CHAPTER-7

LAND USE MANAGEMENT

7.1 INTRODUCTION : Land is a basic resource of man. It plays a dominant role in determining the people's physical environment as well as economic, social and cultural progress. It is often described as a nation's ultimate asset. The asset, being non-elastic, a judicious and rational use of it is of paramount importance in view of the ever-increasing population growth, resulting in decreased man-land ratio. Further, the ever-growing needs, unlimited demands on a variety of land uses and diversified occupation pursuit necessitate proper planning for rational utilization of land. The teeming population with their expanding socio-economic activities in Ajay Damodar Interfluve, Asansol Subdivision, makes the land highly valuable and it is expected that the value of land will increase further in future. The environment in the region is also getting more and more polluted. Besides, the land in the present study area is not being used properly to get the maximum potentiality from it. In this perspective the need of land use planning and environmental management plan are really crucial. Moreover the study of various problems of the region in chapter 6 indicates that some strategies have to be formulated as the most desirable guidelines for the future development of the region.

In order to protect and improve the natural and man-made environment, existing environmental condition should be studied intensively. An environmental management plan spells out the actual working details for implementation of the various protections, mitigation and enhancement measures recommended for the upliftment of the existing condition of the environment.

Land use planning can be defined as those suggestions which provide a new set of land use patterns considering local existing physical, economic and cultural conditions in order to achieve the best possible use of land in future.

It is observed that existing land use pattern in the present study area is not the requirements of future. It is well known that planning is the key to minimise the adverse effects on land and to achieve the best possible after use of the land in a particular area. In the present study, therefore, the local physical, cultural and economic conditions have been analysed prior to everywhere in accordance with the interplay to suggest any new land use pattern. After identifying and analyzing the present situation as well as the problems it has been felt necessary to formulate policies as remedial measures.

Like the highly diversified socio-economic condition of Ajay Damodar Inetrfluve the use of land is also changing simultaneously. This needs dynamic land use planning. Land uses planning should not be static either temporally or spatially and should be revised periodically. The same conception echoed in the words of Prof. Stamp, "Land use planning is in essence the determination of the optimum use of every acre of land which must be elastic and can change from time to adopt the changing conditions". R.B.Mondal considered that land use planning should start from the present position of the land and should be based on a careful objective, detailed survey and analysis of the present land use pattern whose future use must satisfy the basic needs of mankind. He considered food, shelter, work, recreation, movement, and security as six basic needs. So the environment and land should be managed in such a planned way that they can bear benefits and can satisfy the material and spiritual needs of the inhabitants of the present study area.
7.2 AFFORESTATION

7.2.1 INTRODUCTION:
Ajay Damodar Interfluve was once called “Jungle Mahal” due to its dense forest cover, which has now been almost completely depleted due to increasing human interference. The vegetation which are found nowadays are mainly secondary in origin. Social forestry has been taken up but is concentrated within limited areas.

7.2.2. STEPS TO BE TAKEN

7.2.2.1. MAJOR STEPS TO BE TAKEN

The present situation cries for the scientific management of forest which include major three following steps:

1. Rehabilitation
2. Reclamation
3. Afforestation.

These three measures are not the last word to reach the desired goal to reorganize the region as much as possible. Local administration and social organizations have to come up to take some measures locally. Moreover mans awareness is supposed to be very important in order to maintain the vegetation cover in the present study area.

7.2.2.2. DETAILS OF THE STEPS TO BE TAKEN:

The detailed steps which should be taken immediately are as follows:

1. Rehabilitation: Rehabilitation means regularization of fellings and regulation of the cut, so that it does not exceed the annual increment. Suitable steps should be taken to fully regenerate the felled areas, either naturally with suitable species or else artificially by planting in patches, in strips or wholesale. Forests should be carefully protected against illicit fellings, overgrazing and diseases.

2. Reclamation: The region possesses an extensive tract of ravine and gullied area, specially in the western undulating plateau edge belt and along the banks of Ajay. In addition a considerable area known as “marginal lands” is in a state of acute erosion requiring immediate attention to prevent it from becoming ravines. Hence the importance of ravine reclamation to utilise the land for growing wood and fodder is felt badly. Thus unproductive ravine tracts can be reclaimed by afforestation. The reclamation of the original woodland prior to expansion of human activities is also necessary at least from the viewpoint of genetic restoration. Afforestation has already been done in some areas at and around Maithan (Plate 7.1 A, B, C and D).

3. Afforestation: Afforestation is the most vital aspect of all kinds of needs. This will fight against environmental degradation of the region, this will provide useful resources, this will restore organic species, aesthetic beauty and hygienic environment. The technique of plantation and type of plant species to be adopted varies according to local conditions. Choice should be made of species that are hardy and grow on this area formerly and are growing in adjoining similar areas.

4. Mass awareness: Mass awareness is thought to be an important step towards afforestation in the present study area. The Forest Departments of Barddhaman and Durgapur are continuously
trying to increase awareness among laymen through seminar, meeting, workshop, procession etc.

for protecting the forest. People should protect the trees and plants in their locality. In some villages
Forest-Protection Committee has been established to grow more and more Sal and some other
trees which have high commercial value.

(5) **Plantation along the earthen ridges**: Trees can be planted along the earthen ridges around
the agricultural plots. There remains some confusions regarding plantation along the earthen ridges
like,

a) the shades created by the planted trees may be harmful for the agricultural crops,
b) planted trees may suck up the water and nutrients of the agricultural plots,
c) the seeds, branches of the planted trees may create some problems to agricultural crops,

All these may create some problems but if the methods of plantation along earthen ridges are
maintained properly this will create a new means of additional income. The rules that should be
maintained while planting along the ridges are as follows:

a) seedlings should be planted only along the earthen ridges running east-west direction. This
will cast the least amount of shadow on the agricultural plots.
b) Plantation should be done at an interval of at least 10' which will provide adequate space for
branching of the trees.
c) Branches of the trees should be cut frequently and regularly.

Earthen ridges usually remain useless. But plantation along the ridges may produce wood for
fuel and furniture as well as fodder. It is estimated that a new means of additional income of about
Rs 3000 to 4000 can be generated per year by planting only 20 trees along the earthen ridges.
Similarly the narrow strip of land along banks of rivers, roads, railway lines and canals under private
or Government ownership remain barren. Plantation along these lands may be a profitable business
(Table 7.1 Fig 7.1) to the owner of the land. Leaves of the planted trees will introduce humus and
organic matter to the agricultural land.

**Table 7.1**: Approximate market value and amount of forest product from different species of
plant at different ages.

<table>
<thead>
<tr>
<th>Age of species</th>
<th>Name of species</th>
<th>Approximate amount of forest product</th>
<th>Approximate market value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Size of pole (inch)</td>
<td>Weight of fuel (kg.)</td>
</tr>
<tr>
<td>3 Years</td>
<td>Akashmani</td>
<td>3&quot;</td>
<td>7.50</td>
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<td></td>
<td>Eucalyptus</td>
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<td>2.75</td>
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<tr>
<td></td>
<td>Subabul</td>
<td>2.5&quot;</td>
<td>5.50</td>
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<tr>
<td></td>
<td>Sishu</td>
<td>2&quot;</td>
<td>5.00</td>
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<tr>
<td>Age of species</td>
<td>Name of species</td>
<td>Approximate amount of forest product</td>
<td>Approximate market value</td>
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<tr>
<td></td>
<td></td>
<td>Size of pole (inch)</td>
<td>Weight of fuel (kg.)</td>
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<tr>
<td>5 Years</td>
<td>Babla</td>
<td>2&quot;</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>Akashmani</td>
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</tr>
<tr>
<td></td>
<td>Eucalyptus</td>
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<td>17.50</td>
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<tr>
<td></td>
<td>Subabul</td>
<td>5&quot;</td>
<td>21.25</td>
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<tr>
<td></td>
<td>Sishu</td>
<td>5&quot;</td>
<td>20.00</td>
</tr>
<tr>
<td></td>
<td>Babla</td>
<td>4&quot;</td>
<td>19.50</td>
</tr>
<tr>
<td>7 Years</td>
<td>Akashmani</td>
<td>9&quot;</td>
<td>60.00</td>
</tr>
<tr>
<td></td>
<td>Eucalyptus</td>
<td>7&quot;</td>
<td>41.25</td>
</tr>
<tr>
<td></td>
<td>Subabul</td>
<td>9&quot;</td>
<td>59.50</td>
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<tr>
<td></td>
<td>Sishu</td>
<td>7&quot;</td>
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<tr>
<td></td>
<td>Babla</td>
<td>5&quot;</td>
<td>42.00</td>
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</tbody>
</table>

**Source:** Forest Department, Barddhaman

6) **Social forestry:** Local organizations like Bumpur Notified Area Authority, Asansol Municipality, Forest Departments of Durgapur and Barddhaman, local clubs have taken up the social forestry schemes which give emphasis on:

a) Afforestation,

b) improvement of the quality of timber,

c) conversion of wasteful cutting into quality yield harvesting,

d) increase in forest protection,

e) expansion of forest area,

f) development of fast growing trees,

g) control of harmful forest agents,

h) development of useful varieties and

i) use of disease resistant varieties.

7) **Measures taken by local authority:** Protection of existing plants and the regeneration of new plants are the main procedures to get rid off the major hazards existing in the present study area. Although this would not help to return immediately to the prior forest tract but it would at least help to retain the existing one. For this reason the Forest Department of Barddhaman is now working for creating green canopy on the arid region to save the ecology of the region. The most important
objectives of this forest department are as follows:

a) protection of existing forest,

b) regeneration of new forest,

c) quick materialization of various plans and projects,

d) creation of man's awareness and

e) scientific production, utilization and distribution of some useful materials from forest like grass, wood fuel, leaves etc.

Bumpur Notified Area Authority is now producing seeding in nursery and distributing them for plantation among people at the free of cost. The seedings of Sisoo, Segun, Neem, Sonajhuri, Eucalyptus, Siris etc. are planted for wood and fuel; Safeda, Guava, Mango, Jackfruit, Cashewnut, for fruit; Gulmohar, Dwarf Gulmohar for flower; Dewdar, Thuga as decorative plant. Some people have planted the seedings of Guava, Papaya, Bakphul, Lemon at the site of homestead as useful plants (Plate 7.1 G).

8) Joint Forest Management: The people should work shoulder to shoulder with administration to implement the forest development work in their locality. The people and forest managements joint effort along with the Government was eventually adopted at Arabari village at Medinipur district in West Bengal. The model is now followed in many parts of India. This model can also be followed in the present study area. While implementing the ecodevelopment programmes it came out very loudly that it is particularly necessary to give a far more rigorous protection to the government forest lands and save the remaining stands of forest cover from being mercilessly felled by the forest exploiters. In West Bengal, the local voluntary forces, for example, the School of Fundamental Research - gave lead to the people's own forest conservation and protection movements in Ajodhya forest area in Purulia district. With a view to establish the usufruct rights of the forest dwellers on the forest produces, a movement had to be launched, to which finally the Government agrees and suitable acts and orders were promulgated to admit the usufruct rights of the forest dwellers and the neighbouring adivasis and allow them to have a share of the forest products in lieu of the protection the forest rendered by them (Das Gupta, 1998).

7.3 PLAN FOR CONTROLLING SUBSIDENCE AND UTILISATION OF SUBSIDED AREAS

7.3.1. INTRODUCTION:

Subsidence of land is one of the important environmental problems of Ajay Damodar Interfluve, Asansol Subdivision. After the discussion of the present researcher with some of the mining specialists it is revealed that it is not at all an easy task to resist subsidence on an immediate basis in the present study area which is already suffering from a large number of subsidences and also suffering from the future danger. In these circumstances the present researcher will recommend that the measure to resist future subsidence should be taken prior to any other reclamation measure. Only a particular type of procedure to resist subsidence may not be successful in all the cases. The cause and extent of subsidence vary greatly from place to place, so does the nature of subsidence. The measure to resist subsidence, naturally, should vary according to the requirement and suitability.
Moreover the measures vary considerably in approachable and unapproachable areas. It is the responsibility of the engineers and technical persons to determine the particular type of measure that will be suitable for a particular type of subsidence. The present researcher will only recommend that next to stowing, it is very important to ascertain the effectiveness of stowing.

7.3.2. RECOMMENDATIONS

It is now clear that the problem of subsidence is of large magnitude and solutions have to be planned and executed in a concerted manner. The problem at this stage is not technical alone. It involves social and human aspects too. To minimize the severity of deformation of the surface, the following points may be taken into consideration:

(1) A coordinating and monitoring organization should be established to perform the following duties:
   a) collection of detailed reports on subsidence and potholing,
   b) collection of information about the mine workings in such case,
   c) maintenance of subsidence plans of vulnerable areas,
   d) preparation of data bank in connection with the subject,
   e) co-ordination with research organizations in the field for conducting or monitoring researches and use of equipment where necessary and
   f) making detailed studies of cases and formulate proposals for measures to be taken to make the areas safe.

(2) It is sometimes needed to evacuate an area before stowing but the most important human problem is that a man affected or likely to be affected by subsidence would not like to abandon his cloister and hearth, even if alternate accommodation is offered. This is for his deep-rooted sentiments. Further the offerer becomes a suspect in his view, because he thinks that the promises given to him may not be fulfilled. However, when the problems becomes unavoidable, somewhere a beginning has to be made and the small habitable area may be taken up first with whatever method possible that is persuasion, law and force etc. Persons can be persuaded to shift if alternate accommodation is offered, like the one at Falsadanga (near Kulti) where villagers are willing to vacate if alternate accommodations are offered. But in that case a time-bound programme has to be implemented for offering temporary accommodation, permanent alternate accommodation and necessary amenities. This will establish the creditability of the offerer and thus may motivate others to vacate. So a beginning is necessary and where to begin and how to begin may be decided by the authorities concerned. Keeping this problem in consideration Government is trying to develop a satellite township in Mangalpur to reduce the population burden from unsafe areas, specially Raniganj.

(3) It is not that persons have to be vacated from the concerned area in every case. In some cases structures like rail line, road, building etc. may have to be shifted to safer areas. As mentioned earlier G. T. Road near Kulti and J. K. Ropeway and Eastern Railway Main line near Nimcha are under acute danger and so need to be shifted.
(4) General public do not always know which area is unsafe on surface as there is no such demarcation. It is a common knowledge that whenever a public thoroughfare is known to be dangerous due to bumps or curves or narrowness etc., signboards are placed at different points to guide the traffic properly. On a similar analogy it may be suggested that such dangerous areas as declared unsafe or thought to be dangerous, should be conspicuously marked, so that a person intending to construct a house or a person intending to use the road or even a passerby is duly warned in advance.

(5) After subsidence or potholes have occurred coal companies should undertake such humanitarian efforts as repairing houses, buildings and structures in mining areas, providing temporary accommodation, evacuating small bustees of colliery workers, taking up work of stabilisation in small accessible areas without undertaking large evacuations, especially when non-workers are involved and the Government does not help. Large scale stabilisation cannot be undertaken by them, unless funds, organisation, administrative and technical support are adequately available there. So an accumulated action from all the associated authorities are needed.

(6) A massive and effective research programme is immediately needed. For this reason, if needed the scientists of our country should consult with scientists of other countries regarding the latest technology and know-how and then they should apply these technologies to overcome the problems they face. We should not, however, imitate their ways blindly. Before applying any technology we should be aware whether it would be suitable for our country or not. The conditions of mining in India and other foreign countries are not similar in different aspects like depth of working, thickness of seams, crushing strength of coal, chemical composition of coal, method of working and machinery and equipment used etc. Our research should be oriented to our conditions.

(7) Establishment of green horizon is immediately needed in the present study area. In order to provide a barrier against continuous subsidence in the mined out areas, an effective and efficient biological community should be developed. Planting of trees with wide spreading root system may provide additional protection because they have the topsoil binding capacity. Recently, this approach appears to be successfully tried in U.S.A. But what type of species should be chosen depends completely upon the micro climatic and edaphic condition of and around the mined out areas on which the trees have to be thrived. Besides, before plantation arrangement for water, fertilizer, tree guards and fencing for their protection is necessary (Plate 7.1 E).

(8) As subsidence zones encompass several hectares of surface area, it is desirable to evolve an appropriate multipurpose land use pattern. This is particularly so in some areas where the topsoil layer is thick, although the mining area itself is generally devoid of topsoil. The main advantage of such multipurpose land use pattern is to keep alternate uses. If any one of them will fail to acclimatize with surrounding conditions then others may adopt themselves successfully. For example in such areas forestry, agriculture, fodder cultivation, pasture land, pisciculture etc. may be operated at a time. If agriculture and forestry will fail to acclimatize, it is expected that fodder cultivation, grazing field, pisciculture will surely succeed. In this way the risk of failure can be lessened to a large extent.

(9) The large subsided pits which get filled up with water during rainy season may be utilised in various ways (Fig 7.1):
(a) The subsided pits or open voids which are located near big towns or villages can be utilised as fishing ground to avail the market facilities. Such pits are located near Raniganj and Dishergarh. They can also be connected with nearby jhoras and nalas to get water during dry seasons.

(b) Subsided land with or without the prospect of further subsidence can be efficiently developed as pasture land. Grass and other suitable vegetation can be planted after taking care of cracks developed due to subsidence. Later it may become necessary to replant grass etc. in the zone affected by the development of cracks due to subsequent subsidence. For such an immediate use of subsided land it is not necessary to bring the subsided land back to original topography. It would be necessary to make arrangement for drainage of water for the subsided area to be used as pastures.

(10) The proposed sites for underground mine pits should be sufficiently away from areas of natural geological discontinuities like faults, thrusts, fractures etc.

7.4 PLAN FOR CONTROLLING UNDERGROUND FIRE AND UTILISATION OF LAND WITH UNDERGROUND FIRE

7.4.1 INTRODUCTION :

An extensive area covering about six square kilometres of land in the present study area has been burnt by underground fire. Excessive heat (often reaching up to 650°C) alters the physical, chemical and biological properties of the overlying soil inhibiting the growth of vegetation, even bushes and weeds. The topsoil over the underground fire area has become spoiled with undesirable pH value. It is hardly possible to return such dormant and barren fire-burnt areas to partly agricultural area. However some reclamation measures can be taken up to put the land to some other uses.

7.4.2 MEASURES TO CONTROL UNDERGROUND FIRES :

The measures to suppress the underground fire should get the prior importance before taking any other reclamation measure. There are a number of applicable and proven methods to deal with mine fire. The pattern, character and the extension of fire in any two collieries are not akin to each other. So any of these methods can be applied to deal with a particular fire. Different methods of suppressing fire area are as follows:

(a) dousing the fire,
(b) digging out the fire,
(c) trench barrier,
(d) surface sealing

After discussion with the mine engineers it is revealed to the present researcher that among these various methods ‘surface sealing’ is very often suggested as only economically feasible method of controlling fire, extending over a large area as in the present study area.

Surface sealing consists of operations like sealing of cracks and other openings on the entire surface area over an underground fire with earth for a thickness of one meter mainly to prevent air from flowing underneath through these openings. Thus active fire gradually dies out and their advancement is checked and probability of fresh fire is reduced if surface sealing is done properly.
Sealing will be more successful if occasional resealing and planting of trees are also done on fresh earth cover. Fire area in Raniganj coal-field areas are mainly subsided zones with cracks, holes and depressions all over the surface. Naturally, it is apparent that the method of surface sealing is most suitable and effective for dealing with the underground fire herein. As suggested by the planning engineers of British Consultants Ltd. (BMC-UK) and CMPDIL a working group was constituted by Regional Director, Regional Institute No.-1, CMPDIL, in May 1982 to suggest methods to deal with the fire and other hazards (water and ventilation) at J.K.Nagar Reconstruction Project and make suitable recommendations. The method for dealing with fire as suggested by them is sealing.

7.4.3. PROPOSED METHODS FOR CONTROLLING FIRE:

The whole of the J.K.Nagar fire area has been divided into two sectors - (1) active sector where fire exists and (2) dormant sector where there is no indication of fire at present.

Both the active as well as dormant sectors will at first be cleared of the vegetation and the entire area is bulldozed to smooth out the uneven surface. In situ materials and the detritals, in that process will fill up the cracks by subsidence to a large extent.

(1) The active sector of underground fire includes Sitaldarji, East Jemehari and Kamani Nimcha where fire exists and where there are cracks on the surface over the periphery of the depillared pannels. Some cracks have already been filled up with earth and debris naturally while others are still quite open to a depth. Earth or 'mati' from nearby areas will be transported by scrapers and stacked close to the cracks. Another source of mati will be spoil dumps which exist within the boundary of the fire attacked 'danger zone'. This acquired mati will be spread uniformly over the cracks for a thickness of about 35 cm by a bulldozer. After spreading this loose earth, water will be spread on it followed by use of a roller for compaction. The process will be done repeatedly many times to achieve a thickness of one metre of the compacted mati in order to seal the cracks. Extra stock of 'mati' will be always kept in the nearby areas for sealing of new cracks.

(2) In the dormant sector of underground fire, the areas are khas Chalbalpur, New Jemehari khas, Jemehari khas East, Old Nimcha, Jemehari part of Karnani Nimcha and Searsol. In these parts of the fire area open cracks are not visible. For this sector specially, proper bulldozing of the existing cracks will be sufficient for dealing with the fire. However, mati will have to be transported and kept ready in some suitable places so that if any problem of fresh crack will arise after dewatering of underground coal-seams, the same can easily be used. Precautions should also be taken to ensure that the fresh air may not reach up to the coal left over in the gallery of abandoned quarries. All the shafts excepting one or two on the dip side are to be sealed at the top with arrangement for fixing up the monitoring gadgets down to the seam. The shafts, which will at the first phase be left in unsealed condition will be used for dewatering of underground coal seam afterwards. Inclined openings, if any, are also to be covered. This sealing operation will be done for a period of three years and after its completion the whole area will be kept under watch for another two years (maintenance period). Quick action of refilling will be taken, if any crack or sink hole is formed during this period of the cooling of the strata. Suitable plants or grasses may be strewn over the earth cover in order to bring the entire area under vegetation cover and thereby to lessen the chances of soil erosion or washing off this mati (Basu Mukherjee, 1988).

J.K. Nagar Fire Project was started from the year 1984-85. This project divided active fire in three parts. Work has been started from one end and work of one part of the active fire has been
completed by sealing and blanketing as suggested by the experts. However how far this venture has been fulfilled could not be assessed accurately. Besides surface sealing, often fire excavation is felt as an immediate precaution. Migratory fire attack stocks and damage them accelerating subsidence further. In such cases if the fire could be bodily excavated, at least the danger of subsidence due to fire would be removed. But for this purpose the extent of fire and the economic feasibility of the project that would operate over that particular point should be taken into consideration. For such areas close observation like recording of borehole temperature is necessary. A dead zone by water infusion from surface could be done to keep the active fire away from the point of fire excavation. Therefore, for maintaining a status quo the areas have to be under close observation. Subsidence survey may have to be conducted and borehole temperature may have to be recorded frequently. After taking all these technical operations suitable plants and grasses which might acclimatize with the surrounding environment, may be strewn over the earth cover in order to bring the entire area under vegetative cover to maintain the aesthetic beauty. At least one or two natural channels from Nonia Nala which pass nearby (Fig 2.3) can be diverted to pass through this region to make the region watery at least to some extent. Few channels can be brought from Ajay or Damodar to fulfil the additional requirement.

7.5. PLAN FOR REHABILITATION AND UTILISATION OF WASTE HEAPS

Mainly dumping of waste products from mining and industrial sectors produces waste heaps, which look like small isolated hills. The reclamation measures of the waste heaps include the following measures:

(1) Proper Configuration of the disposal dump:

Waste heaps must be recontoured to achieve a suitable configuration. Several other soil conservation measures like the land leveling, soil compaction, pile stabilization and terracing may be carried out. Waste heaps should be graded so that they can be utilized for planting to reduce erosion and water pollution. Mine spoil can also be utilized for filling the subsidence sites or for refilling the abandoned opencast voids. Thus previous contour or near to it, prior to mining can be obtained consequently (Mathur, 1978). A part of waste heaps created by dumping materials from IISCO near river Damodar has leveled for the expansion of the steel plant itself.

(2) Selection of proper disposal site:

The mining muck, low-grade ore, tailings and industrial wastes should not be disposed anywhere. They should be disposed in certain specific areas, which are

a) not productive so far as any land-based activities are concerned like agriculture;

b) not contributing much to the run off of the catchment;

c) not having any potential aquifer in the area;

Systematic dumping of mining and industrial waste minimizes future expenditure, reclamation cost and simplifies treatment and expands future land use.

(3) Resoiling or creating of topsoil:

The top soil in any area is the best medium for revegetation and hence it should be separately preserved and the mine waste dumps should be covered with this soil. This will help in the early
growth of plants. In most of the cases dumps whether created by dumping of mixing waste or industrial waste are either deficient of top soil or the top soil is very thin and infertile. If such dumps are covered with appreciable quantity (5 - 20 cm. thick) of top soil their physical, chemical and biological properties would be improved, at least at the coverface. These amendments are necessary, as the absence of soil shall limit the plant establishment, growth and productivity. In another process the top soil might be scrapped off and stacked away safely for later use. The ridge of dumped debris would then be leveled and covered with the topsoil that had been safely stacked apart. Soon after appropriate species of grasses, shrubs and trees are planted, making liberal use of fertilizers to accelerate the plant growth (Valdiya, 1988).

(4) Soil conservation:

Besides creation of top soil over giant waste heaps its conservation by utilizing proper methods is also very important. Measures like leveling, soil compaction, building, contour furrowing, trenching and mulching will help in restoring the productivity of the surface area of the waste heaps to some extent by way of resisting erosion and retention of moisture.

Table 7.2: Rehabilitation of mine over burden and industrial waste heaps

<table>
<thead>
<tr>
<th>REHABILITATION PROCEDURE</th>
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<tr>
<td>Physical</td>
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<tr>
<td>Configuration of heaps</td>
</tr>
<tr>
<td>Soil Conservation</td>
</tr>
<tr>
<td>Creation of top soil</td>
</tr>
<tr>
<td>Prevention of soil erosion</td>
</tr>
<tr>
<td>Addition of soil fertility</td>
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<tr>
<td>Biological</td>
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<tr>
<td>Forest</td>
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<tr>
<td>Grassland</td>
</tr>
</tbody>
</table>

(5) Plantation:

Mine and industrial waste heaps may vary in width, height and extent depending upon the type of mining and industrial activity and the amount of dumping material. But one thing is undoubtedly certain that the most important reclamation measure for gigantic waste heaps is revegetation on them. Any approach for revegetation of such heap needs following considerations:

a) deficiency in plant nutrients;
b) high or low pH value;
c) steep slopes of waste heaps;
d) physical nature of dump;
e) extremely dry condition due to physical and chemical nature of soil;
f) unsuitable surface condition;
g) bare slopes of dumps;
h) severe erosion of materials existing in the slope

Table 7.3: Possible land use pattern to be adopted over industrial and mining waste heaps

Keeping in mind all such previously mentioned possible rehabilitation and land use measures associated with waste heaps any one measure or a combination of a number of measures can be taken up after assessing the local physical condition and economic viability.

7.6. BETTER UTILISATION OF WATER

7.6.1. INTRODUCTION:

Analysing the present hydrological condition of Ajay Damodar Interfluve, Asansol Subdivision in chapter 6 it is very clear that some active steps should be taken immediately to overcome the acute problem of the scarcity of water in one hand and the water pollution on the other hand specially in and around the mining sites. Prevention of disruption of hydrological cycle is one of the most important aspects of environmental management of the region. Afforestation as well as careful adoption of biological strategy can help to restore the hydrological regime.

7.6.2. RECOMMENDATIONS FOR THE IMPROVEMENT OF HYDROLOGICAL CONDITION:

Any recommendation, however, regarding the improvement of the existing condition is really hard due to the complicated geo-hydrological features of the region. Although, some immediate and reasonable steps can be recommended on the basis of high priority.
(1) Exploration of ground water through open or bored well is immediately necessary to overcome the scarcity of water. The complex hydrological set up concomitant with the complicated geological condition and effect of mining on the underground water regime of the area have made the task for the selection of sites for bored wells very difficult. Future performance of these wells, as a result, is rather uncertain. However, an attempt has been made to study the feasibility of bored wells and to select sites accordingly based on the results obtained from hydrological and geophysical studies and consulting the working plan of nearby coal-mines. Fifty three sites have been selected for exploratory bored wells by Central Ground Water Board, Eastern Region, Calcutta (Fig 2.4).

(2) Afforestation is a primary measure for the retention of hydrological regime. It is worth appreciating in this context that planting of trees alone can never result in the restoration of water level. It is only through the carefully evolved biological strategy that can restore the hydrological cycle and thus the non-depletion of water level can be possible.

(3) According to the scientists and experts of CGWB, Calcutta, the exploratory bored wells should be drilled in the semi-consolidated Granite formation down to 100 m.b.g.l. The rocky formation, which has high water holding potentiality, should be chosen with high priority. These water rich rocky layers may provide water throughout the year and for long times, otherwise after working for few years such layers may bleach and the wells on them will dry up.

(4) The choice of the means of exploration i.e. whether it would be deep bored well or shallow open well or hand pump or submersible should depend upon the depth of water obtained.

(5) Considering the complex hydrological set up of the coal-field area both qualitative and quantitative assessment of ground water is required to be made periodically by studying carefully the performance and prospect of the wells and chemically analyzing the water samples from time to time.

(6) The pollutants present in the waste water from mining and industrial units should be treated before they are let off in the natural water channels like river Damodar or Ajay or in any of their tributaries. The measures of amelioration and abatement through many scientific methods of treatment and control at source are well known. According to experts sewerage treatment plants, oxidation ponds and devices like clarifiers, sludge digesters and trinkling filters will make the waste water less harmful for living creatures. Settling ponds and coagulant aids prior to discharge of waste water into water bodies to reduce influx. The decant ponds must be adequately deep to provide a quiet settling zone for the particles. Wind and wave action prevent settling if the pond is too shallow.

(7) The dissolved solid from the water should be neutralised or removed by a variety of techniques including lime treatment accompanied by aeration or oxidation process to convert ferrous iron to ferric iron; neutralisation with soda ash, caustic soda and anhydrous ammonia, reverse osmosis, iron exchange; desulphating; sulphide iron removal; micro biological control and permanent iron removal.

(8) The underground mine shafts should be sealed against aquifer zone so that underground water cannot come in contact with heavy metals.

(9) The mines or part of them should be sealed after closure to retard the emergence of acid-mine drainage.

(10) The ground water flow system should be controlled by well fields or other methods to prevent the exposure of ground water to sulphides in mine coating sources with gels.
(11) According to experts acid-mine drainage should be controlled by some technical methods like deep well injection, subsurface dams and grout curtains.

(12) Tailings should be properly located and waste disposal sites should be selected away from the waterbodies to reduce the scope of acid-mine drainage. Waste heaps with abnormally high concentration with iron sulphides or other undesirable reactive elements should be disposed off in sanitary landfills (solid waste).

(13) The acid mine drainage should be diluted to an acceptable effluent quality.

7.6.3. RECOMMENDATIONS OF ASANSOL DURGAPUR DEVELOPMENT AUTHORITY (A.D.D.A.)

Some suggestions were recommended by A.D.D.A. for general improvement and surveillance. These can be enumerated as follow:

(1) As far as possible treatment should be made to ensure discharge of harmless effluents from the mine pits and factory premises, the quality should be maintained by periodical checking.

(2) Release of water from D.V.C. should be maintained perenially along with the periodical flushing.

(3) Effluent quality to Damodar should be periodically checked by all existing industries and organization by Damodar Valley Corporation (D.V.C.) and brought to the notice of the concerned organization.

(4) The programme treatment of effluents by industries requires to be completed as soon as possible and the progress should be observed.

7.7 PLAN FOR CONTROLLING AIR POLLUTION

The main sources of air pollution and noise pollution are the mining, industries and transport sectors. A number of measures can be suggested to reduce air pollution and noise pollution, at least to some extent.

(1) In case of mining sector, dust suppression at the source and also along the transportation routes is, by far, the most effective and most economic measure to overcome the hazards of dust. Pneumoconiosis occurs due to constant inhalation of coal dust. Although all the factors which may make coal dust a hazardous one are not yet known properly as well as the safety levels of dust concentration have not been fully established, it can still very safely and confidently be said that in dust suppression lies its (pneumoconiosis) ultimate control and prevention. Therefore, more effective suppression of dust at source is necessary. Dust suppression methods like infusions, wet cutting, use of spray - all have their legitimate place in substantial reduction of dust concentration. In case of industries also the first and foremost suggestion is the treatment of air pollutants before they are let off in the air. The measure of amelioration and abatement through many scientific methods of treatment and control at source are well known. Water spraying and dust catching are the two most common processes of treatments with the waste effulents in the manufacturing units in this region.
Water spraying method is used to control dust from Coke Oven. The existing gas cleaning system in Blast Furnace is equipped with dust catcher, static washer etc. Due to arrangement of dust catcher power plant stacks emit comparatively cleaner flues. In case of transport sector old machineries and conventional fuels creating air pollution should be replaced. Coal, petroleum, diesel are the conventional fuels for transportation which are emitting pollutants in the present study area. All these must be replaced by some other energy resources with least pollution potential like electric, battery, solar energy etc. The technology for tapping the solar energy for transport purpose has not yet been applied in this region. But this technology has to be imported and to be applied to check further pollution hazard. Although such replacement is both time as well as money consuming, but it has to be adopted. Both private and public sectors should take initiative for it. Electrification of railway tracts is also of a vital importance. All the main lines and most of the loop lines have been electrified but the rest of the lines should not also be left out of electrification. If the rest of the lines become electrified, coal and diesel engines can be replaced successfully.

(2) Use of preventive measures and equipments should be made mandatory to control chest and eye damage. According to Relief Act, 1963 and Environment Protection Act 1986, any citizen of India can pray legal action through the court against sound pollution. Over and above sound pollution deserves a lot by some regulations also such as

a) sound preventive machines should be introduced during working hours at the working places. Use of buffer, silencer, earplus, earcover of wool etc can be introduced. Soundproof arrangement is to be made in the generator sets. It is also necessary to introduce air obstructor in public bus and minibus.

b) Blowing of electric horns should be strictly prohibited at the protected places as ordered by the Government.

c) Microphone, radio, T.V., tape recorder, record player etc should be played at as much low as can be during any festival or daily use so that any disturbance can not be happened to the neighbours or ones own family members.

d) It should be strictly prohibited to establish any industrial complex or factory, which can create air or noise pollution within domestic area.

e) Silent zone should be strictly observed around school, college, hospital, nursing home etc.

f) Doors and windows are to be double paneled at special areas.

(3) To reduce the noise pollution from transport sector electric horns should be replaced by musical horns, which are quite comfortable for hearing and less hazardous for health. The frequency of horns can also be reduced by smoothing out the transport system which can be achieved by taking following steps:

a) The number of roads should be increased to lessen the pressure of transport on few roads passing through this region.

b) Flyover should be constructed in the busy transport points. In some places where feeder
roads have crossed or meet with G.T. Road it becomes very difficult for crossing roads, specially at office or school hour due to heavy traffic. In these busy transport points like B.N.R. More and Station Bazar More in Asansol, Kajora More, Raniganj More flyovers are immediately needed for smoothing the transport system and thus to reduce the frequency of horns.

(4) Introduction of a system of periodic medical examination of miners is supposed to be the quick and the most economical method in the prevention of pneumoconiosis next to the use of dust suppression method. Such examinations are common in all developed coal mining countries as they provide an immediate protection to the workers since radiological changes nearly always appear much before disability or functional injury has been done to the lungs. Radiological control provides a biological proof of the adequacy of dust control methods. Comprehensive occupational health services should be developed in all mines.

Coal miners pneumoconiosis is a preventable disease if it would be detected at the initial stage. It is essential to teach about the prevalence of pneumoconiosis in individual mine which is actively developing and where mechanized coal getting is being rapidly introduced on large scale. Unless dust suppression method is considerably extended commensurate with plans for future developments in the coal-fields, which are likely to intensify dust production and risk of pneumoconiosis, there is little likelihood of seeing a fall of frequency of the disease. During personal discourses with the coal miners it is revealed to the present researcher that most of them are not even aware of such fatal disease like pneumoconiosis. As the detection of this disease at the initial stage without powerful X-ray examination is not possible, most of the miners, who are suffering from shortness of breath or exhaustion, are often wrongly treated.

(5) Plantation along the both sides of roads are of prior importance to reduce the dust pollution. Plant roots have a binding effect on soil, which will check the soil erosion from roadsides as well as reduce the further origin of dust. The choice of species, which are to be planted, must be taken with great care. The trees with strong roots may create injury to the road surface. This is evidenced from the surface condition of the concrete footpath and some roads of Burnpur Township. The plants with dense branching may create problem to the vehicles plying through those roads. The species with tall, straight stem with least branching is most suitable for plantation along the roads. For this reason eucalyptus is the most suitable and is most widely used plant. Plantation has already been done along many of the roads but most of them remain unshaded, barren and naturally have gone to the stomach of roaming herbivorous (Plate 7.1 F). So after plantation proper protection should be provided.

(6) To reduce air and noise pollution some rules and regulations should be provided first. Regulation of some rules is not enough, they should be applied strictly and widely. Legal and penal measures are to be provided in the Bengal Smoke Nuisance Act, the Factories Act and Bengal Municipal Act and they should be applied effectively.

7.8. PLAN FOR POPULATION MANAGEMENT

Ajay Damodar Interfluve, Asansol Subdivision, is suffering from great pressure of population on land. It has further accentuated a large number of other problems like haphazard growth of urban
centers etc. In this circumstances population growth is important. But the separate policies to control population cannot be applied in micro level i.e. in such small areas like Ajay Damodar Interfluve. Population controlling policies are usually applied in macro level i.e. in wide administrative unit like for the whole nation. Another important problem from which the region is suffering is rural to urban migration. Rural to urban migration is a very common feature all over the region creating a number of adverse effects on the urban areas which receive the immigrating people. Unemployment, poverty, population congestion, slum formation, social conflict etc are some of the adverse consequences of immigration process from rural to urban areas. Most of the rural immigrants do not have any technical qualification to get a good job in mining or industrial sectors as they expect. With the dream in their eyes and mind, when they reach the towns they are forced to face the real situation. In this situation the present researcher suggest to develop the rural areas which may reduce the rural to urban migration to a large extent. Rural areas should be provided with the academic facilities like vocational training, technical education and some other sedative amenities. In most of the cases people shift from rural to urban areas either in search of job or for obtaining the higher education. So if these two will be available in rural areas people will automatically settle down in the villages and the towns will get rid off the undesirable population pressure and far more undesirable social and economic consequences. Due to haphazard and extensive growth of villages and towns large amount of coal remains locked under surface structures (Fig-6.14). In this respect two important steps have to be taken up immediately

(1) Technological enactment for extraction of coal that remains locked under different surface structures,

(2) Strict control of haphazard and unplanned growth of settlement on the coal-field area.

There is an urgent and immediate necessary to find out an effective technology for the extraction of tons of good quality coal locked under different surface structures. The Central Mining Research Station, Dhanbad, should play a more effective role in this regard. Bulk of the coal reserves in these areas occurs at shallow depths and in relatively thicker seams. Under such circumstances, it is almost impossible to prevent surface subsidence, even with maximum possible stowing, unless bulk of coal (upto 85%) is left unextracted and lost for ever. Some effective steps therefore need to be taken to prevent new construction or all important coal bearing areas, till the time when the CMRS is able to find out an effective technology for coal extraction from below the villages, townships and other important installations etc. It is mentioned in chapter 6 that more and more land, even fertile agricultural lands, are going under settlement. So rules and regulations should be provided first to stop this malpractice. Regulation of some rules are not enough, they should be applied widely as well as effectively. Legal and penal measures, if needed, are to be provided strictly.