

Research Article

Evaluating the strategies of dams environmental management

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ABSTRACT

Nowadays in some world countries, we can see the inappropriate environmental signs and effects of water projects. The bad consequences of such projects have been appeared in various fields that ecologic destruction and lack of development realization which are final results of such these water projects can be mentioned. The goal of this program is generally proposing appropriate strategies with reasonable price in order to reduce destructive effects derived from building and exploiting dam on area's environment and comparing it with standard and ideal conditions. The goal of performing environmental management is generally accomplishing effective actions in order to decrease destructive effects, monitoring program, control and environmental education. Meanwhile proposing an executive program for each one of these actions in this article, the conditions for performing environmental management program will be facilitated through identifying responsible organizations and estimating executive and organizational needs.

Key words: environmental management, dam, sustainable development, ecologic, dams environmental effects

1- INTRODUCTION

As we know, among divine blessings, water has a crucial position and this is because most of researchers have searched the initial source of survival in water. A short sight in the situation of available and usable waters and other living creatures which need sweet water to survive, clarifies the depth of serious and cautious behavior toward water. The whole water existence in our planet that we know it as hydrosphere is about 1/360/000 cubic kilometers which is near 97.2 percent of this water is salty one and only 2.7 percent is sweet water. Out of this value 2.14 percent includes inaccessible arctic ice and what we have is estimated about 12000 cubic kilometers that out of this one a small percentage can be taken. The amount of

groundwater is a little more than 8000 cubic kilometers that only 3 out of 1000 of that are naturally recycled. The water falling on the earth's surface is 450/000 cubic kilometers per year that due to evaporation get balanced and out of this value only 110000 cubic kilometers rain on continents.

According to these statistics, critical condition of water on earth can be better perceived that in order to prevent its wasting, it should be stored in some places and also take care to prevent any contamination. Here we can understand the importance of dam engineering knowledge and use this method as the best one in inhibition of fresh water for nearly seven billion humans and countless living beings who have a right to life.

Of course above importance shouldn't make us neglect environmental evaluation of dam projects not to sacrifice environment for excessive development in order to achieve sustainable development.

The thing which is required real analysis in an environmental evaluation report is identifying, measuring and summing up effects. For identifying, the effects of environment should be completely described before the activity. These conditions are unique for each place depending on geographical situation. For example a project might not have any effect on environmental parameters or be less important but this very project affect environmental parameters a lot in another place in terms of geography. For measuring the effects, all of them should be converted to quantitative units. The last step requires summing up effects for evaluating whole project's effects.

2- Defining sustainable development

The UN Food and Agriculture Organization (FAO) defines sustainable development in this way: sustainable development is managing and main maintaining natural resource and directing technology and traditions to a way which human needs will be assured to be met for ever, present and future. Ecologic sustainable development is considered the best and most ideal type of development and includes: a development that has improved the general quality of life now and future so that it mains necessary ecologic processes for survival.

Based on this developmental activities should be developed based on social needs. These activities include constructional and biological methods, promoting modern methods, trying for public participation, education and advertisement. Then opponent items should be noticed in terms of economic and finally ecologic processes should be investigated. It is natural where these processes are somehow ignored or damaged, sustainable development cannot be achieved. In

ecologic processes section, natural resources have to be considered. Soil and water are the most important and available natural resources in ecologic processes. Sustainable development can be only realized in common chapter of three social, economic and ecologic components and of course increasing need of human being to more food and also fresh water in future and environmental regress which threaten these needs increasingly, the subject of sustainability in resources such as soil and water has been increasingly important,so now sustainable development seems to be nonsense without considering the situation of soil and water.

3- The need for environmental assessment before the project

Each kind of development with any degrees of quantity or quality will have particular environmental effects. Human manipulation in natural environment means creating changes in initial shape of environment. The durability of human action in changing natural resources ultimately can ruin existing balance in environment and have a chain of unwanted or unpredicted consequences as nowadays human communities have faced this problem.

It is obvious that since the idea of establishing a project is created till its exploitation, difficult and long way should be passed. Considering environmental problems in all executive levels of a project is the most important duty of environmental Protection Agency in different countries.

This monitoring includes designing levels, project performing levels and after exploiting that project because preventing the establishment of a factory or dam whose location is considered inappropriate for example that based on type of activity cause environment pollution that is easier and more economic than changing place or changing its technology after establishing them so using valuable experiences of other nations which have been obtained expensively can be

suitable for other developing countries and prevent repeating those mistakes on the other parts of world. Therefore main principles that should be noticed in environmental evaluating of civil projects include:

- Appropriateness or inappropriateness of ecosystems to human activities or development projects
- Classification of ecosystems according to a variety of uses and applications
- Comparison between the yields obtained and the force should be spent for any required activity or application

It is natural that if interactional effects of environment and human performances are evaluated in form of developmental projects, potential power of environment and its capacity and effects that can have on performances can be cleared through initial identification. The degree of importance and the aspects of negative effects in conditions that environment power is not for relative acceptance of considered activities as well as effects which are exposed to activities in terms of economic and social can decrease through the function of technical technologies or traditional-scientific protecting methods. Human ecology mainly (a part of land which is considered as permanent place of residence and human activities) can only be maintained through using law and public awareness and meeting balance between ecologic and economic problems.

3-1 The levels of environmental evaluating of dams

The hierarchy of an environmental assessment report of the dam is according to below:

Nontechnical summary which includes:

Type of activity, the reason of implementation, technical justification, economic, social, political, technical and spatial options, the time of beginning and the end, important environmental effects, the final choice of programs to prevent and control adverse effects, conclusions and project description.

Describing the current state of the environment: climate and the quality of air, water resources that include all current waters in dam's basin and also groundwater and its characteristics, area's ecology-tectonic and seismic, identifying and classifying soil in area, classifying ecosystems and their situation, can be mentioned in this case. Predicting environmental effects of items in different construction, exploitation and after each project levels:

Items evaluating that include: evaluating each one of items in construction and exploitation phases, unavoidable and non-compensable effects on resources and environment and finally choosing final item.

4- Dams and their effects on environment

4-1 the effects of dams on river's ecosystem life

All living organisms such as plants and animals have a particular tolerance range toward each limiting environmental factor. During exploiting dam, the speed of river water flow will usually change on that part and these changes affect environment till kilometers in dam upstream and downstream.

For example in upstream which dam river is formed, water flow speed decreases in great extent and this causes the accumulation of debris and silt in it that can badly affect the life of *Chamaesiphonfucus* or non-branching filamentous algae such as *Ulothrixzonata* and kill them and increase the destruction of other rings of ecosystem chain through one ring of ecosystem. For example animal species have usually adopted with specified speed of water flow so that specie will be vanished through water speed and changing zone and the other specie will be replaced with that which is more compatible with new situation. This subject is applied to Macrofites too. Fish are the most abundant aquatic in rivers that some of them swim against water flow for laying egg to take them to river upstream. After creating dam in a

river this moving path will be cut and this causes terminating rare species of fish and animal life in the river is destroyed. Fish termination causes animals and mammals which are feed by fish also face trouble of hunger and it can badly affect the life of these animals and their population will be reduced but there is a solution for the problem of fish immigration in rivers, it is creating series of fish freight elevators at dams and this solution can somehow solve above problems only under this condition that out designers valorize ecosystems.

4-2 dams and changes of river bed

Changing river beds is the other effect of dams on rivers. The water which is usually stored behind dams contains high values of silt and debris which are accumulated behind dams and the water which is going down the dam has no silt or debris and water high speed during colliding to river causes increasing river erosion. Sea level is the lowest level that rivers can damage the earth. Each change in level causes rivers to set their activities according to that. When a dam is built in the way of river, dam reservoir increases river level.

In dam upstream, river slope will decrease and causes decreasing in speed and carrying. As result river goes on its constructiveness and heightening its path through deposition. This process lasts till river slope get appropriate for carrying its load. In this position of new bed profile will be placed in higher scale than old one.

If a river is higher than basis level, its energy will be more and therefore dig this bed to make another balance with basis level, river changes its position in order to being coordinated with basis level and it causes setting bed profile and its balancing. A balanced river has a slope with determined features in its bed that can carry it; river doesn't do erosion and deposition all the time. This activity is only related to the time which it has not been reached to balance. When a river gets balanced becomes a self-set system and

each kind of change in river features causes, river to pass a trend to make the effects of these changes neutral.

About basis level decline, until the time which passes its bed, river has not been balanced but when river digging is finished, river gets balanced that this balance will leave a lot of expenses for environment, although considering seasons of low rainfall and flooding and also depletion of water during flood and dredging river of dam from deposits causes river erosion be more severe and plant and animal species which are adopting with environment get terminated and the other species will be replaced with them.

4-3 dams and seismic activities

From the other bad effects of dams, seismic activities can be mentioned that these earthquakes happens affected by water very heavy weight and imbalance in pressure in different classes. As the first reason for Bam earthquake which consider it as the main factor of earthquake was accumulated water behind Jiroft dam that later other reasons were also proposed through a lot of researches.

4-4 dams and promoting disease

In terms of biologic, it is also proved that in tropics area, dams and rivers have a lot of effects in people health. The most important ones are: promoting some diseases that their vectors had used stagnant water.

The effects of rivers in dam on biological sets are in two types; first changes that rivers and dams' construction give environment and make it shot down in terms of beneficiary for other activities. The other kind of changes depends on management and the way of administrating dams and rivers.

Performed biological trend in dams is sometimes with the main intention of constructing dam (providing power or drinkable and farm water). Fodder in water can close turbines or growing water algae make river water useless for domestic or industrial consumptions.

4-1-1 biological effects of artificial rivers

Downstream effects of water	Effects on water gathering place	What is affected
	Increasing the Schistosomiasis is due to scattered snail population that carrying increased disease which is transmitted by mosquitoes.	
Reducing the stimulus for migration of migrant fish to the upstream water, interference with fishing at downstream	Interfere with the passing of migrant fish, loss of river fish, and creation of appropriate conditions for fishing in lake.	Fishing
Interference with agricultural operations which is based on the principle of changing seasons	Agricultural land drowning	Agriculture
Changes in river behavior and untimely floods	Drowning areas where are important biologically. Interference in the habitats building of river estuaries because of drowning land, creation of new habitats for waterfowls	Biological protection

The other problem which is investigable related to rivers which enters dam is discharging domestic and industrial waste and sewage and waste water in agriculture, because of self-purification capacity of rivers in normal status and they can decrease their contamination gradually through moving by getting oxygen. Dams cause river speed to decrease to come to static behind dams and this causes the effect of self-purification decrease and by passing time through contaminator material behind dams cause contamination of organisms living in the river dam as well as soil pollution, soil contamination around the dams. Moreover

a) Direct

Negative environmental effects of construction operations	Proceedings to reduce the adverse effects
Water and air pollution due to construction operations and waste disposal	Air Pollution Control
Soil erosion	Proper placement of camps, buildings, waterways, waste disposal sites
Destruction of vegetation and health problems resulting from camps	Prevent of erosion Reclamation of lands
Improper placement of local people in nearby areas	Housing local people in appropriate areas, restriction in reduction and consumption of resources, providing adequate health services of infrastructure and creating job opportunities
Loss of land (agricultural, forest-pasture and wetlands) to create lake and reserves	Location dam in the right place to avoid reducing tank damage, reducing the size of the dam and reserves, protecting planned areas in order to reduce damages
Loss of cultural and historical monuments by aesthetics	Location dam in the right place or reducing the size of reserves to reduce damages and support of cultural symbols and buildings
Negative environmental effects of construction	Proceedings to reduce the adverse effects

because the water behind dams is used for different things can cause transmission of infection to humans and other living organisms in ecosystems around the dam. This leads to the prevalence of diseases and their transmission through these contaminants accumulate depending on the type of them in the body of organisms living in the river and especially fish which causes various types of dangerous diseases through human use of this food resources that its effect in people's body considering their tolerance range is different.

5- Dams negative effects on environment and actions in order to decrease their bad effects

operations	
Destruction and loss of wild life habitat values and wilderness areas	Location dam in the right place or reducing the size of dam to avoid or reduce the damages, construct parks and protected natural reserves, saving beasts and transfer them to compatible sites
Increase of aquatic plants in the reserves or downstream land, irrigation systems, shipping and fishing, loss of water through evaporation	Cleanly shaven wood plant species in drowning are associated with flood with the removal of nutrients, controlling aquatic plants, grass plants harvested for producing water fertilizer or biogas, outlet water regulation, regulation the level of water to prevent plants growth
Degradation of water quality in lakes and reserves	Cutting and cleanly shaven of woody plants at flooding areas, control and management of land use, effluent discharge and agricultural applications at watershed area, limiting the time of water remains in reserves

b) Indirect

Negative environmental effects of construction operations	Proceedings to reduce the adverse effects
Increasing humidity and locally fog, creation of suitable habitats for insects that are considered as diseases vectors (such as malaria)	Insect control by reasonable control methods (such as biological control)
Uncontrolled migration of people to the area that is created as a result of creation of access roads and power transmission lines.	Limiting the access roads, providing rural development and health services to lowest effects
Environmental problems caused by development which is caused by dam construction (e.g. agricultural land under irrigation, industrial and urban development)	Comprehensive regional planning in the area to prevent inappropriate use of soil and water resources
Less important uses of upstream land of dam which is caused by changes in water quality	Planning and preparation of land at upstream land of the dam to achieve efficient results

6- The positive effects of dams on environment

Rivers of dam will be converted to some habitats that have various vegetation and animals through passing the time and in addition to water storing role, dams have an important role in maintaining and protecting sea animals and plants. For example in establishing Great three gorge dam on the Yangtze River in China, aside from its disasters for human life and the termination of area historical building, this dam can be the last refuge for 300 dolphins, 500 Chinese crocodiles and also sturgeon fish and Chinese whale which live in river downstream. In order to compensate current deficiencies and increasing needs for water, further surface tanks are needed to time non-uniform distribution of the rains be modified and beside water transitions installations, the spatial distribution will be improved as well (Los

Angeles case for providing water). Dams have separate roles. With water supply for drinking and agriculture, dams create height of the water

for hydroelectric energy production, room for flood storage, deepening the river for water transportation, water recreation facilities and fishing that can be good income source. In near future, river runoff should be controlled and their water on an unprecedented scale diverted to arid regions. This requires human intervention in the water cycle that causes changes in the quality of surface water and groundwater as well. When the water is as receiving sewage water, there will be some changes in quality of surface and groundwater as well. When water is as receiving sewage water and other contaminations, removing destructive effects should be noticed in managing it. Water management should naturally decrease the life and financial damages of floods

and damages of wildlife (because of drainage or improving badlands) as much as possible.

For at least 5000 years, dams have been caused civilization's blossoming through providing water for domestic and watering consumptions. Many civilizations have been terminated through losing the power of constructing and maintaining dams. In past century, engineers have proposed modern technologies for increasing the power of harvest transmit and purify water and producing electro water energy but what important is that our engineers should work more on environmental aspect of dams in future and moderate destructive effects of dams on environment in a great extent.

7- CONCLUSION

As it is discussed in this article, dams have destructive as well as useful effects on environment. There are many references that mention examples of destructive environmental, cultural, social and economic effects of dams. Three important and often unsolvable problems are:

- a) Moving natives who are often inexperienced and non-political
- b) Salinity and waterlogging of irrigated farms
- c) Health problems because of disease related to water

Positive environmental effects of dams are as following:

Increasing and controlling low river flows, flood control, minimizing the water loss, greening the deserts and create new habitats for animals, generally it has to be tried to evaluate the harmful and beneficial effects of environmental as well as social to include these costs as part of the economic evaluation of a dam project.

Meanwhile dam projects and other structures have often adverse environmental impacts. Adverse impacts sample of large dams in Iran can be seen in deposition of socio-economic, draining and salinity of lands, lack of proper utilization management, water loss issues,

moving people and problems of dam water to supply drinking water in terms of reducing its quality while if environment considerations were widely considered in initial designing and planning, development and establishment programs of such these costly installations they could create the minimum environmental consequences in areas under their influence.

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