Construction of Check Dam in Microwater-Shed Areas in Tundi Block of District Dhanbad, Jharkhand

Anupam Kumar, Kumar Nikhil

***Abstract*— This paper envisages the ecological and civil engineering aspect of check-dam construction in a micro watershed environment for preventing possible soil erosion and silt wastage due to strong current by small streams or river tributaries. The field study was done for checking the feasibility of construction of check-dam over Keshka River, in Tundi block of district Dhanbad, Jharkhand. The physical, ecological, social and economic factors were also noticed during the evaluation of the check-dam. It was observed that the river tributary at Keshka had one of the most unpredictable water current and thus, a proposed check-dam would , firstly, check any abrupt increase in the water flow in the this area. Secondly, due to the strong current of the river, the gully erosion is quite heavily prevalently noticed in the area which can further lead to the decrement of soil quality and basic soil texture, due to silt wastage. Also, considering the ecological aspect, the water if controlled can be used in the near-by irrigation purpose, through which farmers having their land(s) adjoining to the proposed check-dam, would have a high moisture content, and thus, they could enhance the soil water percolation rate of their soil, and on an overall scenario, the ecological aspects also can be enhanced of this area.Further, this will increase ground water level in nearby areas through quick recharge of drinking as well as irrigation wells.**

***Index Terms*— Micro-watershed Area, Check Dams, Tundi Block, Sustainable Development**

I. Introduction

Watershed development projects in the country has been sponsored and implemented by Government of India from early 1970s onwards. The journey through the evolution of watershed approach evolved in India. Various watershed development programs like Drought Prone Area Program (DPAP), Desert Development Program (DDP), River Valley Project(RVP), National Watershed Development Project for Rain-fed Areas (NWDPRA) and Integrated Wasteland Development Program (IWDP) were launched subsequently in various hydro-ecological regions, those were consistently being acted by water stress and draught like situations.

II. Background

Keshka watershed has been selected for the present developmental activities due to the following criteria :

- People's participation is ensured after holding reconnaissance meeting and field surveys in the watershed. Local people show their enthusiasm by assuring their full cooperation in their of their labour and other contributions for the implementation of the programmes of action plan.
- Some of the common lands are assured for proposed development of common assets in the watershed
- Peoples are willing to take responsibilities to actively participate in the activities and after the completion of the project, they agree to maintain the common and other facilities for their further development.

III. Site Details

The said checkdam was constructed at the Keshka Tartand village in Tundi Block of District Dhanbad, Jharkhand.

Keshka Micro-watershed is located in Tundi Block of Dhanbad district, forms a part of Khudia Nadi watershed. The study area is bounded between 23 $^{1/2}$ 52'50" to 12$^{1/2}$56'08"N latitude and 86$^{1/2}$24'47" to 86$^{1/2}$26'45" E longitude. The area covers about 1343.85 ha and is situated about 15 km from the district headquarter, Dhanbad city.

A. Precipitation Details

Table 3.1 Rainfall variation throughout the Year 2014

Month	Rainfall (mm)
January	13
February	18
March	17
April	23
May	50
June	212
July	325
August	308
September	241
October	89
November	7
December	4
Year	**1306**

In the table.3.1 shows the variation of rainfall throughout the 2014year which shows a characteristic humid subtropical climate and a tropical wet and dry climate. The higher rainfall is recorded in the months of June, July, August and September, where as the winter months of January, February, March and summer months of April, May have comparatively scanty rainfall.

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Anupam Kumar, Interim Trainee in EMG, CSIR-CIMFR, Dhanbad, Jharkhand, India & Student of School Of Civil Engineering at KIIT UNIVERSITY, BHUBANESWAR.

Kumar Nikhil, Principal Scientist, EMG, CSIR CIMFR, Dhanbad, Jharkhand, India

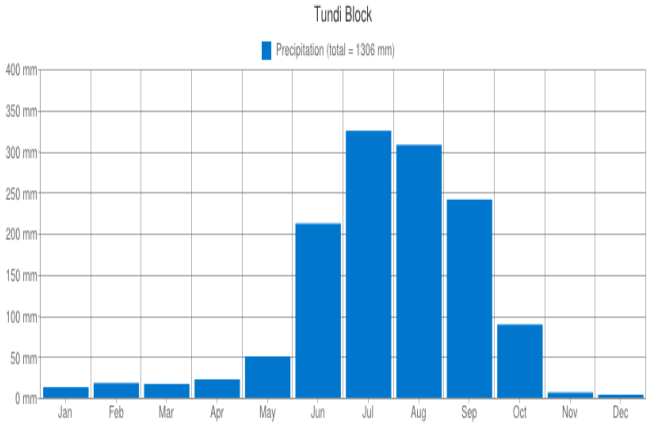

Fig.3.1: Precipitation variation within a year of Tundi Block, district Dhanbad, Jharkhand

B. Cropping Pattern and Agricultural Land Distribution

The cropping pattern of Keshka is of traditional type with single crop practice. Kharif agriculture is dominated by paddy cultivation with limited maize, soyabean and arhar cultivation. Rabi season is dominated by wheat with Rae /mustard mix cropping, maize, beans and other vegetables in low lying areas where irrigation facilities exist. Zaid season crops are generally not being practised with cash crops.

IV. Methodology

- Designing and proper assessment of the adjoining command area for the proper designing of check-dam construction.
- Checking the feasibility of construction of the proposed check-dam after checking the strength of the below soil strata and adjoining rock strata.
- Estimation of cost and employing proper method of cost assessment for construction.
- Collection of data and documents, topographical maps, soil maps, satellite images through GIS technique and rainfall records.
- Analysis of topographical records and proper demarcations of watershed and micro-watershed areas or segregations in Dhanbad district.
- Gradation of the micro-watershed on the basis of identified index of assessment.
- Based on gradation, selection Keshka micro-watershed for preparation of Detailed Development Plan, envisaging inclusive techniques for all around development.
- Training of versatile local youth for data collection and for technical survey mapping work.
- Analysis of the data.
- Validation of the plan by the local villagers.
- Finalisation and implementation of the action plan with participation of the local people.

V. Factors Considered for the Construction of Check Dam

Gravity dams resist water thrust and other overturning forces by their dead weight alone. Both concrete and masonry gravity dams have been constructed in India. As the flood discharges in our country are generally quite high, large spillways are required for passing the flood discharges.

A. Raw materials

The key raw materials for concrete dams are concrete itself and steel reinforcement. number of other materials and components made by specialty contractors which may be used in dam building and include steel gates and tunnel liners, rubber water stops, plastic joint-filling compounds to prohibit the movement of water, electrical controls and wiring, siphons, valves, power generators, a wide assortment of instruments, and even Teflon sheeting to line water outlet structures to prevent turbulence and cavitation (damage due to swirling water).

B. Design

Design of a concrete dam depends on the purpose of the dam and the configuration of the site where it will be built. Dams are of two general types. Overflow dams block flow in a stream and harness the water for generating power or to improve navigation and provide irrigation water. The components of an overflow dam are designed so the water can be released and the level of the water in the reservoir regulated by a series of sluice gates, spillways, or outlet tunnels

VI. Check Dam

The Plan of the present existing check dam is shown below:

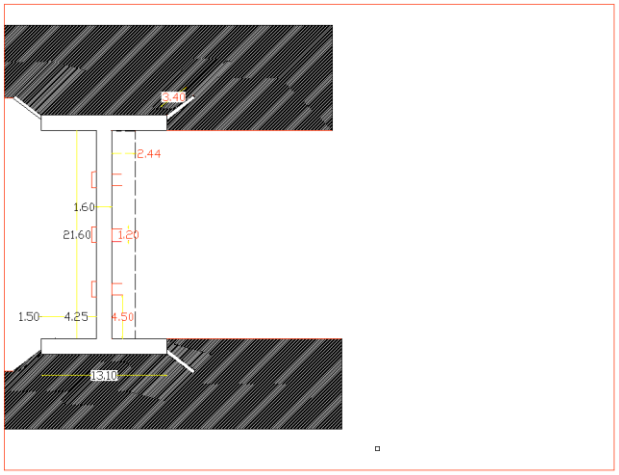

Fig.6.1: Plan of the constructed check-dam

The increasing width of the section towards the base is logical since the water pressure also increases linearly with depth as shown in the above figure. γ is the unit weight of water (9810 N/m³),W is the weight of the dam body.

The top portion of the dam is widened to provide space for vehicle movement. The flood water glides over the crest and downstream face of the spillway and meets an energy dissipating structure that helps to kill the energy of the flowing water, which otherwise would have caused erosion of the river bed on the downstream. The type of energy dissipating structure is called the **stilling basin,** which is provided for deceleration of incoming velocity filled water, released from a certain altitude. The stilling base was given a non-shrinkage quality thickness of **3.33m** with stone chips and Concrete pastes above it for proper protection against any external action of water.

Earth plugs (commonly called plugs), which are small structures about 1.5m deep is also constructed along the gullies for proper percolation and retention of water. The crest

and middle part are constructed with larger concrete blocks with larger cement to water ratio of 1:4 for a greater strength to the composite structure. Also the gates of the dam, is constructed of reinforced steel so that it can withstand the water-pressure from the water of the river.

The thickness of the dam at spillway level is 0.7 to 1.0 m (average 0.85 m), and the inclination of its downstream face is 30 percent (1:0.3 ratio); the thickness of the base is calculated accordingly. The upstream face of the dam is usually vertical to withstand the incoming flow of the current and also to prevent additional gully erosion.

The wings enters at a distance about 1 m into the sides of the gully to prevent sideways cutting of soil.

Fig.6.2: Front view of the constructed check-dam

VII. CONCLUSION

Present study shows that for a sustainable development of micro-watershed in any plateau and hilly areas, needs small and series of check-dams on small streams adjoining to bigger walls followed by rivers. These check dams were made to arrest the run-off of rainwater falling on a particular place of land in a span of a year. The optimum utilization of rainwater is solely dependent on the design and place of its construction of Civil Structures made for water-harvesting or storage.

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