

# Environmental Impact Assessment

Environmental Engineering

# Environmental Impact

- If a certain project has a significant **impact on the quality of the environment**, EIA is mandatory
- Example: power stations, flood-control systems, Agriculture, Forestry activities, Tourism and Recreational Development, Food and beverage industries, and Building and Civil Engineering Industries

# What is an EIA?

An *environmental impact assessment* (EIA) is an activity designed to identify and **predict** the impact of **legislative proposals, policies, programs, projects** and operational procedures on

- the biogeophysical environment and
- on human health and well-being, and to **interpret and communicate information about the impact.**

# What is an EIA?

***Environmental Assessment:*** The methodology of identifying and evaluating in advance, any impact positive or negative, which results from the implementation of a proposed action. (Ethiopia EPA)

# What is it really?

Environmental Impact Assessment is a **process**, set down as a **repeatable series of steps to be taken**, to allow the environmental consequences of a proposed development to be assessed.

The environmental consequences have to be those **INCREMENTAL effects which are due to the proposed development**, and **not** those which are **due to the passage of time** or **other developments not included in the proposal**.

**Screening** (does the project require EIA?)



**Scoping** (what issues and impacts should the EIA address?)



**Baseline studies** (establish the environmental baseline)



**Alternatives** (consider the different approaches)



**Impact prediction** (forecast the environmental impacts)

**Impact assessment** (interpreting the impacts)



**Mitigation** (what can be done to alleviate negative impacts?)



**EIS preparation/review** (document the EIA findings)



**Public consultation** (consult general public and NGOs)



**Monitoring** (monitor impacts of project)

# Screening

- Is an EIA needed?
- Many projects may have no significant environmental effects
- A screening mechanism **seeks** to
  - identify **projects with significant** adverse environmental effects

# Screening

- Criteria used include
  - size of project,
  - nature of project and
  - sensitivity of the environment.
- Outputs of screening
  - *No EA required*
  - *Preliminary Assessment (PA)* – preliminary assessment is applied to:
    - Projects with limited impacts,
    - Projects in which the need of EA is unclear, and
    - Proposals with inadequate information
  - *Full scale EA* – when there is sufficient ground for detail assessment.



# Scoping

- The **scope** of an EIA is the issues and impacts it addresses
- An EIA should focus only on the **significant** issues and impacts
- **Scoping** is the process of deciding **which of a project's possible alternatives and impacts should be addressed** in the EIA

# Scoping

- **Effective scoping** enables
  - **limited resources to be allocated to best effect** (i.e. through investigation of only the most significant impacts)
  - to focus the study and identify those environmental impacts which need detailed analysis
- Scoping is carried out in discussions between the **developer**, the competent authority, relevant agencies and, ideally, the public

# Baseline studies

- Assemble relevant information on the **current status of the environment**
- Should **anticipate the future state** of the environment assuming the project is not undertaken - the '**no action alternative**'
- This provides the '**baseline**' against which future impacts can be assessed

# Alternatives

- EIA is ideally undertaken for a project and its alternatives
  - different locations,
  - different scales
  - different designs
- Alternatives are the 'raw material' of EIA
- the discussion of alternatives as the 'heart' of the EIS
- Many EISs fail to consider alternatives

# Impact prediction

- Prediction requires the **understanding of the cause-effect chain** and of the modifications introduced in the environment by the development
- Impact prediction is where most of the EIA resources are spent.

# Impact assessment

- involves *evaluating* the **significance** of the impacts identified
- Significance can be determined through **professional judgement**, reference to regulations etc.
- Potential for bias in determining what is significant
- Can ultimately be used by decision-makers when determining the fate of the project application

# Impact assessment

- Semi-quantitative approaches:
  - checklist,
  - the interaction matrix, and
  - the checklist with weighted rankings.

# Impact assessment: Checklists

- Checklists: lists of potential environmental impacts, both primary and secondary.
- **Primary effects** :as a **direct result** of the proposed project, such as the **effect of a dam on aquatic life**.
- **Secondary effects** : an **indirect result** of the action. For example, an **interchange for a highway** may not directly affect wildlife, but indirectly it will draw such establishments as service stations and quick food stores, thus **changing land use patterns**.



# Impact assessment: Checklists

- The checklist technique lists all of the pertinent factors; then the **magnitude** and **importance** of the impacts are estimated.
- May be quantified by establishing an arbitrary scale, such as:
  - 0 = no impact
  - 1 = minimal impact
  - 2 = small impact
  - 3 = moderate impact
  - 4 = significant impact
  - 5 = severe impact

# Impact assessment: Interaction matrix

- Two-dimensional listing of existing characteristics and conditions of the environment and detailed proposed actions that may affect the environment.
- The interactions are measured in terms of magnitude and importance.
- The magnitudes represent the extent of the interaction between the environmental characteristics and the proposed actions and typically may be measured.
- The importance is often a judgment part of the engineer.

# Example

- the case of a pollutant that strongly degrades a water flow
- Town A :- a remote region without valuable fauna or human settlements,
- Town B:- a city with significant human settlement

	Importance x Magnitude
Town A	$1 \times 5 = 5$
Town B	$5 \times 5 = 25$

# Example

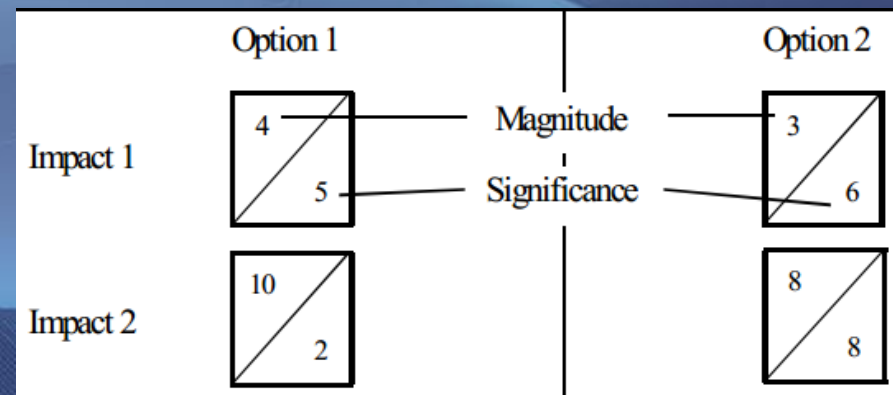
- A landfill is to be placed in the floodplain of a river. Estimate the impact by using the checklist technique.

Potential Impact	Importance x Magnitude
Groundwater contamination	$5 \times 5 = 25$
Surface water contamination	$4 \times 3 = 12$
Odor	$1 \times 1 = 1$
Noise	$1 \times 2 = 2$
Total	40

This total of 40 may then be compared with totals calculated for alternative courses of action.

# Example

- Lignite (brown) coal is to be surface-mined in a small mountainous town. Construct an interaction matrix for the water resources (environmental characteristics) vs resource extraction (proposed actions).



### Proposed action

Environmental characteristics	Proposed action							Total
	Blasting + drilling	Surface excavation	Subsurface excavation	Well drilling	Dredging	Timbering	Commercial fishing	
Surface water	3 2	5 5						8 7
Ocean water								
Underground water		3 3						3 3
Quantity								
Temperature		1 2						1 2
Recharge								
Snow, ice								
<b>Total</b>	3 2	9 10						12 12

# Mitigation

- **Negative impacts** on the environment identified during the EIA can be **alleviated** through **mitigation measures**
- The mitigation hierarchy: ***Avoid - Reduce - Remedy - Compensate - Enhance***
- **residual impacts:** Impacts remaining after mitigation

# EIS preparation / review

- The **Environmental Impact Statement (EIS)** is a formal document which includes information on the development and information relating to screening, scoping, baseline studies, alternatives etc.
- Common requirement to include a **non-technical summary**



# EIS preparation / review

- Once complete, the EIS is submitted to the competent authority (along with the planning application)
- The EIS is often **reviewed** (either formally or informally)
- The review enables the competent authority to decide whether the EIA is adequate, accurate and unbiased

# Public consultation

- The EIA provides for **public consultation** on the application for development and the EIS

# Post-project monitoring

- **Monitoring** should determine:
  - the accuracy of the original predictions
  - the degree of deviation from the predictions
  - the possible reasons for any deviations
  - the extent to which mitigation measures have achieved their objectives

# What is in an EIS?

- Non Technical Summary
- Description of the proposals
- Assessment of Baseline conditions
- Assessment of no development conditions
- Assessment of conditions with development
- Mitigation proposals

# What is in an EIS?

All conditions assessed for

- Construction phase
- Operation phase

# Construction Phase

- Temporary
- Higher levels of impact usually deemed acceptable
- Difficult to predict
- VERY difficult to enforce conditions
- Usually well influenced by effective consultation

# Operation Phase

- Long Term
- Much less room for compromise on standards
- Relatively simpler to predict
- Less difficult to enforce conditions, as the conditions are on the project owner
- Usually less influenced by effective consultation at scheme level, more at detailed level

# Operation Phase

- Can be several phases
- Project itself may be developed in stages
- Sometimes need to look at
  - Commissioning
  - Opening
  - Operation after period
  - Operation once landscaping mature
  - Operation at design capacity
  - Operation at ultimate capacity



