

## CHAPTER : X

### REMEDIAL MEASURES

On the basis of the geo-environmental studies in and around Baroda, recommendations have been made to combat the environmental degradation that has already been caused.

The following remedial measures are suggested to minimize the environmental hazards and to check further degradation in order to have sustainable development :

- \* Since Baroda has become a big industrial complex, further expansion of the existing industries and installation of new industries, in whatever form, should be allowed only if they implement strict pollution control practices.
- \* Further expansion of the city should be restricted to the eastern side of the present complex in between the Ajwa and Dabhoi roads. Expansion towards Mahi should be stopped to avoid being in the proximity of the polluted Mini river, and also to utilize the fertile soils in the west for various agricultural practices to support the urban population.
- \* Effective land-use planning will often require a land reform programme comparable to that needed in the country side. The pioneering legislation, Land Ceiling and Regulation Act [1976] should be enforced strictly with immediate effect.

- \* Land banks, as a non-profit organization, should be established and be empowered not just to buy and sell farmland, but to preempt any sale. Creation of land banks will involve a statutory body which will buy, sell, or allocate property to achieve ownership and use patterns that meet community objectives based on land suitability and land capability. This will protect farmlands from urban sprawl.
- \* Detailed geomorphological study with reference to origin and texture of the unconsolidated materials such as river terraces, buried river channel, etc., which are a major source of water, should be carried out.
- \* Studies of geomorphology and environmental parameters on a micro-level should be done, as they directly affect the inherent properties and engineering problems of land.
- \* Construction of giant civil structures across the E-W lineaments observed around Baroda city [Ramanathan et al, 1982] should be avoided, but this is not a serious problem in itself.
- \* Blocking of natural surface drainage, by construction of buildings, should be avoided, as it causes water-logging during monsoon. This type of water-logged areas provide breeding sites for mosquitos. Also, during heavy rainfall periods, buildings on this sites may collapse.
- \* Ravines along the Mahi river banks should be brought under fodder plantation and treated with peripheral 'bunds', and drop-structures should be provided to reduce peak discharge and consequent soil erosion.
- \* The engineering measures should be supplemented by planting trees and shrubs in the ravines. The slopes can be stabilized by sodding

with grasses such as Cenchrus ciliaris, Dichanthium annulatum and Eve mopogan foveolalious.

- \* Shallow ravines [ 2 m depth] can be reclaimed for agricultural and horticultural purposes by levelling or terracing.
- \* Ravine lands should be strictly closed to grazing and other biotic disturbances.
- \* Cost : benefit ratio is a major constraint in erosional control practices. State Government should share the cost of erosion control practices or else, a typical farmer with a narrow profit margin, and with land suffering from excessive erosion, will continue agricultural practices till the inherent productivity of the land falls to a point where it has to be abandoned giving rise to barren land.
- \* Urban community gardens should be developed by terracing the ravines of Vishwamitri river. This will facilitate the growing of essential vegetables locally. Presently, these have to be brought from far-off places, thereby making them more expensive to the end user.
- \* Establishment of green-belts within and around Baroda city will safeguard and increase local water supplies. A green-belt strategy aimed at permanent protection of open lands within and around Baroda will mitigate pollution problems and increase self-sufficiency in agriculture. Trees and soil absorb many airborne wastes; large expanses of open lands enhance urban air flow and thus improve 'heat island' condition of Baroda.
- \* Green-belts, in the form of community forestry, in and around Baroda city can be made by planting trees on roadside strips, banks of the Vishwamitri, Mahi and other tributaries, should

be developed. This will decrease run-off created by 'water-proofing' and hold rainwater, permitting it to percolate downward to recharge underground aquifers. Decreased run-off will also bring down the soil erosion.

- \* Green-belts in the form of agro-forestry holds a great potential. For this, major industries should be forced legally to create green-belts to compensate their part in air pollution. A combination of green-belts and industrial zoning ordinances will greatly reduce the effect of persistent inversions and weak air flows on pollution level.
- \* Laxmi Vilas Palace complex should be preserved and developed as a green-belt to launder atmospheric pollutants and reduce heating effect.
- \* To control air pollution in Baroda city, strict traffic control measures are required. Vehicular emissions should be regularly monitored. Public transport system should be improved so that usage of individual vehicles will decrease.
- \* Public transport buses should be replaced by electric or solar vans which are cheaper and do not create any air pollution.
- \* Solar architecture can erect energy efficient commercial complexes and thus reduce energy demand. Rooftops can be utilized as collectors of solar energy.
- \* Electricity from sunlight to run grindmills, water pumps, etc. can reduce energy demand.
- \* Reductions in energy demand and increased efficiency of energy generation and energy distribution will contribute to a reduction of air pollution.

- \* Selection of low pollutant fuels for consumption and use of lead free petrol will reduce air pollution. But, this requires a national strategy.
- \* Since Baroda city has flourished with chemical industries, the technique of detecting and absorbing pollutants from air with the help of plants should be introduced.
- \* Steps should be taken to introduce air pollutant filters and treatment plants in all industries which release air pollutants. Air pollution laws should be strictly implemented.
- \* Municipal and industrial wastewater should be treated by installing latest wastewater treatment plants. Wastewater treatment will not only protect the quality of water in rivers, streams, and aquifers, but will set the stage for water recycling and reuse. Much wastewater can therefore be used again within a given factory, home, or business [usually called recycling], or collected from one or more sites, treated, and redistributed to a new site [called reuse]. By using water several times, Baroda city and the industrial complexes can get more production out of each cubic meter of water, thereby lessening the need to develop new water supplies.
- \* The effluents from domestic and municipal sewers and drains, after proper treatment, can be used for industrial and agricultural purposes, which do not require high-quality water. Water once used can again be used for the same or other purposes after recycling, i.e. after eliminating pollutants, pathogens and undesirable elements. Recycled water is not desirable for drinking because the pathogens and organic elements are hard to get rid of completely.
- \* Water should be reused for purposes like steel processing, ore separation, petroleum refining, industrial cooling, irrigating landscapes, irrigating crops, irrigating public parks, recreational lakes, power plant cooling etc.

- \* Industrial effluents should not be released into the Mini and Vishwamitri rivers. Possibility of underground disposal through deep-wells should be evaluated after studying structural parameters in the deep-seated rock body, beyond the zone of groundwater influence. Though this system is not free from any danger of pollution due to leakage, it is more acceptable than the surface disposal.
- \* Gujarat State Government has constructed a closed masonry conduit [effluent channel] 56 km long [Fig. 38] to carry the treated effluent of various industrial units operating around Baroda into the sea near Sarod. The conduit is designed to carry about 45 Mgd of effluent. But, only the mega-industries like Indian Petrochemicals Corporation Limited [IPCL], Gujarat Refinery and Gujarat State Fertilizer Company Limited [GSFC] are using this effluent channel. While all downstream industries located in and around Nandesari are dumping their waste directly into the Mahi and Mini rivers. Analysis of treated waste water which is dumped in the effluent channel is given in Table : 43. This treated waste water of effluent channel is unofficially used by farmers for irrigation [Plate : 32, a and b]. The concerned authority should first prepare an experimental [model] farm wherein effect of treated effluent on soil and vegetation should be studied and accordingly the farmers should be advised.

TABLE : 43

QUALITY OF TREATED WASTE-WATER OF EFFLUENT CHANNEL

PARAMETERS	COUNTS	PARAMETERS	COUNTS	PARAMETERS	COUNTS
pH	9.8	Chloride	800	Arsenic	205
T.D.S.	5010	Sulphate	670	Cyanide	0.70
Calcium	494	Phosphate	410	Phenol	0.20
Magnesium	304	Ammonia	1014	BOD	125
Sodium	410	Urea	636	COD	602
Potassium	50	Silica	238	Oil and	125
Nitrate	10.0	Flouride	10.0	Grease	

[All value except pH and BOD/COD are in mg/l]

Source : Gujarat State Public Health Engineering Department, Baroda.

PLATE 32 : ILLEGAL LIFT IRRIGATION FROM THE EFFLUENT CHANNEL.

'a'



'b'



- \* Illegal lift irrigation from the effluent channel should be immediately stopped. Otherwise, both the soil and groundwater are likely to be polluted. Also, if the pollutants get into the agricultural products, it will create health hazard.
- \* Continuous cultivation by sewage irrigation may alter the inherent soil characters. A soil study is required to monitor the changes. The area, south-east of Wadi, known as Gajrawadi, which is under such irrigation, has shown physical changes.
- \* The Mahi river is a tidal river and the tidal regime occasionally extends over a distance of about 100 km upstream. During high spring tides in summer the tidal effects in the Mahi extend upto Vasad [Barodawala and Patel, in Press]. The industries are, therefore, required to suspend operation of dumping there treated wastes via effluent channel on these days.
- \* A pick-up weir should be constructed somewhere downstream of Fajalpur, on the Mahi river. This will stop the tidal ingress containing effluents, from the Gulf of Cambay, reaching upto Fajalpur where the French-wells are located, and will also, help in recharging river bed aquifers, especially during summer.
- \* Watershed conservation measures should be implemented to protect Pavagadh hill from degrading. These conservation measures in turn will augment the surface water during the monsoon in the Surya river on which Ajwa reservoir has been constructed. Watershed management is essential as the Ajwa reservoir, inspite of good monsoons, has not recorded normal water levels.
- \* The water surface of Ajwa reservoir should be covered by a barrier [e.g. alphatic alcohol] to inhibit evaporation.
- \* Destruction of unwanted phreatophytes and breeding varieties that



transpire less and planting windbreakers to obstruct air movement over crops will reduce transpiration.

- \* To cope up with the rising population that will touch 1.8 million by the end of the century, a detailed study of deep aquifer potential needs to be undertaken, in view of the constraints on shallow groundwater and river water supplies.
- \* Sanitary landfill techniques should be introduced for both domestic and industrial waste disposal. For Baroda city two tentative sanitary landfill area can be suggested which will satisfy most of the necessary geological considerations; [a] East of Harni airport, between Darjipura and Sayajipura, where black pedogenised swampy clay occurs at the top and with the water table below 25 m. The surface channel running through the area can be easily sealed, [b] In a depression, just south of Gotri where the water table is below 26 m, though the ground water flow pattern is not favourable.
- \* Till date, sub-standard construction material from Halol is used for making roads in the city of Baroda, even though standard quality material is available there itself. Standard material from Halol should be utilized and in absence of this an alternative site at Sevalia has construction material meeting the specifications laid down by Indian Road Congress [IRC, 1978].
- \* Excellent co-ordination is required between investigators of urban environment, the planners and decision makers for an adequate implementation of the above mentioned remedial measures.
- \* Environmental awareness should be created through education. An individual can play an important role in creating environmental awareness. He can plant 2-3 local tree species in front of his house and thus set an example for others. Such acts in long run may compensate the loss of natural vegetal cover.