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The construction of Karalloe multipurpose dam for the Kellara technical irrigation development

The construction of Karalloe multipurpose dam for the Kellara technical irrigation development

M Hasbi[1], Subandi[1] M Mappanyompa[1] and B Bakri
[1]The Pompengan Jeneberang Large River Basin Organization, Makassar, Indonesia
[2]Associate professor, Civil Engineering Department, Universitas Hasanuddin, Indonesia

E-mail: subandi_me@yahoo.co.id

Abstract. The problem of Jeneponto regency is a raw water crisis for water drinking and irrigate in dry season. In rainy season, a high sediment to deposit in the lowest area. the regulate flooding and inundates rural and urban. A Jeneponto river is a joint river between Karalloe River and Kellara River which come from Lompo Batang mountain and the existing raw water is not enough to be supplied to the raw water treatment plant and not enough to be supplied to the existing Kellara technical irrigation area so the rice cropping is not optimize although existing Kellara weir and Karalloe weirs will support the irrigation. To solve the problem mentioned above, the Karalloe multipurpose dam will be constructed urgently. The problem will be managed by sustainable integrated water resources management, Step by step method to be applied in 3 terms for example in the short term, the middle term and the long term. Methodology study of this paper focused to solve the raw water crisis and regulate flooding in Jeneponto Regency. The governments apply by not only construction of the Karalloe Dam but also to apply an integrated approach.

1. Introduction

Jeneponto regency has a serious water crisis to be solved by the Karalloe dam. Highest deforestation and eroded has a high sedimentation to damage the lowest area so the regulate flooding inundate urban area for a long time during rainy season. During the dry season the raw water crisis to the regency (district) is a serious problem too. A Jeneponto river is a joint river between Karalloe River and Kellara River, which come from Lompo Batang mountain, flows to Bontosunggu, a capital city of Jeneponto regency. In the upstream (U/S) of Jeneponto regency, no reservoir to restore those rivers so that in dry season, the existing raw water is not enough to be supplied to the raw water treatment plant and not enough to be supplied to the existing Kellara technical irrigation area so the rice cropping is not optimize although existing Kellara and Karalloe weirs are facilitated to support the irrigation area were constructed in 1976. In the rainy season, regulate flooding inundate the urban and rural Jeneponto. In related with the problem mentioned above, on July 4, 2012, the government declared that the Karalloe Multipurpose Dam will be constructed to solve the raw water crisis and regulate flooding. The problem will be managed by sustainable, integrated water resources management, in the short term, the middle term and the long term.

2. Social and environmental aspects of dam

Systematically, social and environmental aspects of the Karalloe multipurpose dam as a solution for the environmental and raw water development in Jeneponto regency will related to greenhouse gas effect control of Karalloe multipurpose dam for food and irrigation development, public participation for the Karalloe multipurpose dam and Kellara irrigation scheme, institutional aspects on the Karalloe dam, land acquisition and resettlement for the Karalloe dam, Environmental management will be written briefly:

2.1 Greenhouse gas effect control of dam for food and irrigation development

Greenhouse gas effect control of Karalloe multipurpose dam for food and irrigation development trough increasing of O_2 and reduce CO_2 to secure the existing environmental and raw water in reservoir for increasing irrigation and clear water. The concentration of Green House Gas in the atmosphere had been increasing slowly. Anomalies in the concentration patterns of CO_2 and CH_4 have been correlated with the development of existing Kellara irrigation, agriculture, floras, fauna and human life. Theoretically, the greenhouse gas effect of dams is the principal cause of climate change. Some regions of the world are experiencing heat waves, severe droughts, and wildfires while other regions are facing unusually strong monsoons, widespread flooding, and rain-induced landslides. For these extreme events, people around the world are facing some form of climate related crisis with increasing frequency. International efforts to advise countries on how to reduce their greenhouse gas emissions and cope with climate change are ongoing. National strategies for sustainable development are being implemented by many countries as well as programs to monitor and mitigate greenhouse gas emissions. Winning the battle to slow down and cope with climate change will be a long term challenge which will likely require substantial changes in the behavioral patterns of society. Climate change is giving rise to all kinds of environmental changes. It results in heat waves, droughts and fires in some regions, and in other regions, floods and freak storms. Even though not everyone is convinced that the changes in climate are abnormal or anthropogenic, there is widespread evidence from many independent sources suggesting that the earth is getting warmer. Temperatures over land and ocean are rising. Temperature records are being exceeded in many regions of the world; extreme events are becoming more frequent. Some of the inter-annual climate variations, which are sometimes attributed to climate change, are undoubtedly due to events such as El Nino. However, it has recently been hypothesized that the frequency of El Nino events, which has almost doubled since 1980, might be due to the increase in the concentration of greenhouse gases in the atmosphere. In this presentation of the greenhouse effect, discuss the main causes of climate change, present information on the magnitude and impact of climate change, mention some of the international efforts to deal with climate change, and present some strategies for minimizing the increase in the atmospheric concentration of greenhouse gases. Many technical solutions are being advanced by the scientific community to mitigate greenhouse gas emissions and to help adapt to climate change, but these are unlikely to be sufficient to stop more global environmental changes unless tremendous progress is made in using resources more sustainably. The temperature of the Earth depends on the energy budget at the Earth's surface. The main source of energy is the incoming short wave radiation from the sun.

Approximately 30% of this radiation is reflected back into space by clouds and the Earth's surface. Having been warmed by the sun's radiation, the Earth cools itself by emitting long wave radiation back into space. Part of the long wave radiation emitted by the Earth is absorbed by heat trapping gases in the Earth's atmosphere such as water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), ozone (O_3) and re-emitted in all directions, including back towards the Earth's surface. Because it is analogous to the way glass greenhouses trap solar energy, this phenomenon is known as the greenhouse effect and those heat trapping gases in the atmosphere are known as greenhouse gases. The global warming potential of a gas gauges its effectiveness in warming the atmosphere. It is different for all Green House Gas, and CO_2 is used as the reference. For example, over a century, a kilogram of N_2O is 298 times more effective at warming the atmosphere than a kilogram of CO_2. Hence the CO_2 equivalent (CO_{2e}) of N_2O is 298. It is interesting to note

that without these greenhouse gases the temperature at the earth's surface would be about 33ºC cooler. For example, from 8,000 to 2,000 years ago an anomalous increase in the atmospheric CO_2 until the 1970s, as much CO_2 concentration of about 40 ppm (parts per million) has been attributed to forest clearing for the development of agriculture in Europe and China. A similar increase in the concentration of methane of 250 parts per billion, which took place 5,000 to 1,000 years ago has been ascribed to the spread of irrigated rice farming in Asia. It has been estimated that the increase in concentration of these two gases increased the Earth's temperature by about 0.8ºC during that period. It had been released into the atmosphere from the clearing of land as from the burning of fossil fuels. However, since then, the contribution of fossil fuel combustion has become much more important. For example, over the past 20 years, of the CO_2 This large increase in energy-related CO emissions are estimated to have come from the combustion of fossil fuels and the remainder from land use changes. The share of Green House Gas emissions related to fossil fuel combustion is now growing at an accelerating rate. During the last two centuries and particularly during the last 3 to 4 decades, the atmospheric concentrations of CO emissions are closely associated with the increase in the world's population.

2.2 Public participation for the Karalloe dam and Kelara irrigation scheme

The most significant part of the Water User Association for the Kellara Irrigation scheme (The irrigation) is in water scheduling and distribution. When irrigation water availability is adequate or between 4 and 6 m3/second, three Water User Association divides irrigation supplies at the major diversion structure in proportion to their areas and then guard those settings. When the available water falls below 4 m^3/Sec, the Water User Association switch to irrigation rotational procedures, involving 2.5, 2 and 2.5 days allocation for each of the three Water User Association. Within each Water User Association sub-command, schedules has been developed for sharing water between day blocks and night blocks. Each block is split again into roughly 1/3rd of their areas, with each sub-area getting an allocation for the 1st, 2nd or the 3rd day. The Water User Association proposes the schedules and the gate operators carry out their instructions for the setting of the gates. This kind of water scheduling needs a high degree of cooperation among water users. It is unlikely that government operators could achieve satisfactory performance levels at the irrigation scheme without the involvement of the Water User Association. The federation leaders ensure that their members obey the scheduling rules and have developed sanctions for persistent offenders. As can be seen from the description of the organization for O&M described above, it is still in the process of adapting to the new national policies. Farmers will continue to participate in irrigation O&M activities in several ways: Farmers are mobilized on a voluntary group bases under traditional practices for twice a year, before the start of the planting to undertake light maintenance work in the secondary canals, such as clearing sediment, grass cutting, small lining repairs [1]. The farmers decide on cropping patterns and water distribution schedules, and the head of regency issues appropriate instructions based on these group decisions [2]. The Water User Association have agreed on sanctions to be imposed on farmers who do not follow the agreed crop and water schedules and then waste valuable water. In previous years, farmers collected funds informally for use in O&M where they saw a need [3]. In 2005, the former a lobbied to change the bylaws about water user fees going to the regency accounts successfully. Under the revised procedures, the Water User Association keeps the funds for their own internal the Water User Association. In 2006, the farmers will strictly enforce payment by members of at a level of Rp.25,000/season/ha and 20% of members have so far paid these amounts. The farmers have greatly expanded the area cultivated in second cropping (palawija) during the dry season so that more area can be planted [4]. In 2005 this palawija area had increased to 2,500 ha, with only 1,500 ha of paddy. In 2003, the Karalloe weir sluice gate stems seized up and could not be closed [5]. The government at that time had no funds for repair so the farmers paid for the repair themselves. The end of 2005, a serious landslide with the sedimentation deposit into the main canal, cutting off irrigation flows at a critical time before wet season plantings [6]. The irrigation maintenance funds through national budget, but no money available for this work. At the initiative of the Water User Association leaders, reparation of

landslide work was initiated by requesting regency assistance with heavy equipment and the Water User Association arranged to provide the necessary labor to clear the blockage. Lessons and learned in the irrigation: Rehabilitation of an operating irrigation needs full participation of the beneficiaries and a multidisciplinary approach involving farmer group strengthening, improved agricultural practices, training in O&M and repairs to the irrigation infrastructure. Placing a lot of emphasis on construction works at the expense of these preceding activities can lead to disappointing results. The whole-heat support of local government is an essential prerequisite for successful participation [1,2]. The Jeneponto Government leader must give his full attention and support to the improvement measures proposed for the irrigation scheme. The appropriate emphasis for improvement works should be improving the water management and crop production development. An overall water management study, carried out before improvement works start will be highly useful and effective in producing a successful strategy. Full consultation is needed with all stakeholders to be focused for the real problems and proposing real solutions. The promise of funds for rehabilitation can be a great incentive for farmers to change negative perceptions and increasing participation in necessary irrigation O&M activities. Participation must be meaningful and involve empowerment of farmers. Previous attempts to use the Water User Association as a government tax collector failed because the benefits of participation were one sided [3-5]. Participation can be improved by the sustained use of neutral groups as who can be trusted by farmers (consultants or NGOs) as an intermediary and a facilitator for irrigation scheme improvements. The participation model must be suitable for local conditions, not a standard and uniform system imposed from above. For example, in the irrigation scheme, the sizes of the Water User Association areas are not equal, the main canal was left out of the water scheduling, and efforts were made to ensure that the traditional local leaders were involved from an early stage, thereby co-opting potential opposition. Designing the Water User Association sub-commands of unequal sizes areas is not a problem. It is much more important that the Federations are granted total control of the water in their areas. A step-by-step approach to initiating irrigation physical, organizational and management improvements is recommended [6-9]. Public participation for the Karalloe dam and Kelara irrigation scheme is shown in figure 1.

Figure 1. Public Participation for the Karalloe dam and Kelara irrigation scheme.

At the irrigation scheme, the rehabilitation was carried out in several separate stages, with the early stages generating significant benefits for all, which in turn led to a greater willingness to participate and cooperate in future activities and stages. Continued support and training after physical works are completed generate positive additional impacts on active participatory water management and outcomes [10]. Layout of Karalloe multipurpose dam is shown in figure 2.

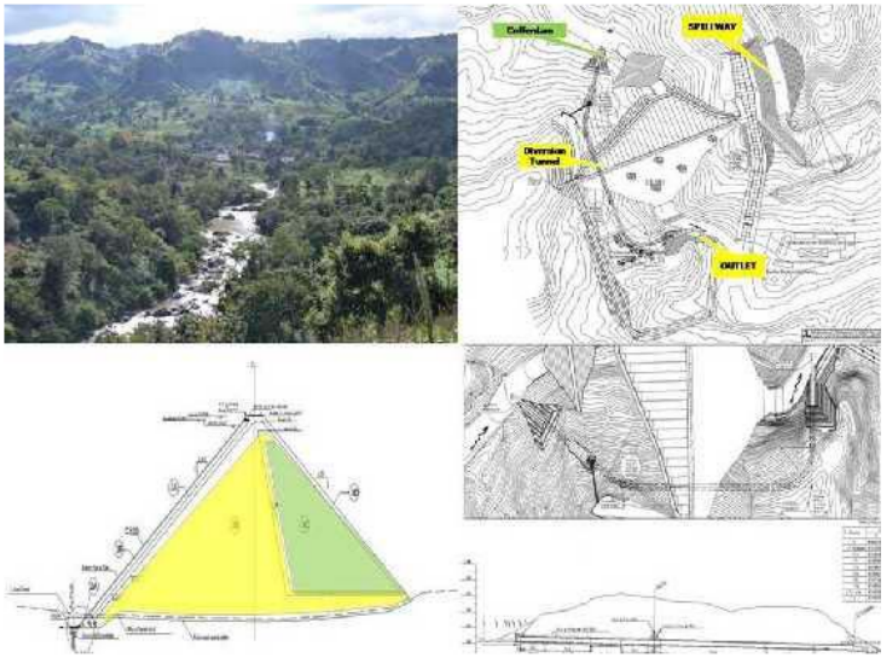

Figure. 2. Layout of Karalloe multipurpose dam.

The comparative study conducted outside of the geographical scheme area, including alternative cultural settings, proved to be highly effective in demonstrating modern O&M practices, the farmers were comparative studied to East Java irrigation schemes where the Water User Association leaders had a high level of positive involvement in O&M matters [11]. The Kellara irrigation schemes lies wholly within the Jeneponto regency within 5 Sub district and 24 Villages. The scheme area covers 7,199 ha, divided into 2,157 tertiary blocks, with 51 the Water User Association and 11,264 farmers. In an attempt to resolve the dilemma situation to maintain sustainable rice production on the one hand, while keeping pace the productivity level with the increasing population growth on the other, an emphasis has been given to irrigation development and management based on a participatory approach. The program had been set up to reduce central government's burden on Operation and Maintenance (O&M) costs, aiming for sustainable irrigation O&M by virtue of Participatory Irrigation Management approach. Under the said program, a number of policy adjustments on water resources had been enacted. Further to this, Participatory Irrigation Management attempts have also been carried out including: turning over to the Water User Association, of small irrigation schemes; encouragement of Irrigation Service Fee; Irrigation Management Transfer; Participatory design and construction program; field laboratories for visual process of learning by doing, and other such government

initiatives. However, it turned up that the attempts has been going very slowly and yet, still tended to be sustainable. This has been partially suspected by the fact that the economy of the farmers and farming conditions under the fragmented land ownership, which in fact, are already small, has been marginalizeded. In the water resources development within thirty years until 1997 through government led development projects. However, the institutional development to sustain this progress got insufficient attention.

From the lessons learned before the multidimensional crisis, it has been recognized that the severe crisis had been due to the chronic neglect of the farmers roles in almost the entire process of development, rehabilitation, and routine operation and maintenance of irrigation infrastructures. At the present time, access road to the Karalloe multipurpose dam has been completed to be continued to the dam construction. The dam is constructed by the Pompengan Jeneberang Large River Basin Organization under Directorate General of Water Resources, Ministry of Public Works to restore water of Karalloe river. In the future time , about 30 million m^3 water come from the reservoir will irrigate the 7,004 ha Kelara irrigation area through 70 km secondary canals. The last time, without the Karalloe dam, the irrigated area had declined to less than 1,000 ha or which is equivalent to 16% designed capacity every year so farmers need additional water and irrigation improvement. The shortage of water led to permanent social discord and the farmers themselves destroyed and damaged the irrigation works in attempts to divert water away from their neighbors' lands and into their own fields. There were no water sharing plans or staggered plantings and coordination of irrigation and water management was poor. A storage dam was proposed as a solution to the water shortages by Karalloe dam. It was recognized that the existing irrigation and agricultural land resources were vastly underutilized due mainly to poor water management. Better irrigation and water management was not possible without full commitment, cooperation and participation of the farmers and the local community. Hence a study was undertaken between 1998 and 2000, with the aim to clarify the real causes of the water shortages by collecting and analyzing data and information on the project from both government officials and local farmers, and by making recommendations for improvements. Measures aimed to improve irrigation and water management were implemented between 1999 and 2002 using participatory methodologies promoting farmer participation. Based on the WMIS, indicate that (1) The main canal carrying capacity was too small, reduced to 25% of the total requirement by defects in the canal, and limited to 50% by the carrying capacity of the tunnels. (2) The secondary system was in a poor condition, with heavy sedimentation and sanitation, and many broken and leaking (3). The tertiary system was either non-existent or in a poor state of repair. (4). Water management was very problematic due to a lack of farmer commitment and involvement, possibly arising from the continuing shortages of water and the special character of the local people.

2.3 Institutional aspects on the Karalloe multipurpose dam

Based on The No.7 Law of 2004 on the water resources, O&M responsibility is assigned by three administrative levels. It is (1) Central (2) Province (3) District or regency with the designation of responsibility depending on schemes area as (a) >3,000 ha (b) 3,000-1,000 ha (c)<1,000 ha. The Water Use Association is delegated the responsibility for the construction and O&M of tertiary systems. Under the revised arrangements, the central government will take responsibility for the irrigation scheme, given its size. The mechanisms and organizations are still evolving, but will certainly involve partnerships, mutually agreed between the different administrative levels for implementation of O&M, depending on the abilities and willingness to participate of each level. Given the positive experience and clear benefits of good water management practices seen over the past eight years, the provincial and district governments, the Water Use Association and the farmer beneficiaries are all well prepared and ready for whatever the new arrangements will bring and hopefully the outcome will lead to a further increase in productivity of the irrigation system.

2.4 Land acquisition and resettlement for the Karalloe multipurpose dam

The Karalloe multipurpose dam is feasible to be constructed to solve the raw water crisis and to the regulate flooding. Based on data of the Karraloe dam that the dam will be constructed using a rock fill dam with

concrete face type, to store Karalloe river located in Gowa regency. The height, crest width and length of the dam is 75.18 m, 11 m, 325 m. The dam is supported by 182 km2 Catchment area, 22 km Karalloe river length with 2.495 mm/year annual average rainfall, 28.47 m3/second Q max, 3 m^3/Sec Q min, 239.65 m maximum water level, 89.20 m minimum water level. The reservoir has 30 million m3 effective storage capacities with 1.6 km^2 surface area will be inundated 3 villages, the government will provide land acquisitions of the inundation villages and relocate about 90 families to new location (resettlement Site).

2.5 Environmental management during construction of the Karalloe dam

The Karalloe multipurpose dam will store 30 million m^3 raw water to be constructed in hilly area located in Taring Village, Biringbulu Sub District, Gowa Regency, located in the upper stream of Jeneponto regency to supply the raw water to the rural and urban Jeneponto regency for example 15 m^3/Sec raw water for 7.199 ha of the existing technical irrigation area, 0.3 m^3/Sec for clean water, 380 Volt 50 Hz for micro hydroelectricity power, 30 m3 for flood control including flushing of drainage. Another purpose of the raw water will be used tourist development. The sketch informs the development of water resources structures will be constructed and developed after the final construction of the dam for instance construction of the Sediment Control Dam, Sand Pocket Dam, Conservation Dam, including development of conservation and reforestation are located in the U/S of the dam to prevent and minimize the sedimentation in the reservoir. Construction of Raw Water Transmission Main including construction of Raw Water Treatment Plant will be located in the D/S of the dam to support increasing of clean water. During construction, environmental improvement works or conservation development must be done to anticipate next disaster, an erosion or a landslide in the upper of the dam and to secure water to reservoir for existing irrigation and environmental development.

3. Conclusions

The 30 million m3 of raw water come from Karalloe reservoir constructed in Gowa regency is the best solution for securing and providing a sustainable existing environmental protection and the existing Kellara irrigation development in Jeneponto regency so the dam will be constructed in 2014.

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