

An Indian-Australian research partnership

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| Project Title: | <input type="text" value="Geospatial monitoring of opencast mines' waste dumps to predict the soil erosion rates and evaluate the associated environmental effects"/> | |
| Project Number | <input type="text" value="IMURA0349"/> | |
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Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address?

(Feel free to nominate more than one. For more information, see www.iitbmonash.org)

1. **Advanced computational engineering**, simulation and manufacture
2. Infrastructure Engineering
3. Clean Energy
4. **Water**
5. Nanotechnology
6. Biotechnology and Stem Cell Research

The research problem

There are number of mines which carryout mining by open cut method to win the coal. The mines would have to move a lot of overburden (OB) and interseam material before they can mine the coal itself. The OB is transported to a nearby overburden dump, which is being progressively rehabilitated to pasture and bushland. This intense mining have had their impact on the soil and

neighboring habitats inclined to it, soil erosions, contamination of soil, pollution spreading to underground water tables etc. are few of the most drastic effects of mining and their waste. This is scenario will raise, beyond control until some rapid steps are taken to control and prevent the damage from becoming permanent effect, making it a necessity to approach this situation with intense hunger to reduce the ill effects of the mining on soil.

Project aims

1. To quantify the relation between the erodibility of the batters and covers and the erosivity of the hydraulic forces that cause their erosion by:
2. To determine the hydrological characteristics of the slopes.
3. To validate computer-based hydrologic and erosion models suitable for use in optimizing the rehabilitation design
4. Geospatial technology is best suitable to study large area in effective manner.

Expected outcomes

- This study will benefit in understanding the hydraulic properties and their relationship to soil erosion
- This research helps to develop a geospatial data about the mining land use and land change aspects in the Latrobe Valley
- This study will help in validating various models for soil erosion study
- This work will produce a soil erosion prediction model suitable for Gippsland region.
- Will complement the other ongoing investigations into the impacts due to coal mining and can deliver better environmental outcomes
- Will assist the industry in transition to low carbon economy by rehabilitant soil using optimized erosion controls and by growing crop that hold soil and prevent erosion.

How will the project address the Goals of the above Themes?

- a) Identifying, for the slopes and channels at RUM, relationships between the hydraulic forces of erosion and slope angle, slope length, material, and vegetation cover;
- b) Evaluating the hydraulic force parameters which determine sediment transport, namely, the shear stress, velocity and power required to entrain sediment, maintain transport, and below which deposition occurs on slopes and in channels;
- c) Determining the texture of material transported by flows;
- d) Determining the nature of armoring and its effect on erodibility of slope materials;
- e) Developing relations between sediment transport rate and hydraulic parameters of shear stress, velocity, and stream power.
- f) Describing the infiltration characteristics of the batters and covers by evaluating saturated hydraulic conductivity, time of ponding, infiltrability rates and parameters of the Phillips

and Horton infiltration equations;

- g) Determining the hydraulic parameters required for hydrological models, namely, roughness characteristics of surface materials on the slopes and in the channels
- h) Determining the influence of the vegetation on the effects of rainfall and on the slope hydrology.
- i) Preparing inventory map of study area and classification land using the hydraulic properties
- j) Thematic and thermal processing of the imageries to locate stress spots on land due to hydraulic properties
- k) Designing models to suggest optimum slope height
- l) Develop prediction model for soil erosion due to hydraulic properties and slope height

Capabilities and Degrees Required

A postgraduate engineer (M.E./ M.Tech. in any branch of engineering) with an interest in soil science; a sound understanding of statistical methods; excellent computer programming skills (in GIS, C and/or Matlab, and/or scripting languages)