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Assessment of the Environmental Destructive Effects of Building Dams

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***Abstract*—**From the beginning of creation, human being has ever fought against the ecosystem by changes has made in environment. The most environmental changes on the nature have been done after starting the concentrated life in the same region. Dams are one of the most important buildings in water resources and transferring. These buildings have been made from old times without access to hydrological, hydraulically, hydro mechanical information. Dams have positive and negative effects on environment. Constructing a dam relatively causes equal ecological consequences. According to different criteria, environmental effects of dams can lead short term and long term damages. These effects may influence on the situation and treatment of meteorology, biology, culture, ancient works, etc and severely causes to change and complicate it. So considering importance of positive effects of dam construction, it is necessary to minimize negative environmental effects of dams to achieve a stable development. In this article the considered effects and their solutions in influencing on assessment of destructive environmental effects of dams construction have been surveyed and presented.

***Keywords*—**Dam, Environment, Water Resources, Assessment

I. Introduction

CONSIDERING vital role of water in all periods of human being's life and ever-increasing growth of population, water crises is predictable and it has made the experts by presenting plans and methods to control water to lessen its casualties and make it easily available for the public. For many years dams construction as an obstacle against water movement and saving it, flood water control and Energy production and . . . has been considered as one of the basic solutions. Moreover great dams are symbols of national pride, power, water and food supplier resource, flood water controller, deserts cultivator and a guarantee to national independence of every country.

However constructing great dams for their high expenses have many national benefits and social profits, but they have some losses that in some cases are irreparable [1]. Although the effects of water on human life and developing of civilization is known all over the world but in some cases the considered economic profits have not been achieved from projects of water resources operation and also necessary predictions to lessen environmental, economic and social damages have not been done accurately. Even some international organizations have done some studies to stop water supplying projects in developing countries. That's why in water resources management, cultural, social and economical development has been taken into consideration and environmental effects led by these studies have found ever- increasing importance [2]. Nowadays environmental problems like economical and technical problems are taken under consideration in studies for dams designing. In these field different types of dams including underground dams cause pollutions such as Nitrogenous pollution over underground waters [3]. Furthermore final approval of a project is depending on positive results of its environmental assessment.Researches show that one of the most important parameters on water resources is protected from different phenomenon. Typically, with construction much hydraulic structure without any planning might be possible to reduce water flow from the rivers into the sea. For instance, the Aral separated into two water bodies in the end of 1988 – beginning of 1989 - a Small Aral Sea in the north and a Large Aral Sea in the south. The Syr Darya flows into Small Aral Sea, and the Amu Darya into the Large Aral Sea. Between 1960 and January 2003, the level of the Small Aral fell by 13 meters and the Large Aral by 23 meters. A channel (river) has intermittently connected the two lakes, with the flow from the Small Sea to the Large. The area of both seas taken together diminished by 75 % and the volume by 90%. Salinity in the small sea is estimated to have doubled whereas in the western part of the large sea it has increased by more than 6 fold. The two lakes have evolved in different ways. The Small Aral Sea, located in the North, receives run-off of the Syr Darya River and began to overfill due to positive water balance. The surface area of this lake is small, and evaporation from its surface is less than inflows from the Syr Darya, atmospheric precipitation and ground waters. As for the Large Aral Sea in the south, its water balance is negative, and evaporation from its huge surface is still higher than the small inputs of the Amu Darya River, atmospheric precipitation and ground waters [4] and [5]. These differences in the hydrological regimes of the two new lakes have led to stabilization of the Small Aral Sea level and the continued desiccation and salinization of the Large Aral Sea [5].

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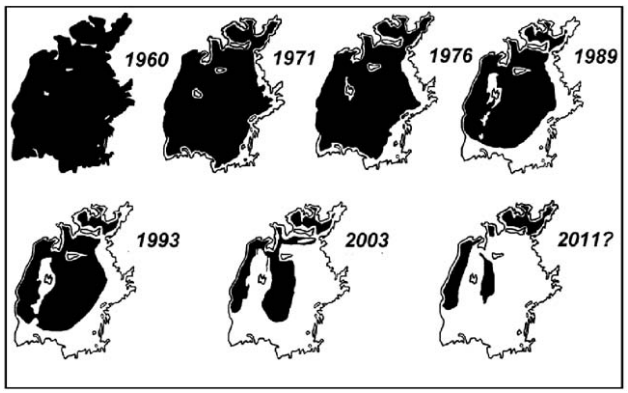

Fig. 1 The changing Aral Sea [5]

II. Definition of Environmental Assessment

It consists process of survey and formal studies to predict the effects of activities and functions of a project on environment, humans' health and social convenience and or in other words recognition and systemic assessment of project results, plans and designs on physical, chemical, biological, cultural and economical, social parts of environment. So assessment of environmental effects as a tool for planning, clarifies positive and negative effects of a project over the environment.

III. Environmental Effects of Dams

Establishment of a large dam with a high saving capacity can have multilateral and remarkable effects. For instance we can name physical, biological, social, economic, political and ecological effects.

Generally environment impression on dam's lake and bilateral effect of this building and its lake on the region can be surveyed in the figure of "negative and destructive environmental effects of dams" [1] Dams ecological consequences depends on the place of their location. They environmental effects can be classified according to different short term and long term criteria, the region of dam construction, bad and beneficial social and non- social effects. However there are more classifications as well. Generally according to directions of International Committee of large dams, dam environmental studies should be done in the categories that include chemical and physical effects, biological effects, hygienic effects, social and economic effects. Of course in most cases environmental effects are surveyed and assessed in two periods of constructing and operation respectively. In the following we introduce the destructive effects:

A. Physical and Chemical Effects of Dams

Physical and chemical effects in dams are explained as follows [1] and [2]:

- Constructing dams as an obstacle against movement and crossing floating objects in the course of rivers.
- Sedimentation of dregs materials in reservoir and lake of the dam that leads to obstructing the gates and outlets. Besides change in natural balance of transferring dregs that intensifies river erosion in lower part of the dam.
- The effect of exit of muddy water containing dregs materials over the lower part regions and regional environment.
- Occurring to much water floods resulting from releasing overflows (spillways) water and drain cocks causes main physical, chemical and biological changes in lower parts of the dams.
- The effect on changes of underground water level.
- Land sliding :at the result of reaction between lake water level and getting wet of the region and different laminated structures beside the reservoir, land sliding happens that its effects lead to lessen of the lake capacity and making high waves and dam overflowing and or destroying it.
- Forming inductive earthquakes: because of the effects that water charge has on the lake floor it may cause inductive earthquakes.
- To salt agricultural lands for running up the underground water levels and draining of lands as a result of surface irrigation [6].

B. Biological Effects of Dams

Biological effects of dams can be suggested as follows [1] and [2]:

- Decrease in food materials condensation at lower part of the dam and its effects on vegetable and brutal community in that region.
- Impact of saving water in shallow reservoir in growth of planktons.
- Birds and animal migration and change in plants growth and destruction of some species.
- Transformation in the lake thermo lamination for drinking hydro power utilizations, etc.
- With change in the quantity of carrying sediments, the places for fish to spawn are confined.
- Excavation operation in rivers bed leads to destroy fishes spawns in sandy beds.
- Following the reservoir formation, water temperature and oxygen and salt distribution may be changed and will produce new species [7].
- As dams act like a barrier, natural routes of animal movements are blocked and they stop upper hand fishes to move for spawning and nutrition, so the fishes population are lessened remarkably [8].
- It is possible to release toxic materials such as pest-killers, toxic metals, etc and their effect on food-chain and decay of sensitive animals.
- River biological life both in reservoirs and in dam's lower part is changed rapidly. Whereas water level is changed repeatedly, some species begin to live under the water, these regions may be changed to marshy

lands or sandy floors depending the soil structure [2] and [9].

- Connection between water, soil, food materials which are settled after floods and uprisings, changes in lower part of dams during the time. These forced transformations happen to plants, animals and agricultural methods of society in the region, that their influence is spread and predictable by kilometers [2].

C. Health Effects of Dams

We can call the hygienic effects of dams in this manner [1]:

- Dams' lake can be source of many contagious diseases such as malaria and blood diseases, this event in some countries including African countries has caused many damages.
- In shallow lakes, it provides an appropriate bed for insects to shed seeds.
- Considering that refilling with water is done at watery season, so less amount of water is transferred to the river and lower part of dam. Considering the stable capacity of wastewater and other entering contaminators in lower parts we expect the added amount of pollution in lower part. Also in dry period the condensation of surface waters contaminators in lower parts increases so that this matter intensifies in lower parts by taking much water [10].

D. Economic and Social Effects of Dams

The economic and social destructive effects of dam buildings can be said as following [1] and [11].

- Villages and community in the area of dam lake are drowned, it leads to immigration and increase in cities population and arising false jobs.
- Destroying the roads and power transferring lines as a result of crossing among the lakes, no access to some parts of dam area, old canals, leak stoppers, etc are among the losses of big dams construction.
- Destroying agricultural lands to provide dam constructing materials or drowning them causes unemployment of so many people.
- Historical and ancient regions and places with special and beautiful topography which are found rarely, will be disappeared by going under water.

E. The Effect of Dams on Hydraulic System

The most important hydraulic effect is changing the basin of the river from a live bed to a still reservoir. Therefore lower part goes under instant changes in a way that with saving water in dam reservoir, lower hand or some part of it becomes dried. During this time hydraulic balance is disordered, irreversible destructions, ruining or sudden structure mutation in water ecosystem is seen. Decay of dead animals and plants in water stream is increased, so water stream of upper hand becomes tainted. Without presence of oxygen in deeper parts, color dullness for long time and usually will be along with the decay smell from hydrogen sulfur discharging. However after this phase, for the river there is possibility to form a new ecosystem but in this region, new balance for soiled ecosystem and even marine environment to which the river joins, has no chance to return to former condition [2].

F. Impact on Sound Pollution

During constructing phase with coming the machineries and equipments of building the dam, sound level is intensified in the region severely. Also produced sound by relevant equipments and explosions done within dam building causes to disturb privacy in the region and has undesirable effects over wild life in the region of constructing operation. Leaving the nest, migrating to adjacent regions, probability of abortion in mammalian and laying eggs in birds are among the effects and sound pollution consequences from project activities in the constructing phase [10].

G. The Effect of Dams on Climate System

Changes in humidity percentage, temperature and air movement because of the great volume of stagnant water will change the climate related to the region of topography. Moreover graded changes of climate are perceived. As an example by building the "Kalghan dam" in the cold region of Iran, great volume of water will be saved behind the dam which will have some effects on weather and climate of the region. Among these changes we can name increase in absorbing solar energy in the region, thermo interchange between dam lake water and adjacent atmosphere and changes in amount of vaporization and fog by increase in vaporization level amount of steaming will grow. Although these changes may not be so harmful for humans' health, but they are remarkable for many plants and animals and have secondary effects on humans [2]. Moreover, one of the most significant factors for air pollution has been to move diesel and petrol cars in during of "Kalghan dam" constructions. These cars was spread a lot of smog.

One of the other bad effects of dams is spreading greenhouse gases from reservoir because of the spoiling and decay of plant covering and carbon stream from the reservoir [6].

H. The Effect of Dams on Marine Species Ecosystem

In constructing phase, increase of erosion and sedimentation in lower part of dam site will happen so by growth in water particles and their sediment causes to eliminate some species of marine environments and confuses ecologic balance of these regions [10].

At the beginning, decomposing of living creatures causes to increase food materials in the water for a short period, so water O2 taking (BOD) is rising up and an anaerobic decomposing environment is formed by assistance of still layers in the depths of reservoir that this creates a dark and noisome smell in the lake, so a high increase in phytoplankton are perceived [2].

Besides the plants which cover water surface in the form of a broad layer in dark green color, some big vegetable species

(macro flora) grow on water surface. This can be dangerous either for the lake life or for people fishing and sailing and even for dam's valves and turbine fans. Sometimes these macro floras act as a disease transmitter, meanwhile increase in water plants results to increase in vaporization and unnatural transpiration [2].

Dams are some barriers to fishes movement from upper hands of the river toward its lower part. Therefore existence of dam means death of species of fishes that spend a part of their life in springs and or in water uprisings and spend another part of it in the crossing of rivers and seas together. Considering that some marine fishes move toward fresh waters and lakes to spawn and then come back to the sea with young fishes, existence of dam halts this movement and interferes the cycle and leads to decline these fishes. Sometimes for this, siding crossing streams are made [2] and [7].

I. The Effect of Dams on Human Being Life

Although dams are counted as an important symbol of progress and development, but they are not accepted easily by the people whose agricultural farms and houses will be drowned. For instance when lake "Volta" was built in Ghana in 1969, however a much more better place was provided for 80000 residents in the region, but after a while 100000 people came back rebuilt their houses on the lake beach with no plan and outline. Such unsuccessful experiences that come from improper sociology can be dangerous for resources and region bio system [2].

So maybe unwanted damages of dams will not consider much for their benefits in the future, but beside these huge engineering structures this matter must be mentioned that we can not just change a part of ecosystem, because all chains are connected in the same ecosystem. Even if only one part of this chain is separated, it will ruin all system. So in planning phase all environmental details should be considered and before any irretrievable damage happens, needed preventions should be done [2].

In spite of remarkable social and environmental profits of dams, the effort to lessen their negative effects on environment as much as possible is very important. The mentioned effects and their solutions are considered in figuring out the meanings of environmental assessment.

IV. A General Glance to Some Environmental Problems of Dams in Iran

Environmental problems are appeared in different phases like in planning, constructing or at the time of utilizing the country's dams. Among these huge dams built in Iran we can suggest to dams "Dezz, Abbaaspour, Doroud, Jiroft, Minaab and Pishin." In these dams the matter of sedimentation, water quality, lack of social, economical and cultural considerations regarding the method of utilizing the dam, saltiness of lands, water casualties, lands drainage, people movement, lack of agricultural growth and development and mismanagement at proper utilizing are perceived. While if environmental considerations were observed in planning and basic programming fully and expanded, constructing and developing plans of such huge and high expense establishments, would have the least environmental damages in its influenced regions [12].

Surveying the executive records of establishing projects in Iran clears that like many other developing countries, importance and value of natural resources and environment has been disregarded from decision makers' attention and many of them have been planned and utilized with no attention to environmental considerations. The result and consequences of such measures has been appearing different pollutions and destroying and damages to the environment resources in the country [1]. Studying amount of entering sediments to the dams such as "Minaab dam" shows that estimating sediment in some dams are less than real volume that is a factor to lessen the profitable life of dams.

In dams built in south of Iran for the low height of the region from the sea level, much amount of vaporization from lake level relatively, importing organic materials, rural wastewaters, chemical composts and entering surface streams with value of high electrical conducting, high salt, thermo laminating in dam lake is possible which decrease quality of the lake water. However some of country's dams have lower after bay that we can exit improper waters of it with an appropriate planning. But in some dams because of its special situation, refilling water is done in surface that it does not let to utilize water with proper quality. This causes to noisome smell and low standard of water and for the reason that cleansing bad smell from water is needed so utilizing expenses will go up. Also entering the rural wastewaters and organic and forged composts to all these dams is a problem making matter.

Also in many dams of Iran, river in the lower part of the dam is dried in some seasons so flood releasing happens only in great water uprisings and misty seasons of the year. No attention to lower part of dams, causes illegal occupation of floodwater plain of the river and with exceeding to the rivers bound in the form of improper removing materials, results to morphological changes in the river that causes to many losses of life and property to lower part by releasing destructive water floods [12].

V. Conclusion

Considering the expanding process of technology and human's more ability to overpower the nature, unfortunately we are witness of destroying a part of this Divine gifted by our own hands every day. As we mentioned so many times, in spite many profits of dams constructing, disregarding their harmful effects on environment and at human's life finally in long term, maybe it is better we think more about the alternative methods to halt water and control floodwater. In some countries by using outside of bed dams or using the low height dams and barriers in some extent they have overcame the use of tall dams with huge reservoirs that have more effects on nature normally and decreased the negative effects

of these huge structures. Meanwhile with taking serious the results of environmental assessment and using them in practice we can lessen some part of these destructive effects.

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