

# A REVIEW ON THE IMPLEMENTATION OF SUSTAINABILITY TO IMPROVE THE DISCHARGE CAPACITY OF THE RIVER JEHLUM.

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*Abstract* : Sustainability is to maintain a safe level for the banks of the River Jehlum such that the degradation of the banks will not take place. This aim is achieved by making use of the geo-synthetics to strengthen the banks of the of the River Jehlum by providing reinforcement by using geo-synthetics which also act as the separator between the soil and the water such that the sludge deposition gets reduced up to a great extent due to which the water can pass easily in the peak flood season without clogging the banks thus reducing intensity of the floods by increasing the discharging capacity and hence preventing the damage to both the life and property.

*Key words*: River Jehlum , sustainability , discharge, geo-synthetics , degradation , river banks, flood.

## 1. INTRODUCTION

River Jehlum is one of the largest water bodies of the Kashmir Valley. All the hydro-water projects in the Valley are based on this water body. This water body has become a threat to the human life , animal life and property as it is prone to flood. The main cause of the floods is the presence of low lying banks , swampy and the marshy area which has been occupied over the time by the population for the urbanisation thus reducing the area for detention basin. During the peak floods due to excessive rainfall as there is reduction in flood channels and also the spill way that has been used as a regulator has also been clogged along with the time the water is not able to pass through the banks and hence overflows the banks due to which the entire city gets submerged. In September 2014, Srinagar city faced very devastating floods which resulted in the excessive devastation to the human life, property, cattle .The main aim of this study, is to provide the strong banks such that they are able to retain water in peak condition. The construction of a regulatory work such as a dam is avoided to reduce the pollution and such that there is no deteriorating effect on the flora and the fauna. There has been a rapid growth of 70% in the population in the past forty years within the Jehlum basin. Due to this urbanization and the tremendous increase in the population density , the demand for the land for the settlement of the people increases considerably .This excessive demand has led to the urbanization of the low lying areas along the left bank of the River Jehlum ; which actually before the urbanization were acting as the flood detentions. These urbanized areas are highly vulnerable to the damage of both the life and the property. Keeping under consideration the devastation caused by the floods in the past ,the discharge that was reduced along with the time due to the narrow banks due to the accumulation of the slit and the soil and also due to the excessive erosion of the banks due to the exposure to the running water. The main reason of the reduced discharged capacity of the River Jehlum is the presence of weak banks along the sides of the River Jehlum as the banks are made up of simple sand bags and due to the continuous dredging of the sand along the banks of the river. In this study by construction the new banks and strengthening the old ones by making use of the geo-synthetics to provide reinforcement to the banks and to act as a separator between the soil and the water such that the soil does not get deposited on the banks rather than by using the traditional sand bags .When sand comes in contact with the water the bulking of sand takes place due to which its volume gets increased up to ten times due to which the quantity of the sand that gets deposited on the banks also gets increased proportionally leading to clogging of banks thus reducing the discharge capacity of the River Jehlum.

## 2. GEO-SYNTHETICS :

According to the ASTM D 4439 a Geo-Synthetic may be defined as under:

It is a planar product which is manufactured from the polymeric material which can be used with the soil, rock, earth or any other geo-technical engineering related material as an integral part of a man-made project, structure or system. The term Geo-Synthetics is made up of two words i.e. Geo and Synthetics. Geo means earth and synthetics refers to the materials that are made by the humans. Geo-synthetics have emerged as an excellent material in the engineering field which find numerous applications in the various fields of the transportation, hydraulics, geo-technical and environmental science. These synthetic liners have been used since 1930's. The various functions performed by the geo-synthetics are as under:

- 1) Separation.
- 2) Reinforcement.
- 3) Filtration.
- 4) Drainage.
- 5) Containment of liquid or gas.

There are main two objectives in using the geo-synthetics, which are as under:

- 1) To perform in a better manner without any deterioration of the material and without any excessive leakage.
- 2) To be more economical than by using the old traditional materials.

## 3. TYPES OF GEO-SYNTHETICS : The various types of the geo-synthetics used are as under:

- 1) Geo-Textiles.
- 2) Geo-Grids.
- 3) Geo-Nets.
- 4) Geo-Membranes.
- 5) Geo-Synthetic Clay Liners.
- 6) Geo-Pipes.
- 7) Geo-Foam
- 8) Geo-Composites.
- 9) Geo Bag.
- 10) Geo Mat.

A brief description of all the above types is given as under:

- 1) **Geo-Textiles:** They are defined as the textiles which are composed of the synthetic fibres rather than the natural ones, as the bio-degradation of synthetic materials is not possible. These fibres are stretched into flexible porous fabrics by standard weaving machinery or are matted together in a non-woven fashion. These are porous towards liquids up to a great extent.
- 2) **Geo-Grids:** They are plastic materials, that are formed into a very open grid like configuration i.e. With larger apertures between the individual ribs in the machine and cross machine directions. They are mostly used to provide reinforcement.
- 3) **Geo-Nets:** They are also known as the Geo-Spacers. They are made up of a continuous set of the polymeric-ribs at acute angles to one another. They are mostly used in the drainage areas.
- 4) **Geo-Membrane:** These are relatively thin, impervious sheets of the polymeric materials which are used as a lining and covers for the purpose of the liquid storage. It is mostly used in reservoirs.
- 5) **Geo-Synthetic Clay Liners (GCL):** These are a combination of both polymers and natural soil materials. They are made into rolls of the factory operated thin layers of bentonite clay which is sandwiched between the two geo-textiles or bonded to a geo membrane. They are mostly used for environment and containment applications.
- 6) **Geo-Pipe:** It is also known as the Buried Plastic Pipe. It is one of the original synthetic materials which is still available. It has a drainage function but it should be designed properly.
- 7) **Geo-Foam:** It is a product which is created by the process of the polymeric expansion which results in the formation of the foam, that is composed of many closed but gas filled cells. It acts as a good separator.
- 8) **Geo-Composites:** It consists of a combination of geo-textiles, geo-grids, geo-nets and geo-membranes, in a factory fabricated unit. All the above mentioned materials can be combined with any other synthetic material or with the soil.
- 9) **Geo Bag:** It is a geo-synthetic product which is made up of polyester, polypropylene. It is used for the protection of the river banks from the erosion.
- 10) **Geo-Mat:** They may be defined as the three dimensional geo-synthetic materials which are thermally jointed with each other.

- 4) **LITERATURE SURVEY:** The various research papers consulted for the use of the geo-synthetics to increase the discharge capacity of the River Jehlum are as under:

**4.1 Geo-Synthetics for water ways and Flood Protection Structures (2014), Heibaum Michael :** The main aim of the author is to control the interaction between the water and the soil ; this is also required to control the erosion. As there is more interaction between the soil and the water more will be the erosion and vice-versa. According to the author , in many cases , it has been observed , that the geo-synthetics , can be designed to control the interaction between the soil and the water. Geo-synthetics provide strength , flexibility , imperviousness and drainage , durability and controlled degradation. Geo-Synthetic is mostly a woven fabric , which is placed across the path of the flowing fluid carrying fine particles in suspension. The main aim is to retain the particles and let the fluid to pass away. The first water structure where the geo-membranes have been used for the first time is Sabetta Dam in Italy in 1959 , which has been lined with poly-butylene. Geo-Synthetics act as a fluid barrier function as compared to the conventional materials used. It provides the function of the reinforcement and , carries the tensile load , and hence maintain the stability of the soil.

**4.2 Use Of The Geo-Synthetics & Geo-Membrane Tubes To Construct The Temporary Walls In The Flooded Area (2011), Isaac.L.Howard.**

The geo- synthetics are mostly used in the form of the geo-textiles and geo-membranes .The main objective is to construct a stable wall within a flooded area by making use of the geo –textiles and geo-membrane tubes. Main focus is given towards the stability of the geo-synthetics ; stability analysis of the geo- membranes and geo-synthetics tubes is done in such a way , such that we are able to assess the stability of the wall during the critical conditions of the flood. The soil is to be de-watered by making use of the geo-synthetic tubes. The method generally followed is to fill a material such as sand , slurry within the thin membrane for the purpose of developing the resistance to the applied load . High slump concrete was pumped into a Geo-Tube units in Chivor Dam in Colombia. These are used to prevent the following problems:

- 1) Erosion ; beach erosion and protect coastal infrastructure.
- 2) Protect the slopes.
- 3) Protect the bridge piers.
- 4) Protect the under-water structures.

**4.3 Geo-Textiles in The Embankment Dams (2008), Rehabilitation Federal Emergency Agency.**

The geo-textiles fail to perform in the critical area of the dam and should not be used there. They should be avoided in the embankment dams. When geo-textiles are deeply buried into a dam they provide proper results as in case of the Valcross Dam , which has been performing successfully since last thirty years . They have a tendency to get damaged during the installation . Due to which the clogging increases and reliability decreases up to a great extent.

**4.4 Review Of The Water Quality & Improvement In The Performance of Geo-Textiles Within Permeable Pavement Systems (2013) , Milkas Scholz Civil Engineering Research Group, University of Salford ,England.**

The sustainable drainage systems are increasingly being used as the ecological engineering techniques to prevent the contamination of the receiving water-courses and the ground water. The role of the geo-textiles is addressed directly. Geo-Textiles help in retaining the suspended material but improves the quality of the water only up to a small extent as it is made up of the chemicals ; due to the presence of the various chemicals it leads to the clogging. Thus , with the help of the geo-textiles the pavement is made safe but the quality of the water is deteriorated up to a great extent.

**4.5 Advancement In The Geo-Synthetic Materials And Application For The Soil Reinforcement And The Environment Protection Works , Ennio . M .Palmeria ,University of Brasilia.**

The Geo-synthetics have become a well established construction material for the environmental applications all over the world. The Geo-Synthetics have been regularly used in the various environmental applications since last four decades. These are used for the reinforcement of the soil. Various Geo-Synthetic polymers in the form of the geo-textiles , geo-clay liners geo-membranes and are used to act as a barrier between the soil and the liquid.

**4.6 Fluid Migration Through Geo-Membrane Seams And Through The Interface Between Geo-Membrane and Geo-Synthetic Clay Liners (2005) , Joseph , Fourier-Grenoble.**

The quality of the geo-synthetics is assessed and is analysed properly. The quality of the various geo-membranes is assessed properly. The fluid migration through geo-membranes , composite liners comprising of geo-membrane with a circular are assessed. These tests are conducted in the field. After conducting the various tests ; the new flow rate is determined by making use of the empirical formulae and is measured.

#### 4.7 The Recent Development In The Geo-Synthetics,G.Venkatappa Rao&P.K . Banerjee.

The stress has been made in the field of the geo-synthetics.They are used to improve the various soil and the ground conditions.Actually, the failure of the structure mostly occurs due to the presence of the weak sub soil conditions.In the last decade , the use of the geo-synthetics has increased continuously and has given highly positive results.They are used to provide reinforcement , act as a fluid transmission and act as a separator.It acts as a moisture barrier and is used as a canal lining.

#### 4.8 Geo-Synthetics In Geo-Environmental Engineering (2015), Werner.W.Muller&Fokke Saathoff.

Geo-Synthetics are the planar polymeric products which are used with the soil , rock or soil like materials to fulfil the various functions.Geo-synthetics are considered as of the ever-growing importance in the construction industry .Sealing of the waste water storage facilities to safely prevent the emission of the water water , landfill gas and the contaminated dust as well as the protection against the storms and the floods and re-construction after the natural disaster , are the important fields of the application .The numerical simulation of the interaction between the soil and the geo-grids is studied.The geo-synthetics are evaluated as the most economical and providing most of the environmental benefits

#### 4.9 State of The Art Review of The Geo-Synthetic Clay Liners (2017) ,De- Chu Kong &Hawai-Na Wu.

Geo-Synthetic Clay Liners (GCL) have achieved a wide spread importance all over the world due to its property of the low hydraulic conductivity and its ability to heal the local damage.Over the past few decades a number of studies have been carried on the GCL and its various properties such as self – healing , water compatibility , hydraulic conductivity , water swelling , gas migration and also the mechanical behaviour which includes the creep.

- 5) **CONCLUSION:** The conclusion that is made from the above discussion is that using the geo-synthetics with soil to act as a barrier between the soil and the water at various flood structures and natural water body to obstruct the soil from getting deposited on the banks to reducing silting and the banks from getting raised , thus increasing the discharging capacity of the water body.It can be concluded that geo-synthetics have replaced the the sand bags and soil due to its various properties.They help in increasing the stability of the structures thus reducing the intensity of the floods.

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