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Concept Article`

Study and prediction of effective environmental parameters of infrastructure water transmission line projects (Case study: Persian Gulf water transfer project)

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Abstract

The purpose of this research is to predict the environmental effects of the water transmission line project on the environment. The research method is descriptive and analytical using existing resources. Investigations showed that in the design of the water transmission line, the implementation of environmental considerations can play an effective role in controlling and reducing the harmful effects of the environment. Therefore, it is necessary to strictly implement measures and solutions to reduce environmental effects in water transfer areas. This is suggested by carrying out preferential environmental impact assessment studies for the superior option from the technical, economic, social and environmental point of view. On the other hand, one of the success factors in the sustainability of development plans is the degree of acceptance of these plans by the people and local communities and their participation in the implementation and exploitation of the plan. Since the project of transferring water from the Persian Gulf is carried out with the main goal of supplying water to industries in the southeast of the country, it seems that in the short term it is not possible to supply drinking water to the residential areas within the scope of the project. However, If local labor is used in the implementation and exploitation stage and the project is welcomed by the project's human communities, this project can have positive effects on the social, economic and cultural environment of the project.

Keywords: *water transmission line design, environment, drinking water supply, earthmoving, canal digging*

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1.Introduction

Today, the use of environmental management techniques and tools to achieve the goals of sustainable development has attracted the attention of human societies. The extensive efforts of recent decades to explain sustainable development, especially after the conference of world leaders (Rio de Janeiro-1992), indicate that the necessity of applying sustainability criteria and protection of important resources has an impact on the environment.

The simplest explanation that can be given for sustainable development is to involve the environment in the discussion of development. The environment consists of three main parts, namely the geosphere, hydrosphere and atmosphere. Therefore, the protection of the total resources of water, soil and air (biosphere or biosphere) is the basis of environmental studies. Currently, the ultimate goal of environmental protection is to achieve sustainable development in the form of economic programs in harmony with the principles of environmental protection and preventing the destruction and depletion of renewable and non-renewable resources. Therefore, in order to fundamentally solve the problems of the environment, macro-views and development infrastructure should be designed in accordance with environmental protection laws, and any policy-making and planning of the future economic, social and cultural development of the country should be based on the protection of environment, natural resources and wise productivity of these God-given resources. It is obvious that achieving this goal is possible with the attitude of creating balance and proportion between environmental laws and sustainable development.

In the study conducted by Teymouri (2022), by examining the specifications of 4 inter-basin water transfer projects at the international level, in order to increase awareness about the environmental, economic, and social effects of these projects. The results showed that inter-basin water transfer schemes directly affect the management of the source and destination basin and although in the short term will reduce water shortage problems in the destination basin, in the long term It weakens the environmental, economic, and social conditions in one of the two basins.

An important part of Iran's mines, such as iron ore mines and copper mines, are located in the southeast of the country, especially in the provinces of Hormozgan, Kerman and Yazd. At present, large development projects in the field of mining industries such as production and

processing of iron ore, concentrate, pellets, steelmaking and copper mining and processing are underway. Gol Gohar Iron and Steel Mining and Industrial Company, National Copper Company of Iran and Chadormello Industrial Mining Company to supply the water shortage of the existing facilities as well as to supply the development projects in the region, the sea water desalination project in the west of Bandar Abbas and the transfer of the mentioned water. They have put consumption places on their agenda. In this regard, the Persian Gulf Water Supply and Transfer Company has been established, which has assumed the responsibility of managing and directing this large project. In the first phase of this project, 110 million cubic meters of sea water per year are desalinated and along a route of about 960 km (including branching of Chadormello iron mine) is transferred to consumption places (Gol Gohar Mining Industrial Complex, Sarcheshme Copper Complex, Yazd Steel Industries, Chadormello Mining Industrial Complex). The plan to transfer Persian Gulf water to the industries in the southeast of the country is designed and implemented in the form of three main parts, which will be briefly described below.

In this regard, it is necessary to identify the existing problems and determine the conflicts of activities harmful to the region's environment in each of the selected routes before taking any executive action. The use of environmental laws and regulations in explaining the protection of the implementation area of the Persian Gulf water transfer plan to industries in the southeast of the country is essential in order to meet economic, social and environmental goals. In this regard, ensuring the proper management of the environment is a step towards achieving sustainable development and improving the quality of life at the local and international levels.

- Case study: water pipe line from Persian golf to south west industrials company

Iran, as one of the large countries in the Middle East and the Persian Gulf region, is facing a serious water shortage, especially in the southern and eastern areas of the country.

On the other hand, having approximately 68 types of (non-oil) minerals, including about 37 billion tons of previously discovered reserves and about 58 billion tons of potential reserves, Iran is one of the world's fifteen great mining powers and is also considered as one of the mineral-rich countries.

A great bulk of Iran's mines, such as iron and copper ore mines, are located in south-east of the country, most importantly in Hormozgan, Kerman and Yazd Provinces. For instance, Gol-Gohar Sirjan Iron Ore Mine, with the geological storage of about 1020 million tons, is the

largest iron ore mine discovered in the Middle East, and Sarcheshmeh Copper Mine is known as one of the largest copper mines in the region.

Due to the region's extremely high potential, large development projects, concerning mining industries such as production and processing of iron ore, concentration, pelletizing, steeling and extraction and processing of copper, are currently in progress.

The high potential of the country's south-eastern region in terms of mines and mining industries, on one hand, and the implementation of massive development projects for mining in the region and consequently processing of the extracted products, on the other hand, have given prominence to this region in terms of development of non-oil economy.

Development and utilization of the aforementioned projects require huge water resources. Local water resources are not capable of supplying this amount of water; thus, the sea water is going to be considered as on the only reliable water resources.

Based on this approach, Gol-Gohar Mining and Industrial Complex, National Iranian Copper Industries Co. and Chadormalu Mining & Industrial Co. have put supplying, transmission and distribution of approximately 110 million cubic meters of water annually on their agenda so as to supply water for the current facilities and the projects in progress. In this regard, the Persian Gulf Water Supply and Transmission Co (WASCO) has been established and has taken on the responsibility of management and operation of this great project. At the first phase of this project, 110 million cubic meters of the sea water per year are desalinated and transferring over a distance of about 950 kilometers to usage places (i.e. Gol-Gohar Mining and Industrial complex, Sarcheshmeh Copper Complex. and Chadormalu Mining & Industrial Complex).

- Objectives of the Project

The major goal of this project is to partially supply the current water requirements and development projects of the companies contributing in the project and the other consumers; which are displayed in the following table.

Table (2-1): The Amount of Water Required by Each Consumer

Consumers	The Amount Of Water Required (Million Cubic Meters Per Year)
Gol-Gohar Mining & Industrial Co.	45
Sarcheshmeh Copper Co.	30
Chadormalu Mining & Industrial Co.	20
Other Usage (Drinking Water)	15
Total	110

- Location and Area of the Project

The project is located between Hormozgan, Kerman and Yazd Provinces.

The project starts from in the desalination plants in the western part of Bandar Abbas City, (adjacent to the shipyard) the of pipe line, passes through the mountain part of Finn and Haji-Abad cities and enters the plain and moves toward Gol-Gohar Mining Co. which is located 50 kilometers south-west of Sirjan city then the pipe line moved toward Sarcheshmeh Copper Mines located south-west of Rafsanjan City in Kerman Province.

Subsequently, from sarcheshme transmission line, moves toward Yazd Province until it reaches Yazd steel industrial zone in north-west of Yazd City. One offshoot of the transmission line is also split towards Chadormalu Mines. In figure (2-1), the transmission line route and the project location are illustrated.

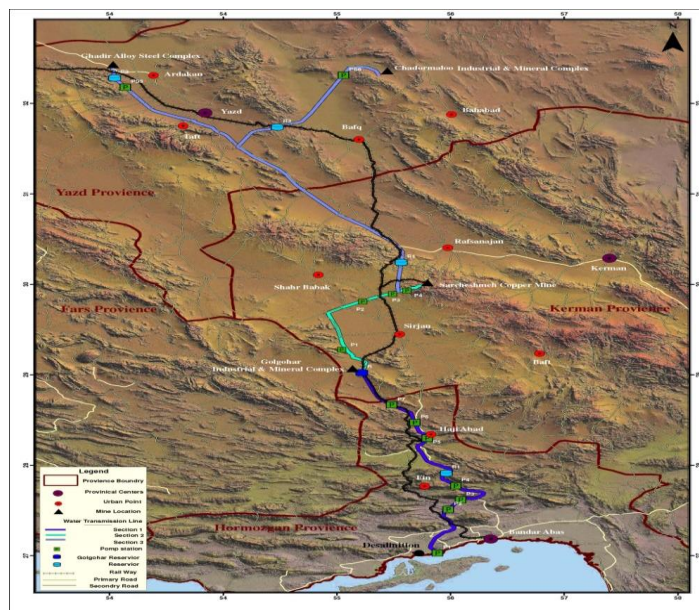


Fig. (1): Approximate Area of the Project and the Initial Pipeline Route

- Different parts of the Project

As observed in Fig. (2-1), the current project includes three main parts. The first part is the distance between Bandar Abbas Desalination Plant and the area of Sirjan Gol-Gohar Mining Co. The second part is the distance between Gol-Gohar Co. and Sarcheshmeh Copper Co., and the third part is the distance between Sarcheshmeh Copper Co. and Ardakan Steel Industry in the region of Yazd and also Chadormalu Mining Industries.

4-1- Features of the Water Transmission pipeline (part1)

In the first part, water is transmitted from Bandar Abbas Desalination Plants and is pumped, by 1600 mm nominal diameter steel water transmission pipe, toward Sirjan Gol-Gohar Mine. This line includes seven pumping stations with the total consuming power of about 145 MW and the total pumping height of about 2400-meter water column.

The length of transmission line of the first part will be approximately 300 kilometers at a rate of 4.0 cubic meters per second from the zero datum of the sea level (Bandar Abbas Desalination plant) to 1800 meters sea level in Gol-Gohar region.

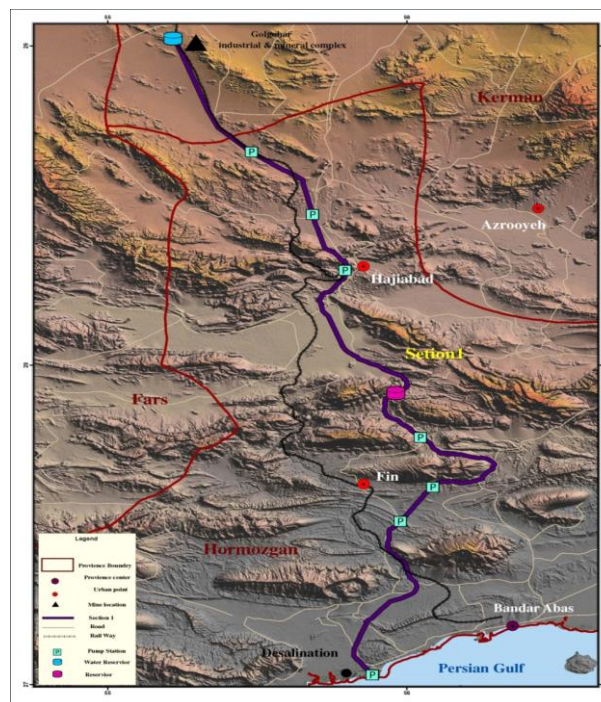


Fig. (2): Water Transmission Line in the First Part

- Features of the Water Transmission Pipeline (part 3)

In the third part, water is transmitted from the reservoir that will be constructed in the area of Sarcheshmeh Copper Mine, by 800 and 1100 mm nominal diameter water transmission line, toward the Steel Industries of Yazd Province and Chadormalu Mining Industries. This line includes a gravity line (main line) and a pumping line sub ordinate line with two pumping stations. The total consuming power is about 3 MW and the total pumping height is 400 meters.

The length transmission line of the third part will be approximately 510 km main line 360 km and sub ordinate line 150 km and transfer water at a rate of 1.5 cubic meters per second to the places of usage.

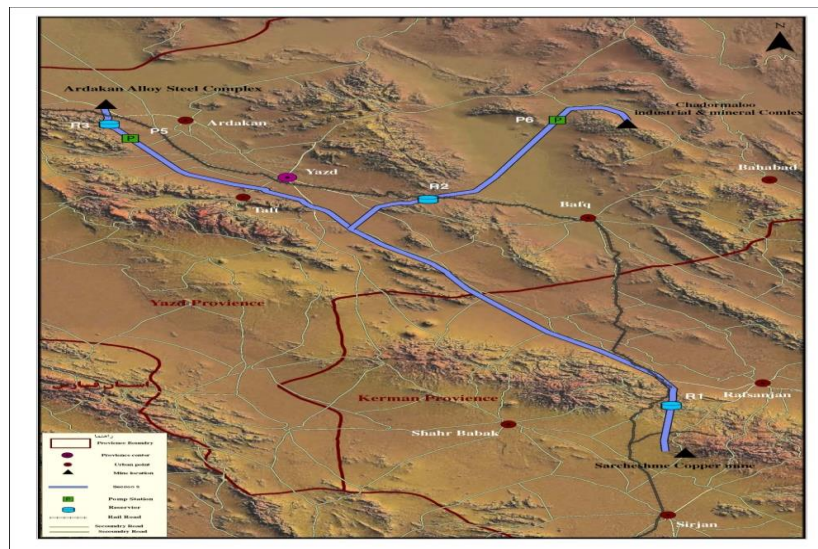


Figure (3): Water Transmission Line in the Third Part

3- presentation of results

Based on this, the aim of the current research is to predict the environmental effects of the water transmission line project on the environment.

Environmental effects of water transmission line design on physical, natural and social resources

- Physical environment

- Effect on air quality:

As a result of the operation of heavy machinery related to the water transmission line construction project, which mainly uses fossil fuels, such as machines related to earthmoving and earthmoving, blasting, construction and restoration of the access road to the project area, which has special topographical conditions. Also, the traffic load of the roads leading to the study area and the increase of airborne particles are likely. During the operation period, there is no air pollution caused by the project.

- **Noise Pollution:**

During the construction of the water transmission line, in the activities related to the project, such as earthmoving operations, machines such as bulldozers, loaders, trucks are used, and in earthworks, the usual equipment is used, and if the mentioned machines are worn out, the noise level exceeds the recommended standards. It seems that the increase in the amount of noise caused by the activities does not have a serious effect on the sound quality in the residential areas due to the distance of the residential places from the water transmission line. Also, during operation, the presence of pumping stations also causes noise pollution, but if the pumping equipment is enclosed in the shed, it reduces the noise pollution to an acceptable level. If there is not much reduction, insulating the sheds will greatly reduce the possibility of noise pollution. Therefore, there will be a negative effect on the sound quality.

- **Effect on soil resources:**

The destructive power of soil depends on natural or unnatural factors caused by human activities on it. This phenomenon regarding water transmission lines can linearly cause the destruction of a layer of surface soil that is important for pastures. In fact, excavation and soil destruction causes a kind of erosion that will remain in the form of a strip without vegetation on the land surface of the region for many years. Therefore, the implementation of the plan according to the usual activities during the execution time, such as excavation of the road, creation of access road, movement of machines and unloading or loading of pipes and machines will be among the cases of destruction of the soil structure during the execution. (Geological and Mineral Exploration Organization of Iran <http://www.gsi.ir>)

Also, in terms of the impact of project activities on soil pollution, operations such as construction, restoration of access roads, as well as excavation and embankment and installation of water transmission lines are carried out by heavy machinery and special devices. Meanwhile, the service, repairs and maintenance of these equipment's are the main

needs of these activities. In this way, replacing oil and oil filters, washing parts with petroleum substances, leaking petroleum substances such as diesel and gasoline are among the pollutants of the immediate study period. During the implementation of the project, there can be soil pollution, which emphasizes the need to observe the sanitary principles of collection and disposal, otherwise, in addition to visual pollution, the presence of waste materials such as: food waste, glass, plastic and paper and Cardboard and... Also cause soil pollution.

- **Effect on the shape of the earth:**

Activities such as earthmoving and canal digging lead to changes in the morphology and shape of the land. One of the aspects of the water transmission line design is the allocation of land for the passage of pipelines and its sanctum, as well as soil removal. Of course, after the soil removal and piping operations, the canal is filled with the harvested soil and the land returns to its original state. Therefore, due to the length of the route, the effect of project activities in changing the morphology and shape of the land is negative.

- **Effect on water resources:**

According to the location of the second water transmission line to the industries in the south-east of the country, this route will not intersect with the main rivers in the area of the said transmission line.

The presence of machines and devices in the place of pipes can cause chemical and oily substances from these devices to enter the water and cause pollution. In the exploitation phase, water pollution will be very small. It will be possible only from the aspect of maintaining fuel tanks in the place of pumping stations.

- Natural environment

Environmental effects of the water transmission line plan on vegetation: Considering that the water transmission options pass through low-density vegetation and a small part of semi-dense land, the vegetation will be slightly affected by the destructive effects of the implementation phase. Of course, due to the fact that the transmission lines are eventually covered with soil, the vegetation can be restored over time and compensate for the destruction (Meteorological Reports, 2013).

Environmental effects of the plan on animal life: Another important and affected part of the construction is the animal life part. Undoubtedly, the construction and operation of transmission lines such as water transmission lines will have a significant role on the fauna of

the region, including mammals, birds, amphibians, reptiles, etc. The construction of the access road and the ease of passing through it may facilitate the conditions of hunting and hunting as well as access to the wildlife habitats in the surrounding areas, the continuation of which will cause negative effects on the wildlife, especially the mammals and birds of the region. became During the operation period, due to the completion of the project and the covering of the pipes with soil, people will still enter the area in the form of inspection and maintenance teams, or in the event of unexpected incidents, in which case there is a possibility of threats and It will result in the destruction of animal habitats. The negative effects of these activities in the region are gradually decreasing.

The environmental effects of the plan on the areas under the management of the Environmental Protection Organization: In the plan to transfer water from the Persian Gulf to the industries in the south-east of the country, according to the map of the status of the protected areas obtained from the Environmental Protection Organization of the country, the closest areas under management The Environmental Protection Agency have been investigated along the route of the proposed transmission line.

In the operation phase, due to the fact that the pipes will be covered with soil and the transmission line will be buried under the soil, and that the pumping stations will be surrounded by sheds and their isolation, the number of adverse effects on the protected area will be low. It will be acceptable.

- Social

The effect of the plan on employment generation and income level: The most important effect of the plan is to increase the welfare of the surrounding villages, as a result of increasing job opportunities and earning a secure income, although in the short term for the villages and towns in the area. In the operation phase, due to the need for periodic visits and monitoring, the operation of pumping stations and sometimes maintenance operations, there will be a need for manpower, and the supply of these forces from local people in the project area will have direct effects. will have on the social environment.

Predicting the effect of the plan on migration: During the implementation period, the most important effect of the plan on the phenomenon of migration in villages affected by the reduction of the rate of migration caused by youth unemployment is due to the creation of job opportunities and earning new and reliable income. Therefore, the use of appropriate human

resources in carrying out project implementation activities can have positive effects on reducing the migration process of people from villages to cities, and in the exploitation phase, some positive effects are expected. (Study Report) Environment, Part I, 2013).

The effect of the plan on land use: In a part of the areas of the transmission line, the agricultural lands will be taken over by irrigation. Therefore, the implementation of the project has negative effects on agricultural use.

Effect on public participation and social acceptability of the plan: One of the success factors in the sustainability of development plans is the level of acceptance of these plans by the people and local communities and their participation in the implementation and exploitation of the plan. Since the project of transferring water from the Persian Gulf is carried out with the main goal of supplying water to industries in the southeast of the country, it seems that in the short term it is not possible to supply drinking water to the residential areas within the scope of the project. However, if local labor force is used in the implementation and exploitation phase and the project is welcomed by the human communities related to the project, this project can have positive effects on the social, economic and cultural environment of the project.

4- discussion

The activities of the project in the preparation and construction phase and the operation phase lead to the creation of several environmental aspects that can somehow affect the environment of the region. As mentioned, in this section, the methods of reducing the negative effects of the project are discussed briefly.

1. Methods of reducing negative effects on the environment in the construction phase

Air and noise pollution caused by construction activities can be reduced in the following ways:

- Speeding up the completion of the entire execution operation, especially earthworks.
- Using healthy and suitable machines with minimal air and noise pollution.
- Spraying on surfaces and dirt roads and access roads.
- Not using motor vehicles that generate unconventional noise pollution.

- Using the delayed method in the blasting operation and applying type, quantity, time and place restrictions to reduce noise pollution and announcing and warning the villagers around the place in advance of the blasting time.
- Taking the necessary measures (appropriate technology and indoor environments for facilities).
- By using the appropriate pattern of consumption of materials, including chemical and petroleum materials, etc., preventing the dispersion of waste and construction debris, proper burial of construction debris with the coordination of the local environmental department, pollution and environmental destruction caused by production waste can be avoided. prevented

In order to eliminate or reduce the effects that lead to surface and underground water pollution, following the following can be effective:

- Non-use of toxic, dangerous and unconventional waste materials during construction.

2. Methods of reducing negative effects on the environment in the exploitation phase

- Reducing the adverse effects of water and land brace systems
- Monitoring the lack of depots and landfills of garbage and solid waste in existing natural habitats and disposal in the appropriate place in the region with the coordination of the environmental department of the cities.
- Monitoring the non-discharge of sewage and human and industrial effluents into the channels in the area.
 - Reducing adverse effects on the areas under the management of the Environmental Protection Organization
- Supervision and inspection of all project activities during the operation phase of the plan to ensure that no pollution is created in these areas
- Monitoring the non-depositing of solid waste materials produced by personnel in these areas.
- Traffic of vehicles and personnel as much as possible from existing access roads.
- Monitoring compliance with the legal privacy of the place of implementation of the project.

3. The frequency and repetition of patrols and inspections to control destructive development activities within the limits of the water transmission pipeline.

One of the most effective ways to control adverse effects in pipelines is to conduct planned patrols and inspections of the route. The signs of damage in the transmission line will lead to leakage and broken pipes with water leakage and wastage, which is quite obvious evidence. The route operator and inspector must identify and report the damage caused to the route and pay attention to potential damaging factors even during the inspection. Among these cases, it is possible to:

- Observing earthmoving and trenching equipment and machinery on site.
- New buildings.
- Roads under construction or constructed or other destructive activities mentioned.

Patrolling can be done by using a car, but the frequency and number of patrols and inspections should be such that it is possible to assess the risk and identify unwanted activities. In case it is determined during the inspection that the unwanted construction activity is being carried out in the area of the water transmission line by the contractors of other projects, the relevant officials of the pipelines should be informed so that they, through the project manager, will be aware of the sensitivity of the pipeline route and control the contractor's operations, take action.

The pipeline along the entire route should be visited regularly and monthly, and the state of expansion and approach of the waterways to the pipeline should be specified in the relevant forms and the reports should be kept for at least 3 years.

If the faucets, connections, or pipes are leaking, action should be taken to replace and fix the defect, and the results of the actions and corrections should be specified in the monitoring and monitoring reports and forms after confirmation.

Signs of the water transmission line should be installed on high-traffic roads and in places close to agricultural areas or residential centers to avoid mechanized agricultural operations and deep plowing or construction.

The sensitive monitoring points along the pipeline route are:

- Residential and high traffic areas.

- Intersection points of the water transmission line with the main and secondary roads.
- Intersection with waterways and canals.
- Installation location of pumping stations.

4. Continuous control of flow in the transmission line through electronic equipment and possible detection of failure and leakage

The design of the transmission line should be carried out in such a way that it is possible to continuously control the flow in the pipeline through electronic equipment and to identify possible leaks, while visual inspection of the equipment and the pipeline is carried out by the responsible people in the form of monitoring and inspection forms. . All the operations of the project should be managed and directed through the control system installed in the control room. The control system provides the following three forms:

- Automatic steering.
- Remote manual control (from the control room).
- Manual driving of the area.

The design should be done in such a way that even in case of failure of the central control system, manual control of the area is possible. The control system is selected in such a way that it has a safe and reliable design and has the highest reliability coefficient.

- **Environmental management program**

The project's environmental management program includes solutions that, on the one hand, reduce important and negative environmental effects and consequences, and on the other hand, increase the positive effects of the project during construction and operation. This management program, in addition to having the main axes and explaining related factors and limiting factors, identifying environmental costs, administrative needs and other executive and supervisory requirements, including the clarification of the public opinion program in environmental protection and education of employees, contractors and associations. It has local and public participation.

The success of the environmental management program depends on environmental education and the enlightenment of social thoughts. This issue will be implemented at the same time as the plan is implemented. Due to the importance of social issues and the need to observe environmental considerations, it is necessary to receive the necessary training for the working

people and some of the residents of the region in terms of literacy and the type of activity to enlighten the public opinion. It is recommended to implement environmental protection and improvement educational programs in order to enlighten and guide the thoughts of personnel and collective experts, technicians, and some local residents. The purpose of environmental education is to provide an environmental education program in reducing and controlling the factors of environmental destruction and pollution. The proposed plan will play a role. In the implementation of environmental education, it is necessary to identify the target groups. Project management, employees, excavating, earthmoving and embankment contractors, blasting operations, land clearing and improvement, and some local residents are among the target groups that clarifying their responsible role in environmental relations plays an essential role in reducing adverse environmental effects.

Environment resulting from construction and operation activities. Under normal conditions, one percent of the total credits of the environmental management program is expected to cover the costs of the public opinion enlightenment program and related trainings.

Attracting people's participation is one of the important components in the correct progress of project activities during construction and operation and in order to achieve the goals of the environmental management program of this project. The purpose of public participation is how to use the opinions and views of local communities and interest groups and be influenced by and accept the plan. The proposed options for public participation include the participation of villagers within the scope of the plan and the participation of other classes. The most important requirements in this regard are identifying the required groups, including people's councils, people's organizations, local elders, officials and residents, explaining the aspects needed to attract people's participation, continuing to attract people's participation in advancing the development goals by the plan implementer, informing and informing. Making the people aware of the implementation of the plan, providing the necessary information in the field of environmental studies, gaining the trust of the people of the region and explaining how to benefit them, justifying local trusted people such as village councils, and then with their help, making the people of the region familiar with the necessity of implementing the plan and its positive effects on their lives and their children. It should be noted that in normal circumstances, it is not possible to propose a specific figure to cover the costs of public participation. Because the correct understanding of public participation in advancing the plan is to attract the spiritual assistance of the people. But in order to create the necessary platform,

this work is expected to account for about one percent of the total costs of the environmental management program.

5- Conclusion

The rules, standards, regulations and local, national and international laws related to environmental issues are diverse and are used according to the requirements and conditions of the development plan and the environment of the region. It is obvious that in the absence of laws, regulations and the lack of executive levers and necessary management, the environmental sustainability of an area under the implementation of the plan is subject to change. This change is created through natural and artificial phenomena in various forms and on an unpredictable scale.

The high potential of the southeast region of the country in terms of mines and mineral industries, on the one hand, the implementation of very large development plans for the exploitation of mines in the region and, accordingly, the processing of extracted products, on the other hand, this region in terms of the development of the non-oil economy It is of special importance. The development and exploitation of the aforementioned projects require large water resources, which cannot be provided by local water resources. Therefore, the use of sea water as one of the sources of water supply is seriously discussed.

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