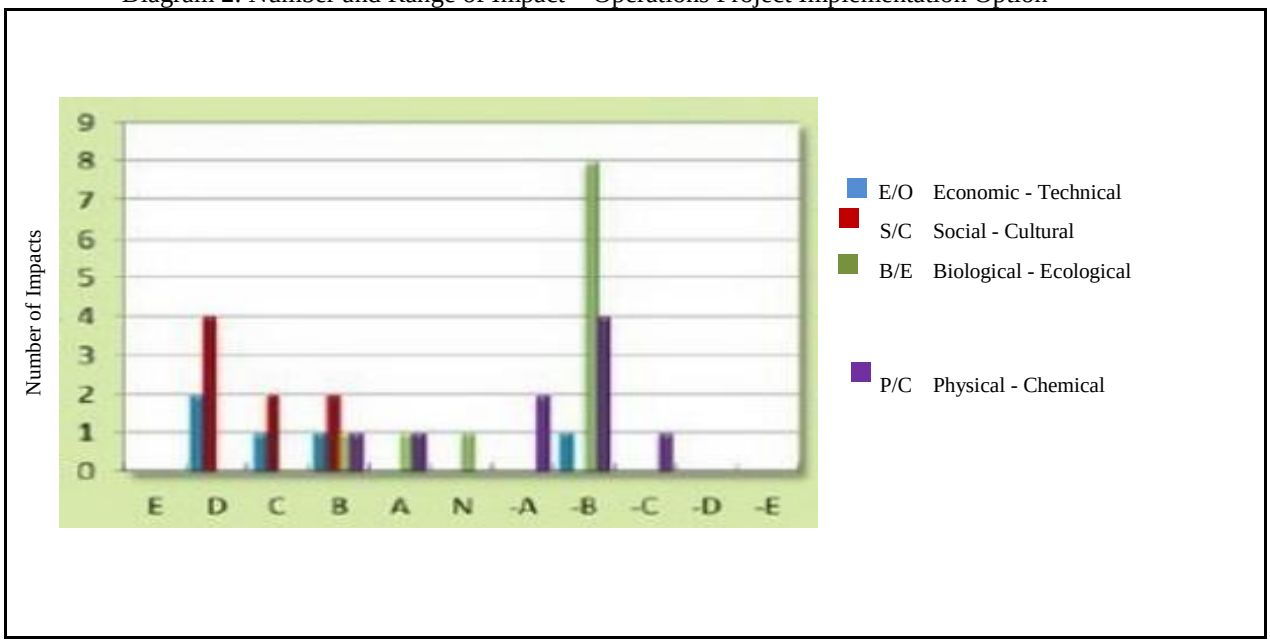


Table 22: Number and Range of Impact – Operations Project Implementation Option

Environments Impact range	Economic-technical (E/O)	Social-cultural (S/C)	Biological-ecological (B/E)	Physical-chemical (P/C)	Total score
E	0	0	0	0	0
D	2	4	0	0	6
C	1	2	0	0	3
B	1	2	1	1	5
A	0	0	1	1	2
N	0	0	1	0	1
-A	0	0	0	2	2
-B	1	0	8	4	12
-C	0	0	0	1	1
-D	0	0	0	0	0
-E	0	0	0	0	0

Diagram 2: Number and Range of Impact – Operations Project Implementation Option



Non Implementation Option

The future situation of this area is discussed in this section if project is not implemented. The following tables and diagrams show the result of environmental impact analysis for construction and operations phases in non implementation option.

Table 23: Impact on Physical-Chemical Environment (P/C) – Construction Non Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	R			
0	0	1	1	1	0	N	Transportation impact on air quality	P/C	1
0	0	1	1	1	0	N	Transportation impact on sound quality	P/C	2
0	0	1	1	1	0	N	Transportation impact on traffic	P/C	3
0	0	1	1	1	0	N	Ground and concrete works impacts on water drainage	P/C	4
0	0	1	1	1	0	N	Ground and concrete works impacts on land form	P/C	5
0	0	1	1	1	0	N	Ground and concrete works impacts on air quality	P/C	6
0	0	1	1	1	0	N	Ground and concrete works impacts on noise production	P/C	7
0	0	1	1	1	0	N	Ground and concrete works impacts on surface water	P/C	8
0	0	1	1	1	0	N	Ground and concrete works impacts on soil characteristics	P/C	9
1	-1	3	3	1	-7	-A	Access road impact on surface water	P/C	10
0	0	1	1	1	0	N	Construction material unloading impact on noise production	P/C	11
0	0	1	1	1	0	N	Access road impact on soil characteristics	P/C	12
0	0	1	1	1	0	N	Sewage disposal impact on soil characteristics	P/C	13
0	0	1	1	1	0	N	Construction work impact on noise production	P/C	14

0	0	1	1	1	0	N	Construction work impact on air quality	P/C	15
0	0	1	1	1	0	N	Construction work impact on land form	P/C	16
0	0	1	1	1	0	N	Construction work impact on surface water	P/C	17
0	0	1	1	1	0	N	Construction work impact on soil characteristics	P/C	18

Table 24: Impact on Biological-Ecological Environment (B/E) – Construction Non Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	R			
0	0	1	1	1	0	N	Deforestation impact on land ecosystem	B/E	1
0	0	1	1	1	0	N	Deforestation impact on water ecosystem	B/E	2
0	0	1	1	1	0	N	Ground and concrete works impacts on vegetation habitat	B/E	3
0	0	1	1	1	0	N	Ground and concrete works impacts on plant concentration	B/E	4
0	0	1	1	1	0	N	Ground and concrete works impacts on animal behavioral pattern	B/E	5
0	0	1	1	1	0	N	Ground and concrete works impacts on animal habitat	B/E	6
0	0	1	1	1	0	N	Construction work impact on land ecosystem	B/E	7
0	0	1	1	1	0	N	Construction work impact on water ecosystem	B/E	8
0	0	1	1	1	0	N	Transport impact on vegetation habitat	B/E	9
0	0	1	1	1	0	N	Transport impact on animal habitat	B/E	10

Table 25: Impact on Social-Cultural Environmental (S/C) – Construction Non Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	R			
0	0	1	1	1	0	N	Impact of supply & transport scraps, construction materials, equipments, machineries, and personnel on local traffic	S/C	1
0	0	1	1	1	0	N	Impact of noise prolusion on local community	S/C	2
2	-1	2	2	2	-12	-B	Impact of employment and construction on people and local community participation	S/C	3
2	-1	2	2	2	-12	-B	Impact of employment and construction on local population density	S/C	4
2	-2	2	2	2	-24	-C	Impact of project hiring on local employment	S/C	5

Table 26: Impact on Economical-Technical Environment (E/O) – Construction Non Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	R			
1	-1	2	2	2	-6	-A	Impact of transportation and equipment on economy	E/O	1
2	-2	2	2	2	-24	-C	Impact of employment on income	E/O	2
0	0	1	1	1	0	N	Costs involved in changing land zoning	E/O	3
0	0	1	1	1	0	N	Construction costs	E/O	4
2	1	2	3	2	+14	+B	Impact of demand for energy	E/O	5
3	-1	2	2	2	-18	-B	Impact of material and equipment procurement on economy	E/O	6

Table 27: Impact on Physical-Chemical Environment (P/C) – Construction Non Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	RV			
0	0	1	1	1	0	N	Impact of operation process on air quality	P/C	1
0	0	1	1	1	0	N	Impact of operation process on sound quality	P/C	2
0	0	1	1	1	0	N	Impact of operation process on surface water quality	P/C	3
0	0	1	1	1	0	N	Impact of operation process on underground water quality	P/C	4
2	-1	2	2	2	-12	-B	Impact of green land on air and sound quality	P/C	5
0	0	1	1	1	0	N	Impact of spillage and accidents on air and sound quality	P/C	6
0	0	1	1	1	0	N	Impact of spillage and accidents on surface water	P/C	7
0	0	1	1	1	0	N	Impact of spillage and accidents on soil characteristics	P/C	8
1	-1	2	2	2	-6	-A	Impact of green land on soil characteristics	P/C	9

Table 28: Impact on Biological-Ecological Environment (B/E) – Operations Non Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	RV			
0	0	1	1	1	0	N	Impact of operation process on land ecology	B/E	1
0	0	1	1	1	0	N	Impact of operation process on water ecology	B/E	2
1	-1	3	1	1	-5	-A	Impact of green land on land ecology	B/E	3
1	1	3	1	1	5	+A	Impact of green land on water ecology	B/E	4
1	-2	3	1	1	-10	-B	Impact of vegetation on land	B/E	5
0	0	1	1	1	0	N	Impact of operation process on vegetation habitat	B/E	6
0	0	1	1	1	0	N	Impact of operation process on animals	B/E	7
0	0	1	1	1	0	N	Impact of spillage and accidents on vegetations	B/E	8
0	0	1	1	1	0	N	Impact of spillage and accidents on animals	B/E	9
0	0	1	1	1	0	N	Impact of spillage and accidents on water ecosystem	B/E	10
0	0	1	1	1	0	N	Impact of spillage and accidents on land ecosystem	B/E	11

Table 29: Impact on Economic-technical Environment (E/O) – Operations Non Implementation Option

Criteria							Activity impact on environmental parameters	Code	
A_1	A_2	B_1	B_2	B_3	ES	R			
2	-2	2	2	1	-20	-C	Impact on employment	E/O	1
2	-1	2	2	1	-10	-B	Impact on property and land prices	E/O	2
0	0	1	1	1	0	N	Impact on community energy consumption	E/O	3
2	-1	2	2	1	-10	-B	Impact on different economic-technical activities	E/O	4
2	-1	2	2	1	-10	-B	Impact on shopping centers on local economy	E/O	5

Table 30: Total Number and Range of Impacts – Construction Non Implementation Option

Environments Impact range	Economic-technical (E/O)	Social-cultural (S/C)	Biological-ecological (B/E)	Physical-chemical (P/C)	Total score
E	0	0	0	0	0
D	0	0	0	0	0
C	0	0	0	0	0
B	1	0	0	0	1
A	0	0	0	0	0
N	2	2	17	10	31
-A	1	0	0	1	2
-B	1	2	0	0	3
-C	1	1	0	0	2
-D	0	0	0	0	0
-E	0	0	0	0	0

Diagram 1: Total Number and Range of Impacts - Construction Non Implementation Option

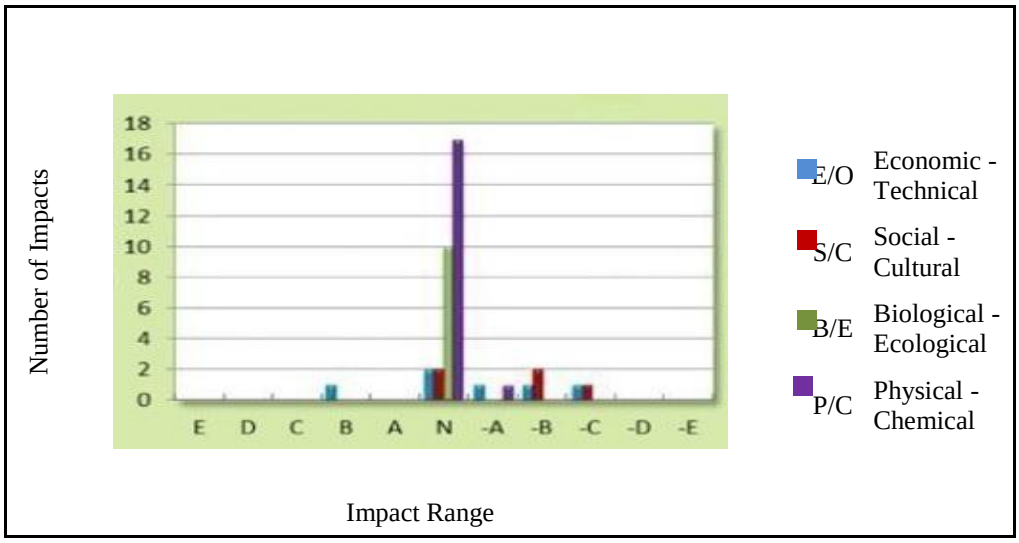
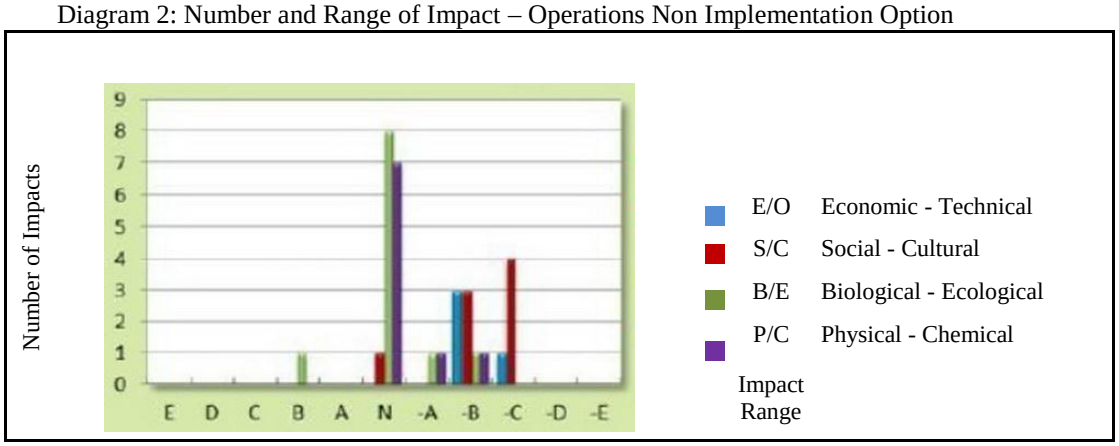


Table 31: Total Number and Range of Impacts – Operations Non Implementation Option

Environments Impact range	Economic-technical (E/O)	Social-cultural (S/C)	Biological-ecological (B/E)	Physical-chemical (P/C)	Total score
E	0	0	0	0	0
D	0	0	0	0	0
C	0	0	0	0	0
B	0	0	1	0	1
A	0	0	0	0	0
N	0	1	8	7	16
-A	0	0	1	1	2

-B	3	3	1	1	8
-C	1	4	0	0	5
-D	0	0	0	0	0
-E	0	0	0	0	0

Diagram 2: Number and Range of Impact – Operations Non Implementation Option



Conclusion and Final Selection

The comparison between the number and range of impacts from construction and operations activities for implementation and non-implementation options shows that:

1- Implementation option has 9 minuscule negative impacts, 11 ordinary negative impacts, and 1 specific negative impact during construction.
2- Non implementation option has 2 minuscule negative impacts, 3 ordinary negative impacts, and 2 medium negative impacts on region.
3- Implementation option has 2 minuscule positive impacts, 2 ordinary positive impacts, and 2 specific positive impacts during construction if environment protection provisions and regulations are observed.
4- Non implementation option has only one minuscule positive impact.
5- Non implementation option has 1 minuscule positive impact during operation on region.
6- Implementation option has 2 minuscule positive impacts, 5 ordinary positive impacts, and 3 medium positive impacts, and 6 specific positive impacts during operations on region.
7- Implementation option has 2 minuscule negative impacts, 13 ordinary negative impacts, and 1 medium negative impact during operations.
8- Non implementation option has 2 minuscule negative impacts, 8 ordinary negative impacts, and 5 medium negative impacts.

The total sum of positive and negative impacts shows that positive impacts from implementation option are higher than the negative impacts. Because this project is considered important as national and regional project, therefore, its implementation is prepared. The evaluation team recommended the implementation of the project after making specific changes in the plan and provisions for management and monitoring systems.

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