# Chapter 1 ACTION PLAN FOR CATCHMENT AREA TREATMENT

## 1.0 Introduction

Soil erosion by water occurs throughout the world, especially more in the mountainous region and threatens natural environment and agriculture productivity. It is the process of detachment or entrainment, transportation of surface soil particles from original location and accumulation of it to new depositional area. Soil erosion by running water has been recognized as the most severe hazard threatening the protection of soil as it reduces soil productivity by removing the most fertile topsoil. The loss of topsoil and terrain deformation due to soil erosion are the consequence of deforestation, removal of natural vegetation and overgrazing in the mountainous regions, Accelerated soil erosion has adverse economic and environmental impacts. It creates on-site and off-site effects on productivity due to decline in land/soil quality. The current rate of agricultural land degradation world-wide by soil erosion and other factors is leading to an irreparable loss in productivity on about 6 million hectare of fertile land a year. Asian rivers contribute about 80 % per cent of the total sediments delivered to the world oceans and amongst these Himalayan rivers are the major contributors. The Himalayan and Tibetan regions although covers only about 5% of the earth's land surface but supply around 25% of the dissolved load to the world oceans. In India about 5334 Mt 2(16.4 ton/hectare) of soil is detached annually, about 29% is carried away by the rivers into the sea and 10% is deposited in reservoirs resulting in the considerable loss of the storage capacity. In India it is estimated that about 38 % out of a total reported geographical area, that is about 127 million hectare are subjected to serious soil erosion.

In the mountainous catchments of Himalaya likethat of the Bursar Watershed, conventional methods of soil loss estimation are time-consuming and costly. Therefore, Sediment Yield Index (SYI) model was used for the estimation of soil loss using various input parameters in a GIS environment. Simulation models are the most effect way to predict soil erosion processes at watershed level and use multi-criteria analysis

for prioritization of the micro-watersheds for effect soil erosion control. The efficient and optimum management and conservation of soil, land and water resources is best achieved based on the watershed prioritization scheme. Normally, the soil erosion control strategies are developed and applied following prioritization and landscape planning. Prioritization plays a key role in identifying areas that require attention. The Watershed Atlas of India published All India Soil & Land Use Survey, Ministry of Agriculture and Cooperation; Govt. of India (1990) has been referred for delineation from watershed to micro-watershed level.

### 1.1 Catchment area treatment plan

Marusudar river catchment receives a large proportion of precipitation in the form of snowfall in the upper catchment while it is rainfall that is mainly received in the middle and lower parts. The terrain comprises very steep slopes to escarpments. These two factors are responsible for soil erosion by way of sheet erosion, rill erosion, gully erosion, bank erosion by streams, glacier erosion and landslides. In addition to these natural erosion processes that are active in the region, various project related construction activities would accentuate this erosion process. The landslides in the area are caused mainly by geological, hydrological and seismic factors. One or combination of all these factors causes the landslides in the rainy season. Recurrent blasting for tunneling, etc. during the construction period might also trigger off minor slips/ landslides due to the reduction of shear strength of rock material.

Therefore, catchment area treatment plan has been formulated with the main objective of arresting soil erosion in the catchment area up to dam site. Based upon the topographic factors, soil type, climate, landuse/vegetation cover in the catchment area various measures, both engineering/mechanical and biological are being proposed to be undertaken with the aim to check the soil erosion, prevent/check siltation of reservoir and to maintain its storage capacity in the long run. The engineering measures will comprise construction of a number of check dams/walls, retaining walls, wire crates, etc. for gully control, stabilisation of flood prone nallahs, landslides/slopes, river banks, roads, etc.

The Bursar is situated within the jurisdiction of Kishtwar district. Bursar Project (longitude $75^0$ 47′ 06′′ E and Latitude $33^0$ 30′ 38′′ N), with storage capacity of more than two million acres feet and the power generation capacity of 800MW is a storage scheme that would be constructed on 133-km long Marsudar River, the right bank tributary of river Chenab in Dachhan-Marwah area of Kishtwar District of J&K.

### 1.2 Objectives

The Bursar Project catchment area treatment plan has been prepared with the following objectives:

i) Checking soil erosion and land degradation by taking up adequate and effective soil conservation measures in erosion prone areas (very severe and severe).

ii) Rehabilitation of degraded forest areas through afforestation and facilitating natural regeneration.

iii) Rehabilitation of degraded slopes and landslide prone areas.

### 1.3 The Problem of Soil Erosion

Different types of erosion that occurs in the catchment of Marusudar are i) sheet erosion i.e. washing of surface soil from arable land is the first step in soil erosion, ii) gully erosion is the aggravated form of rill erosion and iii) stream bank erosion. Soil erosion is an important social and economic problem and an essential factor in assessing ecosystem health and function. Estimates of erosion are essential to issues of land and water management, including sediment transport and storage in lowlands, reservoirs, estuaries, and irrigation and hydropower systems. Sustainable use of mountains depends upon conservation and potential use of soil and water resources.

### 1.4 Soil Erosion Estimation

"Sediment Yield Index" (SYI), method was used to estimate the soil erosion in the Bursar watershed. In this method, the terrain is subdivided into various sub-watersheds and the erodibility is determined on relative basis. SYI provides

comparative erodibility criteria of catchment (low, moderate, high, etc.) and does not provide the absolute Sediment yield. SYI method is widely used mainly because of the fact that it is easy to use and has lesser data requirement. Moreover, it can be applied to larger areas like sub-watersheds, etc. The application of SYI model for prioritization of sub-watersheds in the catchment areas involves the evaluation of:

- Climatic factors comprising total precipitation, its frequency and intensity,
- Geomorphic factors comprising land forms, physiography, slope and drainage characteristics,
- Surface cover factors governing the flow hydraulics and
- Management factors.

Various thematic layers such as effective rainfall, drainage, drainage density, delivery ratio and rainfall erosivity were used in a GIS environment for SYI method. The details about the input parameters and their integration for soil erosion estimation are described in the chapter.

**1.5 Drainage:**

A major stream of water and its tributaries constitute a drainage system of the Bursar watershed. Drainage systems are made up of an interconnected network of streams which together form particular patterns. Some of the common patterns of drainage are dendritic, rectangular, radial, and centripetal and trellis pattern. The Drainage map was prepared from ASTER DEM. Drainage pattern shows the area is having a dendritic type of drainage pattern as shown in **figure 1.1.**