

## **Neutralization of Acid Mine Drainage Contaminated Water and Ecorestoration of Stream in Coal Mining Area of East Jaintia Hills, Meghalaya**

Coal mining is an environmentally detrimental activity which adversely affects various environmental components such as water, soil, air, flora and fauna etc. The water resources, in particular are severely affected by contamination of acid mine drainage (AMD) which is generated by chemical reaction of pyrite minerals with water and air. As a result, stream water of the mining area often becomes acidic and devoid of aquatic life. Such water is unfit for human uses and thus affects livelihood and life of the people in and around the mining area. Environmental effects can be severe if mining activity is unscientific and lacks environmental safeguards.

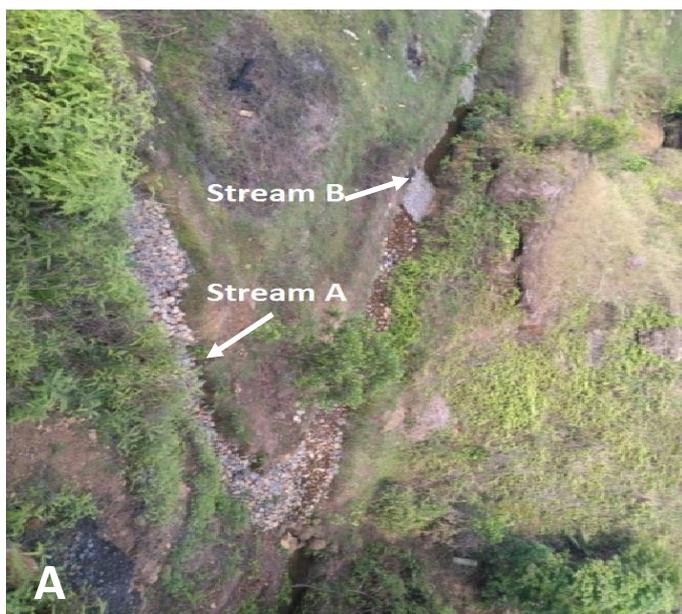
Coal of Eocene age is found in Meghalaya both in Khasi, Jaintia and Garo Hills. The sub-bituminous tertiary coal found in the state is characterised by high sulphur content (2%–8%), high volatile matter and vitrinite, low ash content and high calorific value. In addition, coal contains many environmental sensitive organic compounds and mineral bound elements responsible for causing air, water and land pollution. In Meghalaya, Jaintial Hills is a major coal producing area with an estimated coal reserve of about 40 million tonnes. Sutnga, Lakadong, Musiang-Lamare, Khliehriat, Ioksi, Ladrymbai, Rymbai, Byrwai, Chyrmang, Bapung, Jarain, Shkentalang, Lumshnong, Sakynphor etc. are the main coal bearing areas.

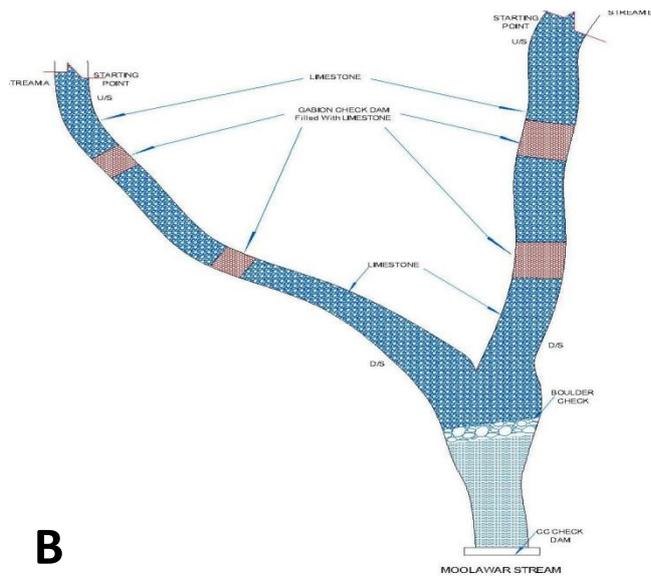
'Rat-hole' Primitive mining method is commonly practiced for extraction of coal. This unscientific mining has brought severe environmental degradation in and around the coal mining areas such as alteration in the land cover/land use pattern, change and denudation of forest cover, air, water and soil pollution; degradation of agricultural fields; scarcity of clean potable water and other major environmental problems related to natural resources. Lack of any post mining treatment activity and environmental safeguard make the fragile ecosystems more vulnerable to environmental degradation.

Acid mine drainage generated from active and abandoned mines, coal storage sites and overburden rocks are the main cause of surface water pollution in coal mining areas of Jaintia Hills, Meghalaya. AMD contaminated stream water in Jaintia Hills has become highly acidic (pH as low as 3.0 to 4.0). Due to acidity other parameters of water quality have also been deteriorated and stream water can be seen coloured, turbid and rich in unwanted elements. Such water is unfit for human uses and thus poses scarcity of water supply meant for domestic and irrigation purposes. The coal mining in Jaintia Hills, Meghalaya is not only associated with surface water pollution, but also responsible for degradation of aquatic

habitats and loss of aquatic life. In some areas of Jaintia Hills, people do not have access to clean water and hence are forced to depend on acidic water available in the streams. In spite of serious environmental, health and socio-economic implications of AMD contaminated surface water in the coal mining areas of Meghalaya, very little has been done to tackle these problems. In order to find a solution to the problem of acidity, study was undertaken to improve the water quality of Moolawar stream in Mukhaialong village, East Jaintia Hills District, Meghalaya, India. The Open Limestone Channel (OLC) using locally available limestone rocks was used to reduce the acidity of stream water. The Open Limestone Channel (OLC) was found cost effective and technically feasible in rural area to raise pH of stream water near to neutral, improve aquatic habitat and restore many aquatic flora and fauna in treated water.

**Study Site:** The study was conducted at Mukhaialong village in East Jaintia Hills District. The village has about 300 households situated at an elevation of 1299m between  $25^{\circ}.39'467''$  N Latitudes and  $92^{\circ}.26'216''$  E Longitudes. The undulating landscape of the area is interspersed with agricultural fields and coal mines. The field experiment was carried out on a small tributary of river Myntdu, the Moolawar stream located near the village. The stream is used for domestic purposes by the villagers. However, being located in coal mining area both the streams are contaminated with AMD and thus carry acidic water having pH in the range of 4.3 to 5.0. The pH value drops further in winter months when water discharge of the streams reduces drastically due to absence of rainfall.





**A.** Photograph showing aerial view of Moolawar Streams (Streams A and B); **B.** Diagrammatic representation of Open Limestone Channel (OLC); **C & D.** View of Open Limestone Channels constructed on Moolawar Streams at Mukhialong Village, East Jaintia Hills District, Meghalaya

**Neutralization of acidity and improvement in water quality:** Since, acidity was the main cause of water pollution in coal mining area, neutralization of acidic water of streams can be a solution to water pollution to some extent. Hence, a simple low cost method of neutralization by constructing an Open Limestone Channel (OLC) has been attempted using locally available limestone. The stream water was allowed to pass through the layers of limestone which gets reacted with acidic water and raises the pH from 4.31 to 6.57. After the water has been neutralized, reappearance of many aquatic flora and fauna including two species of fishes and some insects has been observed which indicates that the water quality has been improved. OLC was found to be cost effective and technically feasible in rural area. Success of this study has encouraged for undertaking more such projects in the mining affected area of Jaintia Hills for the improvement water quality of affected streams. Details of the study and associated improvement in water quality and aquatic ecology was published in [Mine Water and the Environment](#) volume 38, pages 551–555 (2019).