

## Industrial Estate Siting

### Objective

#### A. New industrial estates

- i) Site identification
- ii) Identification of industries suitable
- iii) Suggest effluent/emission/waste treatment and disposal options
- iv) Suggest land use controls around the sites

#### B. Existing industrial estates with vacant plots

- i) Identification of industries suitable
- ii) Suggest improvements for effluent/emission/waste treatment and disposal
- iii) Suggest land use controls around the sites

The studies are to be taken up collaboratively with the industrial estate owners/developers.

### Methodology

#### **Step I:**

Regional level environmental assessments (Macro-level Zoning Atlas studies) in 1:250,000 scale

#### **Step - II:**

Identification of a search area from the suitable areas of macro-level studies in 1:250,000 scale

#### **Step - III:**

Mapping of the study area (25 km around the candidate site) in 1: 50,000 scale

#### **Step - IV:**

Identification of areas to be avoided for siting of industrial estates

#### **Step - V:**

Identification of candidate sites based on socio-economic factors from the areas other than those areas to be avoided

#### **Step - VI:**

Rapid environmental assessment of the candidate sites and identification of potential site(s)

#### **Step – VII:**

Assessment of sensitivity of land use and air/water pollution sensitivity and suitability to industries

**Step-VIII:** Recommendations on:

1. Site(s) for industrial estates
2. Suitability to industries
3. Land use development concept around the site

### **Step I: Regional level environmental assessments (Macro-level studies) in 1:250,000 scale**

Refer the criteria for preparation of district-level 'Zoning Atlas for Siting of Industries'

### **Step - II: Identification of a search area from the suitable areas of macro-level studies in 1:250,000 scale**

- Land availability - extent of land to suit to the industrialization demand, preferably wastelands
- Land ownership - government or private land lease in acquisition.
- Electricity- nearness or distance of various pre- final sites from nearest existing sub-station / power plant.
- Nearness to the major settlement - distance of nearest major settlement from all the pre-final candidate sites.
- Water availability- distance from source of water supply for domestic and industrial purposes
- Distance from existing industrial areas
- Distance from sensitive zone
- Drainage- distance of major rivers or drains from the pre-final sites
- Nearness to transportation network for economic handling of both raw materials and finished goods
- Environmental sensitivity of the area to suit to the needed industrial development.
- Transportation facility: distance from existing railway line and highway.

### **Step - III: Mapping of the study area (25 km around the candidate site) in 1: 50,000 scale**

1. Base Map
2. Village reference Map
3. Land use/Land cover Map
4. Slope Map
5. Drainage Map
6. Hydrogeomorphology Map
7. Existing industries map
8. Infrastructure map (transportation network, water availability, electricity etc.)
9. Air quality map
10. Surface water quality map
11. Ground water quality map
12. Environmentally sensitive zones and resource areas

## Step - IV: Identification of areas to be avoided for siting of industrial estates

### A.1 Biological diversity of an area

|     |   |
|-----|---|
| 1.  | National parks  |
| 2.  | Wild life sanctuaries   |
| 3.  | Game reserve  |
| 4.  | Tiger reserve/elephant reserve/turtle nesting ground, breeding grounds              |
| 5.  | Core zone of biosphere reserve  |
| 6.  | Habitat for migratory birds   |
| 7.  | Mangrove area   |
| 8.  | Areas with threatened (rare, vulnerable, endangered) flora/fauna , protected corals |
| 9.  | Wetlands  |
| 10. | Botanical gardens, Zoological gardens, Gene Banks                                   |
| 11. | Reserved forests, Protected forests   |
| 12. | Any other closed/protected area under the Wild Life (Protection) Act, 1972          |
| 13. | Any other area as locally applicable  |

### A.4 Sensitive/incompatible land uses

|     |   |
|-----|---|
| 1.  | Public water supply areas from rivers/surface water bodies - Upto 2 km from watersheds u/s of public water supply abstraction points in the rivers/surface water bodies           |
| 2.  | Public water supply areas from ground water- 1 km around public water supply abstraction points from ground water   |
| 3.  | Ground water recharge areas - 1/2 km ground water recharge areas  |
| 4.  | Scenic areas/tourism areas/hill resorts - 1 km from the periphery of the core areas of scenic areas/tourism areas/hill resorts with tourists/visitors more than 10 lakhs a year   |
| 5.  | Religious places, pilgrim centers - 1 km around core areas of religious places that attract over 10 lakhs pilgrims a year   |
| 6.  | Protected tribal settlements - notified tribal areas where industrial activity is not permitted   |
| 7.  | Coastal Regulatory Zone (CRZ)   |
| 8.  | Monuments of national significance - 1 km from monuments of national significance   |
| 9.  | Monuments of state significance – ½ km from monuments of state significance   |
| 10. | Monuments of national significance – 100 m from monuments of local significance   |
| 11. | World Heritage Sites - 2 km from World Heritage sites   |
| 12. | Flood prone areas (based on flood in 1 in 25 years )  |
| 13. | Agricultural research stations  |
| 14. | Air port areas  |
| 15. | Any other feature as specified by the State or local government and other features as locally applicable (including prime agricultural lands, pastures, migratory corridors etc.) |

## Step - V: Identification of candidate sites based on socio-economic factors from the areas other than those areas to be avoided

- Land availability - extent of land to suit to the industrialization demand, preferably wastelands
- Land ownership - government or private land lease in acquisition.
- Electricity- nearness or distance of various pre- final sites from nearest existing sub-station / power plant.
- Nearness to the major settlement - distance of nearest major settlement from all the pre-final candidate sites.
- Water availability- distance from source of water supply for domestic and industrial purposes
- Distance from existing industrial areas
- Distance from sensitive zone
- Drainage- distance of major rivers or drains from the pre-final sites
- Nearness to transportation network for economic handling of both raw materials and finished goods
- Environmental sensitivity of the area to suit to the needed industrial development.
- Transportation facility: distance from existing railway line and highway.

## Step - VI: Rapid environmental assessment of the candidate sites and identification of potential site(s)

**Candidate Site Matrix of Industrial Estate Siting**

| Parameters  |               | Site – I | Site - II | Site - III | Site<br>..... |
|---|---------------|----------|-----------|------------|---------------|
| <b>ENVIRONMENTAL PARAMETERS</b>                           |               |          |           |            |               |
| Distance to sensitive zones                               | Weightage     |          |           |            |               |
|   | Justification |          |           |            |               |
| Suitability to air Polluting Industries                   | Weightage     |          |           |            |               |
|   | Justification |          |           |            |               |
| Suitability to Water Polluting Industries                 | Weightage     |          |           |            |               |
|   | Justification |          |           |            |               |
| <b>PHYSICAL INFRASTRUCTURE PARAMETERS</b>                 |               |          |           |            |               |
| Availability of water and nearness to water supply source | Weightage     |          |           |            |               |
|   | Justification |          |           |            |               |
| Availability of effluent disposal places                  | Weightage     |          |           |            |               |
|   | Justification |          |           |            |               |

| Parameters   |               | Site – I | Site - II | Site - III | Site<br>..... |
|--|---------------|----------|-----------|------------|---------------|
| Nearness to Road                                     | Weightage     |          |           |            |               |
|  | Justification |          |           |            |               |
| Nearness to Railway Line                             | Justification |          |           |            |               |
|  | Weightage     |          |           |            |               |
| Availability of Land and Land Costs                  | Weightage     |          |           |            |               |
|  | Justification |          |           |            |               |
| <b>SOCIO-ECONOMIC PARAMETERS</b>                     |               |          |           |            |               |
| Skilled Manpower Availability                        | Weightage     |          |           |            |               |
|  | Justification |          |           |            |               |
| Nearness to Sales Market                             | Weightage     |          |           |            |               |
|  | Justification |          |           |            |               |
| Nearness to Major Settlement                         | Weightage     |          |           |            |               |
|  | Justification |          |           |            |               |
| Contribution to balanced industrial development      | Weightage     |          |           |            |               |
|  | Justification |          |           |            |               |
| Social acceptance to the proposed estate development | Weightage     |          |           |            |               |
|  | Justification |          |           |            |               |

The categorization of physical, environmental and social parameters have to be done rationally, such as in the case of physical infrastructure given below.

### Physical Infrastructure Parameters

| Parameters  | Good                        | Moderate                            | Poor                            |
|---|-----------------------------|-------------------------------------|---------------------------------|
| Water supply (Nearness to the source)                   | Upto 5 km                   | 5-10 kms                            | 10-15 kms                       |
| Availability of electricity                             | Uninterrupted power supply  | Power supply with intermittent cuts | Frequent power cuts             |
| Discharge from the ETP (nearness to the disposal point) | Disposal point within 5 kms | Disposal point within 15 kms        | Disposal point more than 15 kms |
| Nearness to road  | Up to 1 km                  | 1-5 km                              | More than 5 km                  |
| Nearness to railway line                                | Up to 1 km                  | 1-2 km                              | More than 2 km                  |
| Availability of land                                    | Government ownership        | Institutional ownership             | Private ownership               |

*Weightage out of 5 : 5 for excellent, 4 for very good, 3 for good, (-ve)3 for poor, (-ve) 5 for very poor.*

### Description of potential site(s)

| Parameters  | Industrial Estate 1 | Industrial Estate2 |
|---|---------------------|--------------------|
| Location  |                     |                    |
| Area  |                     |                    |
| Habitable villages                                      |                     |                    |
| Land use  |                     |                    |
| Land availability                                       |                     |                    |
| Nearness to the road                                    |                     |                    |
| Nearness to the railway line                            |                     |                    |
| Water supply (Nearness to the source)                   |                     |                    |
| Discharge from the ETP (Nearness to the disposal point) |                     |                    |

## Step – VII: Assessment of sensitivity of land use and air/water pollution of the potential site(s) and suitability to industries

### A. LANDUSE SENSITIVITY ASSESSMENT

| a         | Biological diversity  | 0.5 km | 0.5-2 km | 2-5 km | 5-7 km | 7-15 km | >15 km |
|-----------|---|--------|----------|--------|--------|---------|--------|
| 1.        | National parks  |        |          |        |        |         |        |
| 2.        | Wild life sanctuaries   |        |          |        |        |         |        |
| 3.        | Game reserve  |        |          |        |        |         |        |
| 4.        | Tiger reserve/elephant reserve/turtle nesting ground, breeding grounds  |        |          |        |        |         |        |
| 5.        | Core zone of biosphere reserve  |        |          |        |        |         |        |
| 6.        | Habitat for migratory birds   |        |          |        |        |         |        |
| 7.        | Mangrove area   |        |          |        |        |         |        |
| 8.        | Areas with threatened (rare, vulnerable, endangered) flora/fauna, protected corals  |        |          |        |        |         |        |
| 9.        | Wetlands  |        |          |        |        |         |        |
| 10.       | Botanical gardens, Zoological gardens, Gene Banks   |        |          |        |        |         |        |
| 11.       | Reserved forests, Protected forests   |        |          |        |        |         |        |
| 12.       | Any other closed/protected area under the Wild Life (Protection) Act, 1972  |        |          |        |        |         |        |
| 13.       | Any other area as locally applicable  |        |          |        |        |         |        |
| <b>b)</b> | <b>Incompatible Land uses</b>   |        |          |        |        |         |        |
| 14.       | Public water supply areas from rivers/surface water bodies - Upto 2 km from watersheds u/s of public water supply abstraction points in the rivers/surface water bodies |        |          |        |        |         |        |

|           |   |  |  |  |  |  |  |
|-----------|---|--|--|--|--|--|--|
| 15.       | Public water supply areas from ground water   |  |  |  |  |  |  |
| 16.       | Ground water recharge areas   |  |  |  |  |  |  |
| 17.       | Scenic areas/tourism areas/hill resorts (over 10 lakhs tourists/visitors a year)  |  |  |  |  |  |  |
| 18.       | Religious places, pilgrim centers (over 10 lakhs pilgrims/visitors a year)  |  |  |  |  |  |  |
| 19.       | Protected tribal settlements - notified tribal areas where industrial activity is not permitted   |  |  |  |  |  |  |
| 20.       | Coastal Regulatory Zone (CRZ)   |  |  |  |  |  |  |
| 21.       | Monuments of national significance  |  |  |  |  |  |  |
| 22.       | Monuments of state significance   |  |  |  |  |  |  |
| 23.       | Monuments of local significance   |  |  |  |  |  |  |
| 24.       | World Heritage Sites  |  |  |  |  |  |  |
| 25.       | Flood prone areas (based on flood in 1 in 25 years )  |  |  |  |  |  |  |
| 26.       | Agricultural research stations  |  |  |  |  |  |  |
| 27.       | Air port areas  |  |  |  |  |  |  |
| 28.       | Any other feature as specified by the State or local government and other features as locally applicable (including prime agricultural lands, pastures, migratory corridors etc.)   |  |  |  |  |  |  |
| <b>c)</b> | <b>Land Use:</b>  |  |  |  |  |  |  |
| 29        | Double Cropped  |  |  |  |  |  |  |
| 30        | Single Cropped  |  |  |  |  |  |  |
| 31        | Plantations   |  |  |  |  |  |  |
| 32        | Command Areas   |  |  |  |  |  |  |
| 33        | Fallow Lands  |  |  |  |  |  |  |
|           | <b>Forests:</b>   |  |  |  |  |  |  |
| 34        | Reserved Forest   |  |  |  |  |  |  |
| 35        | Protected Forest  |  |  |  |  |  |  |
| 36        | Scrub/Degraded Forest   |  |  |  |  |  |  |
| 37        | Other Forest  |  |  |  |  |  |  |
|           | <b>Waste Lands:</b>   |  |  |  |  |  |  |
| 38        | <ol style="list-style-type: none"> <li>1. gullied and/or ravenous land</li> <li>2. upland with or without scrub</li> <li>3. water logged and marshy land/salt pan</li> <li>4. land affected by salinity/alkalinity-coastal/inland</li> <li>5. shifting cultivation area</li> <li>6. under utilized/degraded notified forest land</li> <li>7. degraded pastures/grazing land</li> <li>8. degraded land under plantation crops</li> <li>9. sands-desertic/coastal</li> <li>10. mining/industrial wasteland</li> <li>11. barren rocky/stony waste/sheet rock area</li> </ol> |  |  |  |  |  |  |

|           |   |  |  |  |  |  |  |
|-----------|---|--|--|--|--|--|--|
|           | 12. steep sloping area<br>13. snow covered and/or glacial area  |  |  |  |  |  |  |
| <b>d)</b> | <b>Population</b>   |  |  |  |  |  |  |
| 46        | Rural   |  |  |  |  |  |  |
| 47        | Urban   |  |  |  |  |  |  |
| <b>e)</b> | <b>Environmental Quality</b>  |  |  |  |  |  |  |
| 48        | Areas with 'critical'/'high' air pollution  |  |  |  |  |  |  |
| 49        | Critically polluted areas or 'low' quality areas - areas with surface water quality exceeding the applicable 'criteria' |  |  |  |  |  |  |
| 50        | Areas with ground water quality exceeding the applicable 'criteria'   |  |  |  |  |  |  |
| 51        | Hilly stretches that act as barriers for dispersion of emissions, areas with frequent inversion conditions              |  |  |  |  |  |  |
| <b>f)</b> | <b>Others</b>   |  |  |  |  |  |  |
| 51        | Municipality/ Metro City  |  |  |  |  |  |  |
| 52        | NH  |  |  |  |  |  |  |
| 53        | Railways  |  |  |  |  |  |  |

**Note:**

1. Use 'X' to indicate not existing and '✓' to indicate that a feature exists.
2. From the above table, the conclusions on the land use sensitivity are to be drawn. For example, if a sensitive land use falls at a distance of 6 km, for this site industries with pollution potential of 5-7 km are not permissible.

**Site Suitability**

| Distance to sensitive land use      | < 0.5 km | 0.5 to 2 km | 2 to 5 km | 5 to 7 km | 7 to 15 km | > 15 km |
|-------------------------------------|----------|-------------|-----------|-----------|------------|---------|
| <b>Impact potential of industry</b> |          |             |           |           |            |         |
| <b>Upto 0.5 km</b>                  | B        | G           | G         | G         | G          | G       |
| <b>0.5 to 2 km</b>                  | R        | B           | G         | G         | G          | G       |
| <b>2 to 5 km</b>                    | R        | R           | B         | G         | G          | G       |
| <b>5 to 7 km</b>                    | R        | R           | R         | B         | G          | G       |
| <b>&gt;7 km</b>                     | R        | R           | R         | R         | B          | G       |

|          |                                      |
|----------|--------------------------------------|
| <b>R</b> | Unsuitable                           |
| <b>B</b> | Partially Suitable, Preferably avoid |
| <b>G</b> | Suitable                             |



## B. AIR POLLUTION SENSITIVITY ASSESSMENT

### a) Air Pollution Potential of Industries

| Industry Category | Impact Potential* |
|-------------------|-------------------|
| A1                | > 7 km            |
| A2                | 5 to 7 km         |
| A3                | 2 to 5 km         |
| A4                | < 2 km            |

\* impact potential considered without pollution control equipment in operation

### b) Air Quality in the Area

| Distance from IE Site | Upto 0.5 km | 0.5 to 2 km | 2 to 5 km | 5 to 7 km | 7 to 15 km or more |
|-----------------------|-------------|-------------|-----------|-----------|--------------------|
| Air Quality*          |             |             |           |           |                    |

\* Low, Moderate, high, Critical

| Concentration | Industrial | SO <sub>2</sub> | SPM     | Residential | SO <sub>2</sub> & NO <sub>2</sub> | SPM     |
|---------------|------------|-----------------|---------|-------------|-----------------------------------|---------|
| Low           | L          | 0-40            | 0-180   | L           | 0-30                              | 0-70    |
| Moderate      | M          | 40-80           | 180-360 | M           | 30-60                             | 70-140  |
| High          | H          | 80-120          | 360-540 | H           | 60-90                             | 140-210 |
| Critical      | C          | > 120           | > 540   | C           | >90                               | >210    |

### Site Suitability -

| Distance to 'critical'/'high' quality | < 0.5 km | 0.5 to 2 km | 2 to 5 km | 5 to 7 km | 7 to 15 km | > 15 km |
|---------------------------------------|----------|-------------|-----------|-----------|------------|---------|
| Impact potential of industry          |          |             |           |           |            |         |
| A4 (>2 km)                            | R        | B           | G         | G         | G          | G       |
| A3 (2 to 5 km)                        | R        | R           | B         | G         | G          | G       |
| A2 (5 to 7 km)                        | R        | R           | R         | B         | G          | G       |
| A1 (>7 km)                            | R        | R           | R         | R         | B          | G       |

|          |                  |
|----------|------------------|
| <b>R</b> | Unsuitable       |
| <b>B</b> | Preferably avoid |
| <b>G</b> | Suitable         |

### c) Land Use Sensitivity

#### Site Suitability

| Distance to sensitive land use | < 0.5 km | 0.5 to 2 km | 2 to 5 km | 5 to 7 km | 7 to 15 km | > 15 km |
|--------------------------------|----------|-------------|-----------|-----------|------------|---------|
| Impact potential of industry   |          |             |           |           |            |         |
| A4 (> 2 km)                    | R        | B           | G         | G         | G          | G       |
| A3 (2 to 5 km)                 | R        | R           | B         | G         | G          | G       |
| A2 (5 to 7 km)                 | R        | R           | R         | B         | G          | G       |
| A1 (>7 km)                     | R        | R           | R         | R         | B          | G       |

|          |                                      |
|----------|--------------------------------------|
| <b>R</b> | Unsuitable                           |
| <b>B</b> | Partially Suitable, Preferably avoid |
| <b>G</b> | Suitable                             |

### d) Dispersion Sensitivity

| Distance from IE Site   | Upto 0.5 km | 0.5 to 2 km | 2 to 5 km | 5 to 7 km | 7 to 15 km or more |
|-------------------------|-------------|-------------|-----------|-----------|--------------------|
| Dispersion Sensitivity* |             |             |           |           |                    |

\* Low, Moderate, high, Critical

#### Site Suitability

| Distance to critical/high dispersion area | < 0.5 km | 0.5 to 2 km | 2 to 5 km | 5 to 7 km | 7 to 15 km | > 15 km |
|---|----------|-------------|-----------|-----------|------------|---------|
| Impact potential of industry              |          |             |           |           |            |         |
| A4 (> 2 km)                               | R        | B           | G         | G         | G          | G       |
| A3 (2 to 5 km)                            | R        | R           | B         | G         | G          | G       |
| A2 (5 to 7 km)                            | R        | R           | R         | B         | G          | G       |
| A1 (>7 km)                                | R        | R           | R         | R         | B          | G       |

|          |                  |
|----------|------------------|
| <b>R</b> | Unsuitable       |
| <b>B</b> | Preferably avoid |
| <b>G</b> | Suitable         |

### e) Confirmatory Tests Through Air Quality Modelling

The Kilder Dispersion Model system (POI-KILD and ARE-KILD) of the NILU programs specially prepared for planning use for the Central Pollution Control Board in India

should preferably be used to confirm the site suitability by placing the data from existing industries of the suitable type at the proposed site and assessing its behavior.

### f) Suitability to Air Polluting Industries

Summary statement showing the site suitability for air polluting industries from various aspects as above (air quality, dispersion, land use, modeling) should be summarized as below:

| S.No. | Parameter                       | Suitability |        |
|-------|---------------------------------|-------------|--------|
|       |                                 | Site 1      | Site 2 |
| 1     | Land use sensitivity assessment |             |        |
| 2     | Dispersion sensitivity          |             |        |
| 2     | Air Quality                     |             |        |
| 4     | Air quality modelling           |             |        |

## C. WATER POLLUTION SENSITIVITY ASSESSMENT

1. Water pollution potential of industries
2. Wastewater disposal options (place of disposal) available
3. assimilative capacity of the receiving water body (taking into consideration source strength (pollution potential of industries), dilution factor (flow), use, existing quality etc.)
  - a) Location of wastewater disposal point in the river or receiving water body
  - b) Flow available in the rivers/streams (hydrology of the receiving water bodies);
  - c) Uses in the downstream (ecological sensitivity and functions of the receiving water bodies);
  - d) Existing water quality (ref. Chapter 2)
  - e) Assimilative capacity

### a) Water Pollution Potential of Industries

| Industry Category | Description   | Impact Potential* |
|-------------------|---|-------------------|
| W1                | <ul style="list-style-type: none"> <li>• Industry with <math>\geq 25</math> kld discharge of effluents (irrespective of organic load) that are not easily bio-degradable (<math>BOD/COD \leq 0.4</math>) or toxic or having TDS generation more than 10,000 mg/l</li> <li>• Industry with 100-500 kld discharge of non-toxic effluents with organic load of <math>&gt; 100</math> kg/d with <math>BOD/COD</math> ratio <math>\leq 0.4-0.7</math></li> <li>• Industry with <math>&gt; 500</math> kld of discharge of non-toxic effluents (irrespective of organic load) that are less bio-degradable (<math>BOD/COD=0.4-0.7</math>)</li> </ul> | Very High         |
| W2                | <ul style="list-style-type: none"> <li>• Industry with 100-500 kld discharge of non-toxic effluents</li> </ul>  | High              |

| Industry Category | Description  | Impact Potential* |
|-------------------|--|-------------------|
|                   | with organic load of < 100 kg/day with BOD/COD $\leq$ 0.7 <ul style="list-style-type: none"> <li>Industry with &gt;500 kld discharge of non-toxic effluents (irrespective of organic load) that are less biodegradable (BOD/COD ratio of &gt;0.7)</li> <li>Industry with <math>\geq</math>25 kld discharge of effluents (irrespective of organic load) having TDS generation &gt;5,000 mg/l but <math>\leq</math> 10,000 mg/l</li> </ul> |                   |
| W3                | <ul style="list-style-type: none"> <li>Industry with 25-500 kld of non-toxic effluents that are easily biodegradable or less biodegradable (BOD/COD ratio of &gt; 0.7)</li> <li>Industry with <math>\geq</math>25 kld discharge of effluents (irrespective of organic load) having TDS generation <math>\leq</math> 5,000 mg/l</li> </ul>  | Medium to High    |
| W4                | Industry with <25 kld discharge of effluents that are easily biodegradable (BOD/COD ratio of > 0.7) and non-toxic  | Low               |

\* impact potential considered without pollution control equipment in operation

### Assimilative Capacity

Assimilative capacity is assessed using Streeter-Phelps model. The model is based on the kinetics of the BOD reaction.

The computer model is based on these BOD equations and the necessary inputs for this model are as follows:

- location of existing water polluting industries and other pollution sources
- sampling points
- probable/existing discharge points
- water quality data (MINARS, SPCB, reports, etc.) from probable/existing disposal point and beyond (up to 10-15 km at frequent intervals for different seasons/months)
- flow rate and velocity of rivers ( in different seasons/months)
- Location of existing water intake points in downstream.

For a particular quantity of BOD load, the impact zone in the downstream of the river can be assessed using the model.

The model operates in the following manner:

- If the discharge from the industrial estate has a BOD load of  $Q_1$  and the drain into which it is to be discharged has a BOD load of  $Q_2$ , then the resultant BOD is:

$$\text{Resultant BOD } (Q_3) = (Q_1 F_1 + Q_2 F_2) / (F_1 + F_2)$$

where  $F_1$  is the flow from the industrial estate and  $F_2$  is the flow of the drain

- The time taken for the effluent discharged into a drain or a smaller stream to reach the confluence of a river is calculated as follows:

$$\text{Time (number of days)} = \text{Distance} / \text{Velocity of the stream}$$

The permissible BOD load at a discharge point is calculated as below:

Permissible BOD load at a discharge point (say "X" t/d) = Max. permissible BOD load - (Existing BOD load in d/s of the river + existing BOD load at the discharge point)

The corresponding quantity of discharge if BOD after treatment from the estate is 30 mg/l is calculated as below:

$$\frac{\text{"X"} \times 1000 \times 1000 \times 1000}{30 \times 1000} = \dots\dots\dots \text{m}^3/\text{d}$$

Based on above analysis and the simulation results the sites are suitable for the following water polluting industries.

| Site | Suitability (Category of Industries) | Max. Permissible BOD Load, Quantity of Discharge | Remarks |
|------|--------------------------------------|--|---------|
|      |                                      |  |         |
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|      |                                      |  |         |
|      |                                      |  |         |

## Step VIII: Recommendations

### A) Site(s) for Industrial Estate (in 1:12,500 scale)

- Exact Location, their distances to the nearest settlements
- Linkages- railway/roadway/port
- Area
- Land use description
- Nearest water body
- Distance and description of the nearest land use

### B) Suitability to industries

| <i>Suitability</i>        | <i>Industrial Estate - 1</i> | <i>Remarks</i> |
|---------------------------|------------------------------|----------------|
| Suitability to industries |                              |                |
| Industries not suitable   |                              |                |

## C) Recommendations on treatment and disposal of wastes/effluents, greenbelts, buffer zones etc.

## D) Land use development concept around the site

| <b>Zone type</b>               | <b>AGRICULTURAL PREFERENCE ZONES APZ</b>   |
|--------------------------------|--|
| <b>Sub-type</b>                | AGRICULTURAL PREFERENCE ZONE APZ 1<br>(AFFECTED BY AIR POLLUTION)  |
| <b>Definition</b>              | The Zone which is primarily used for agricultural production and where the air pollution risks are high i.e. where the ground level concentration exceed 50% of the maximum ground level concentration (as per the results of dispersion modeling).  |
| <b>Distance from Estates</b>   | Will vary depending on results of simulation, in particular type of air polluting industries and their stack height permitted for the estate but often within 2 – 4 km distance from estate  |
| <b>Function</b>                | Primary agricultural function without extension of other, not related uses   |
| <b>Allowed uses</b>            | Infrastructure development (electricity, water supply, sewage or effluent treatment, roads, rails etc.)<br>Plants for processing agro-products (e.g. rice mills etc.)<br>Agriculturally related buildings (store houses, go-downs etc.)<br>Extension of farm buildings<br>Extension of residential buildings only of villagers<br>Structures related to water management |
| <b>Excluded uses</b>           | Industrial development<br>Residential development unrelated to agriculture<br>Commercial development   |
| <b>Procedural requirements</b> | To be included into regional perspective plan as agricultural preference zone [UDPFI GUIDELINES, Model Urban & Regional Planning and Development Law: Section 26, Sub-Section (1),(a), (I), (ii) and/or (viii)]  |

| <b>Zone type</b>             | <b>AGRICULTURAL PREFERENCE ZONES APZ</b>  |
|------------------------------|---|
| <b>Sub-type</b>              | AGRICULTURAL PREFERENCE ZONE APZ 2  |
| <b>Definition</b>            | Zone primarily for agriculture production   |
| <b>Distance from Estates</b> | Varies with the existing land use   |
| <b>Function</b>              | Primary agricultural function without extension of other, not related uses  |
| <b>Allowed uses</b>          | Infrastructure development (electricity, water supply, sewage or effluent treatment, roads, rails etc.)<br>SSI related only to agricultural products (e.g. rice mills etc.)<br>Agriculturally related buildings (store houses, go-downs etc.) |

| <b>Zone type</b>               | <b>AGRICULTURAL PREFERENCE ZONES APZ</b>  |
|--------------------------------|---|
|                                | Extension of farm buildings<br>Limited residential development<br>Structures related to water management  |
| <b>Excluded uses</b>           | Industrial development<br>Large residential development<br>Organised commercial development   |
| <b>Procedural requirements</b> | To be included into regional perspective plan as agricultural preference zone<br>UDPFI GUIDELINES, Model Urban & Regional Planning and Development Law: Section 26, Sub-Section (1), (a), (I), (ii) and/or (viii) |

| <b>Zone type</b>               | <b>BUFFER ZONES BZ</b>  |
|--------------------------------|---|
| <b>Sub-type</b>                | Subdivision into an core buffer and outer buffer possible   |
| <b>Definition</b>              | Peripheral strip of land surrounding the boundary of estate   |
| <b>Distance from Estates</b>   | Up to 50 m from estate border for low air and water polluting industries<br>Up to 250 m from estates with moderate air polluting industries<br>Up to 1000 from high air polluting industries under consideration of dispersion conditions |
| <b>Function</b>                | Dispersion of air pollutants<br>Attenuation of air pollutants<br>Separation of estate from residential developments<br>Land treatment of effluents<br>Groundwater recharge of storm water   |
| <b>Allowed uses</b>            | tree plantation<br>agro-forestry<br>agriculture (if not affected by emission of pollutants)<br>infrastructure development   |
| <b>Excluded uses</b>           | All others  |
| <b>Procedural requirements</b> | Specific landscaping, use and management concept necessary<br>If buffers are subdivided for each buffer zone different management recommendations needed  |

| <b>Zone type</b>            | <b>DEVELOPMENT ZONES – DZ 1</b>   |
|-----------------------------|---|
| <b>Sub-type</b>             | To be further detailed and subdivided according to zoning regulations applicable for town planning  |
| <b>Definition</b>           | Zone that after environmental sensitivity assessment is suitable to accommodate development directly or indirectly connected with the estate and likely to come close to it |
| <b>Distance from Estate</b> | Outside of Buffer Zone (distances see there)<br>Outside of APZ 1 (Zone affected by air pollution)   |
| <b>Function</b>             | Accommodate informal development<br>Accommodate residential and commercial development  |
| <b>Allowed uses</b>         | In accordance with a lay-out plan to be specifically prepared for the marked development zone   |
| <b>Excluded uses</b>        | Industry and Infrastructure facilities related to industries  |

|                                |  |
|--------------------------------|--|
| <b>Zone type</b>               | <b>DEVELOPMENT ZONES – DZ 1</b>  |
| <b>Procedural requirements</b> | To be included into regional perspective plan as agricultural preference zone [UDPFI GUIDELINES, Model Urban & Regional Planning and Development Law: Section 26, Sub-Section (1),(a), (ix) and (if applicable) Section 44, Sub-section (2), (c), (f)]<br>Lay-out plan to be prepared by appropriate local authorities and to be approved and implemented as per prescribed procedures |

|                                |  |
|--------------------------------|--|
| <b>Zone type</b>               | <b>DEVELOPMENT ZONES – DZ 2</b>  |
| <b>Sub-type</b>                | To be further detailed and subdivided according to zoning regulations applicable for town planning   |
| <b>Definition</b>              | Zone that after environmental sensitivity assessment is suitable to accommodate development directly or indirectly connected with the type of industries likely to come in the estates   |
| <b>Distance from Estate</b>    | Outside of Buffer Zone (distances see there)<br>Outside of APZ 1 (Zone affected by air pollution)  |
| <b>Function</b>                | Accommodate informal development<br>Accommodate infrastructure likely to come with the state   |
| <b>Allowed uses</b>            | Industry and Infrastructure facilities related to industries<br>Wholesale and ware housing facilities, Integrated freight Complex, Truck Terminals, Substations , Fire Stations and Service centers related industries.  |
| <b>Excluded uses</b>           | Residential and commercial development likely to come of with residential development.<br>In accordance with a lay-out plan to be specifically prepared for the marked development zone  |
| <b>Procedural requirements</b> | To be included into regional perspective plan as agricultural preference zone [UDPFI GUIDELINES, Model Urban & Regional Planning and Development Law: Section 26, Sub-Section (1),(a), (ix) and (if applicable) Section 44, Sub-section (2), (c), (f)]<br>Lay-out plan to be prepared by appropriate local authorities and to be approved and implemented as per prescribed procedures |

|                             |   |
|-----------------------------|---|
| <b>Zone type</b>            | <b>ENVIRONMENTAL RESOURCES PROTECTION ZONES ERPZ 1</b>  |
| <b>Sub-type</b>             | Regional green corridors, National Parks, Forests, Sanctuaries, Natural resource areas Ground water recharge areas etc.   |
| <b>Definition</b>           | Legally restricted and environmentally sensitive zones  |
| <b>Distance from Estate</b> | From buffer boundary up to 10 km  |
| <b>Function</b>             | Natural resource areas<br>Dispersion of air pollutants<br>Attenuation of air pollutants<br>Improvement of micro-climate<br>Separation of estate from large urban areas (over 10 lacs population)<br>Groundwater recharge<br>Recreational functions<br>Agriculture |



| Zone type                      | ENVIRONMENTAL RESOURCES PROTECTION ZONES ERPZ 1  |
|--------------------------------|--|
| <b>Allowed uses</b>            | Infrastructure development (electricity, water supply, sewage or effluent treatment, roads, rails etc.)<br>Plants for processing agricultural products (e.g. rice mills etc.)<br>Agriculturally related buildings (store houses, go-downs etc.)<br>Extension of farm buildings<br>Limited residential development (not-related to farming)<br>Structures related to water management |
| <b>Excluded uses</b>           | Industrial development<br>Larger residential development<br>Organised commercial development   |
| <b>Procedural requirements</b> | To be included into regional perspective plan as agricultural preference zone in accordance with UDPFI GUIDELINES, Model Urban & Regional Planning and Development Law: Section 26, Sub-Section (1), (a), (ii) (viii) and/or (xii)   |