

ENVIRONMENTAL IMPACT ASSESSMENT OF DAMS AND RESERVOIRS

Kyohei Baba

K. Baba Engineering Consultants Co., Japan

Toshio Hirose

Japan Commission on Large Dams, Japan

Keywords: dam and reservoir, environmental impact, modern dam, construction period, natural environment, Limit to Growth, The United Nations, Declaration on the Environment, Club of Rome's message, Limits to Growth, sustainable development, UNCED, ICOLD, WCD, World Bank, World water vision, energy vision, environmental concepts, damming river, socio-economic impact, life, energy, agricultural, industrial, domestic, upstream and downstream sides, pain-off, economic implication, inter-relationship, marco-economic, bio-physical impacts, techno-economic consideration, employment opportunity, resettlement, local economic impact, cultural landmark, heritage resource, social acceptance, geophysical process, reclamation and drainage, slope stability, sediment impact, seismicity, geophysical impact, ecological impact, ecological systems, physical, chemical, and geomorphological consequences, biological productivity, streamflow, riverine, plant-life, fauna, wetland, plankton, emission of greenhouse gases, methane, carbon, dioxide, population, geographical location, minimization, mitigation, Applied Ecological Engineering, GHG, climate, global warning potential, atmospheric effects, nitrous oxides, sulphuric oxides, fossil fuel, water quality, organic residences, oxygen, eutrophication, monitoring, La Grande project, fishes, water depth, temperature, atmosphere, radiation, evaporation, thermal stratification, fish species, rheophile, flowing water, calm water, ubiquitous, water bottom, benthic fauna, carnivorous species, nitrogen and phosphorus contents, migrate, eggs, anadromous fish, salmon, sturgeon, catadromous fish, eels, sodium chloride, algae, macrophytes, phosphate, nitrate, salmonid, pH

Contents

1. Introduction
 2. Socio-economic impact
 3. Geological impact
 4. Ecological impact
 5. Water quality and climate (ICOLD, 1994)
 6. Dams and Fishes (ICOLD, 1998)
 7. Concluding Remarks
- Acknowledgement
Glossary
Bibliography
Biographical Sketches

Summary

Dams may be built for many reasons, flood control, improvement of navigation,

generation of electricity or provision of water for domestic, industrial or agricultural use.

The construction of a dam and the creation of a large reservoir have a very significant effect in that a land and river environment is actually transformed into a new environment with lacustrine conditions. In these new conditions, some important impacts such as socio-economic impact, geological impact, ecological impact and water quality and climate are described.

1. Introduction

The environmental impacts by dams and reservoirs have been recognized widely in the first stage of modern dam construction period that was after the end of Second World War. In this period, large scale dams and reservoirs had been constructed especially in north and South America, Canada and Europe zone. At the same age, the dam developing activities in Africa and Asia zones were promoted due to financing supports.

Increased awareness of the natural environment and its endangered situation is one of the most important developments of the late twentieth century. The United Nations “Declaration on the Environment” and the Club of Rome’s message on the “Limits to Growth” left their mark on our thinking in 1972, followed in 1987 by immediate and worldwide agreement on the convincing concept of “sustainable development” as propagated in the Brundtland Report of the United Nations on “Our Common Future”. In 1992, the United Nations Conference on Environment and Development (UNCED) put the issue into a global perspective and drew up a comprehensive action programme (ICOLD (1997)).

In 1995, International Commission on Large Dams (ICOLD) issued their concept concerning to the dams and reservoirs impacts to the environment titled the Position Paper on Dams and Reservoirs (ICOLD (1997)). The Paper describes firstly as “All dams and reservoirs become a part of their environment which they influence and transform to a degree and within a range that vary from project to project.

Frequently seeming to be opposite, but not necessarily irreconcilable, dams and their environmental interrelate with a degree of complexity that makes the task of the dam engineer particularly difficult. The solution must be to find the golden mean by striking a balance between divergent and sometimes contradictory goals.”

In 2000, World Commission on Dams (WCD) issued their final report titled Dams and Development (WCD (2000)). WCD worked hard for two years how to develop dams and reservoirs with sustainable states ordered by World Bank. The report points important problems for sustainable development of dams and reservoirs at the stance of socio-economic. The World water vision and the energy vision described in the report are precise views to the environmental concepts in the future of the world. Non dam professional published his opinion concerning to environmental impacts due to damming rivers (ICOLD (1992)). He mentioned geological, morphological and water quality effects, the environmental impacts of dams and reservoirs will be mitigated with

human wisdoms and sustainable dam development will be active cooperating with natural environment.

2. Socio-economic impact

The concept of water and development has been changing recent decade. Water for life, energy, agricultural, industrial and domestic sectors should be widely managed between upstream and downstream sides. These water managements will mitigate the Socio-economic impacts in the local regions. The notion of economic impacts refers to the effects, on the local and regional economies, of project construction and subsequent operating activities. These include: direct and secondary (or spin-off) demands for labor and services, as well as effects on local resources and thus on the very structure of the local economy.

Such economic effects also cause significant social impacts which impinge on economic parameters. Also, various social impacts stem directly from project activities and these also have economic implications. Overall, socio-economic impacts engender a complex dynamic which is not easy to predict accurately. Impacts are most conveniently evaluated and managed when this dynamic is seen in terms of issues, but it is essential to remember that such issues are not discrete problems; mitigation, like the impact analysis and project planning must take into account the inter-relationships between the various social and economic considerations.

Because large dams are often seen as essential for national economic development, their macro-economic benefits tend to be highlighted while environmental considerations and especially local economic impacts and social impacts may be less adequately evaluated. This is particularly the case for underdeveloped or developing countries in tropical zones where the attractions of cheap hydro-electric energy for improving the conditions of the general population are self evident. The socio-economic impacts can be subtle yet complex and often of an indirect nature.

Being less dramatic than bio-physical impacts, they are sometimes harder to evaluate. Socio-economic impacts tend to be less dominant in project design than bio-physical impacts or the techno-economic considerations of project planning. In extreme cases socio-economic impacts may simply be neglected (ICOLD, 1992). The assessment of the environmental impacts of dams, the following impact areas need special attention during the implementation of a project, which mentioned by ICOLD in 1980. Such as, Employment opportunities, Resettlement, Local economic impacts, Cultural landmarks and Heritage resources, and Social acceptance (ICOLD, 1980).

-
-
-

TO ACCESS ALL THE 10 PAGES OF THIS CHAPTER,
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

Bibliography

- ICOLD (1980), Bulletin 35 Dams and The Environment.
- ICOLD (1985), Bulletin 50, Dams and Environment Notes and Regional Influences.
- ICOLD (1992), Bulletin 86, Dams and Environment Socio-economic impacts.
- ICOLD (1993), Bulletin 90, Dams and Environment Geophysical impact.
- ICOLD (1994), Bulletin 96, Dams and Environment Water quality and climate.
- ICOLD (1997), Position paper on Dams and environment.
- ICOLD (1999), Bulletin 116, Dams and Fishes Review and Recommendations.
- WCD (2000), Dams and Development.

Biographical Sketches

Kyohei Baba: Doctor Engineering. Past Vice-President of International Commission on Large Dams (ICOLD). Chairman; Committee on the Environment of ICOLD and Committee on International Affairs of Japan Commission on Large Dams. Lecturer of Science University of Tokyo. He has been engaged engineering works for large dam projects in the world since 1956. His special fields on dams engineering are environmental problems for reservoirs and structural designs of dams.

Toshio Hirose: Doctor Engineering. The honorary member of the Japan Society of Civil Engineers, past former Vice-Minister of the Ministry of Construction, the former President of the Japan Commission on Large Dams and the President of the Ecology and Civil Engineering Society. He is the top leader of dam engineering in Japan. He has experienced every stages of dam engineering such as design, construction, and operation for river management and also environmental countermeasures for reservoir by biotechnological conception. Especially he has originally proposed the Roller Compacted Dam (RCD) method and applied on actual projects. He has also established the Ecology and Civil Engineering Society aiming at the close cooperation between civil engineering and ecology. It is organized by civil engineers and biologists from all biological fields such as algae, fishes, plants, animals and birds. He is now getting actively in these fields.