

**CONSEQUENCES OF LAND USE CHANGE TO
FLOOD, ERROTION, AND SEDIMENTATION FOR
STUDY CASE NORTH BANDUNG**

By:

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INTRODUCTION

- In the first century, the world population was approximately 200 to 300 millions, which grew to 4,000 millions in the year 1975. In the year 2000 it grew to 6,500 millions. Now existing water is believed to be insufficient to the needs.
- The world is concerned with the possibility of a water crisis in the 21st century. Water Conservation Conference during the Rio de Janeiro Earth Conference in 1997 stressed on the conservation of water resources that must be managed in integrity.
- For the last two decades, water consumption increased for domestic, municipal and industrial use. The same applies to briny water that is used in fish bank/ponds. In the present, natural resources exploitation tend to be excessive and destructive, causing distortion to the water cycle.
- Water is not 'man made commodity' but is the gift from God, and according to the statement in UUD 1945 article 33, must be used for the welfare of the people. This is the reason for integrated River Network (DAS) Management in Indonesia already implemented in Brantas and Citarum River Network with the slogan: ***one river basin, one management.***

THE PRESENT CONDITION OF THE CITARUM RIVER NETWORK

- **The Citarum DAS is now facing many problems that are caused by the relatively-rapid growth of the population demanding change and development of new settlement areas.**
- **The Citarum DAS faces many environmental problems as well. It is estimated that the upstream portion of the Citarum-Saguling DAS is suffering from critical land, with low production.**
- **The Bandung basin still faces routine annual floods caused by an increase of erosion and sedimentation.**
- **Thus the role and function of the Citarum DAS is very vital in fulfilling the need of the people. The density of the population is relatively high: 1,640 people per km². It is estimated that by the year 2005 the demand for water will exactly meet the availability of water of Citarum River.**
- **This is the reason we need a plan addressing water problem with the Citarum DAS completely, not partially and descriptively.**
- **Without environment control, it is possible there will be an exponential increase of floods, erosion, sedimentation, and carbon-dioxide and industrial waste, that will continually threaten the environment, especially water resources.**

THE CONDITION OF NORTH BANDUNG

- **Development in North Bandung has yielded negative effects for the catchment area or conservation zone and the increasing spread of critical land**
- **In 1994 the mayor issued a decree to stop all settlement constructions in the North Bandung Area:**
 - **As an effort to apply environmentally-friendly development**
 - **To maintain conservation of the natural resources**
 - **Realize optimum condition of DAS arrangement in order to increase regional support capacity**
- **To conserve land, the level of erosion and flood must be controlled. The growth of population and industries also increase environment pollution and disturb the ecosystem balance of the river network.**
- **The Bandung Area has experienced rapid growth of various life-sectors and uncontrolled change of land-use. The northern/upper area is intended to be a catchment area. If the land use exceeds its capacity, the land will turn critical causing it to fail its function as a distribution controlling media and will damage the river network in the end.**
- **Disturbance in water distribution in the river network will cause various problems such as: increase floods, erosion and sedimentation, and minor flow will decline.**

DISTORTION OF THE HYDROLOGIC CYCLE

- **Water is known as a natural resource that is always available for free in the form of rain, rivers, and deep in the earth.**
- **Flood and drought are basically the result of a distortion to the system of hydrologic cycle**
- **Rainwater is relatively constant from time to time, obeying the hydrologic cycle in the river network. In the beginning, people will not feel the water being insufficient because they think that water will always be available.**
- **A long dry season occurred in 1991 through out the island of Java. However in 1996, flood came from Ciliwung River struck Jakarta. This illustrates that there has been a disturbance to the upstream river network. Forest that substitute reservoir is no longer sufficient and now the forest is only 22 % of what it used to be.**
- **In the present, the Java Island tends to experience extreme water availability problems. Water availability tends to decline caused by pollution from various industries.**
- **Experts predict that water crisis will occur if the annual water availability is 1000 to 1600 m³ per head. That is why it is very**

important that the river network management, especially for Java, should be implemented wisely and advanced.

THE FLOOD PHENOMENON

- Rain and floods are hard to predict. The quantity and frequency can not be forecasted
- By using the theory of probability from records of flood occurrence frequency, we can estimate bigger extent of floods (with a certain return period)
- Probability is contrarictory to the return period. Mathematically:

$$Pr = \frac{1}{Tr}$$

- And , according to Weibull, the frequency distribution is:

$$Weibull = \frac{N + 1}{M}$$

- Flood calculation in accomplished by implementing "frequency analysis", in two methods:
 - Graphical: by position plotting
 - Mathematic: Gumbel, Normal-Log, Pearson methods
- Flood calculation by using the Gumbel analysis requires a long record of data (10 to 20 years record)
- If the data is less than 5 years, flood calculation is accomplished via other methods such as the POT (Peak Over Threshold) method.

SYSTEMATIC APPROACH TO RIVER NETWORK MANAGEMENT

- DAS is considered as an ecosystem unit wherein the living and non-living environment co-exist
- The function of the ecosystem can be monitored as: water input (rainfall) and output (discharge), erroded material and biological material solution. The system can be built simply with the interaction of sub-systems and their components.
- DAS management is the method to modify the natural hydrologic cycle with another system that will create a balance between demand and supply.
- Using the system analysis we can easily understand or interpret complex hydrologic cycle phenomenons and modify them using a simulation of systematic approach
- Simplification of a system is called a model. Complex water resource problems are solved by using model approach such as the following models: Rain-Surface flow, Sintesa Model, Ground Water Model, etc.