METHODS of Environmental Impact Assessment (EIA)

EIA: methods

- Methods for identifying environmental impacts and their significance
- Common shortcomings concerning the application of EIA in practice

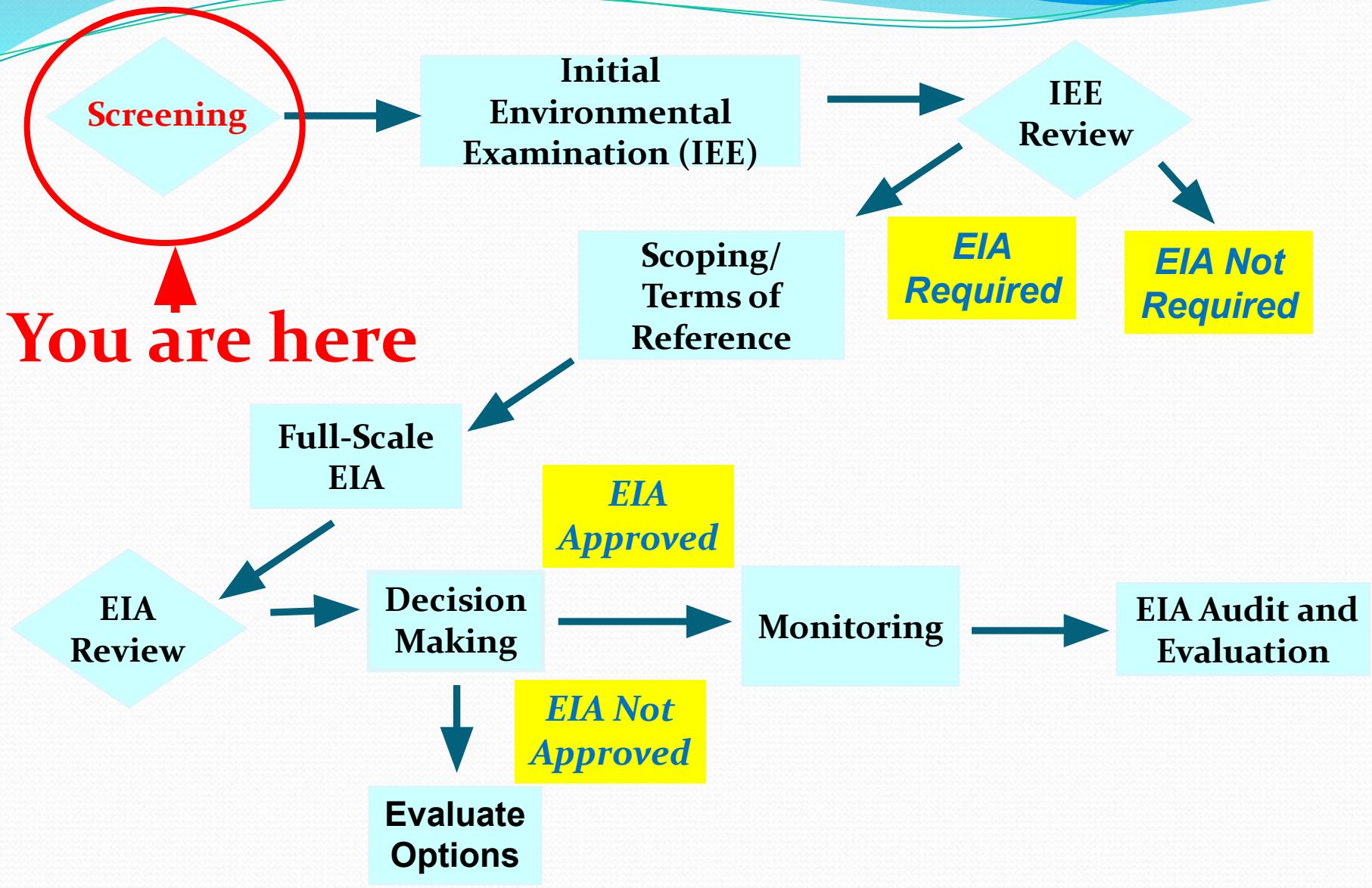
EIA

- EIA is a systematic process to identify, predict and evaluate the environmental effects of proposed actions and projects.
- A broad definition of environment is adopted. Whenever appropriate social, cultural and health effects are also considered as an integral part of EIA.
- Finally, particular attention is given in EIA for preventing, mitigating and offsetting the significant adverse effects of proposed undertakings

The Environmental Impact Assessment Process

Major steps in the EIA process are:

- Screening
- Initial Environmental Examination (IEE)
- Scoping
- Full-Scale Assessment
- EIA Review and Decision Making
- Monitoring and Follow-Up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Screening

- It would be time consuming and a waste of resources for all proposed projects and activities to undergo EIA
- Not all development projects require an EIA, as some projects may not pose an environmental threat
- Screening is the process used to determine whether a proposed project or activity requires an EIA and, if so, what level of environmental review is necessary

Purpose

- Identify those projects or activities that may cause potential significant impacts
- Identify special conditions/analyses that may be required by international funding bodies
- Categorize the project as one where:
  - Full-Scale EIA required
  - Some further environmental analysis required
  - No further environmental analysis required

Typical Proposals Requiring Full-Scale EIA

- Infrastructure projects
- Large-scale industrial activities
- Resource extractive industries and activities
- Waste management and disposal
- Substantial changes in farming or fishing practices

Screening Techniques

- Assessor or decision-maker discretion
- Project lists with thresholds and triggers
- Exclusion project lists
- Preliminary or initial EIAs
- Combination of these techniques

Screening Criteria

Screening criteria typically consider:

- Project type, location, size (e.g., capital investment, number of people affected, project capacity, areal extent)
- Receiving environment characteristics
- Strength of community opinion
- Confidence in prediction of impacts

Project Location

Requirements for screening:

- The screening checklist should include a section on site location characteristics, including, at a minimum, the four categories of environmentally critical areas:
  - National Parks
  - Indigenous people's area
  - Tourist area
  - Ecologically sensitive area

Project Location (Cont'd)

- Site selection defines the location of the study area and the specific environmental resource base to be examined
- Often the single most important factor contributing to a project's potential negative impacts
- Regional development plans should be used as guides to select project locations where environmental conditions will be minimally impacted

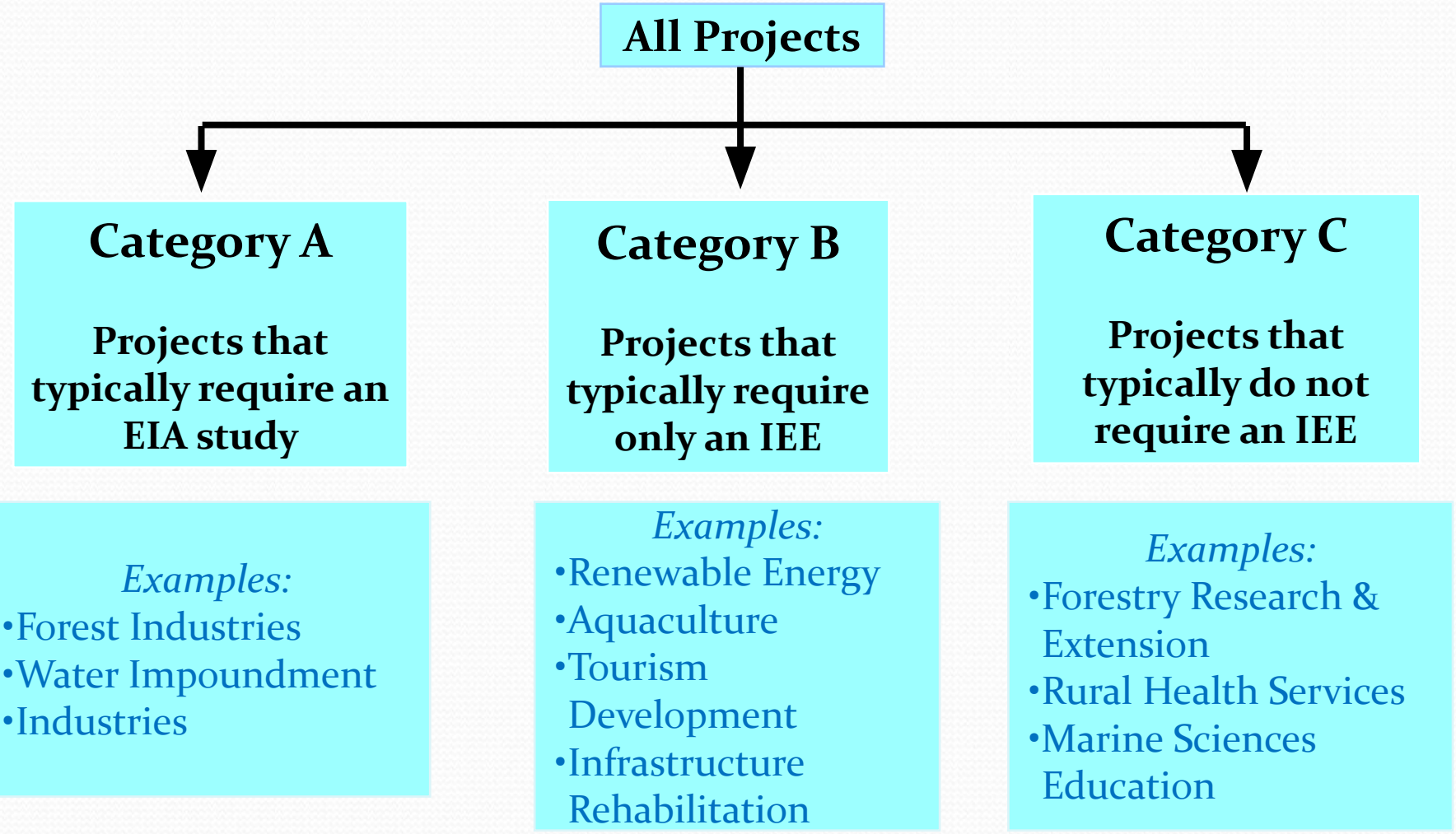
Example Project Screening Criteria

Type of Project	Threshold Scale	Location
1. Infrastructure • Commercial Airport • Mass Transit System • Hotel or Resort	 All All > 80 Rooms	 - - 4 Critical Areas
2. Agriculture & Natural Resources • Dam or Reservoir • Irrigation	 >100 million cu. m. > 15 sq. km.	

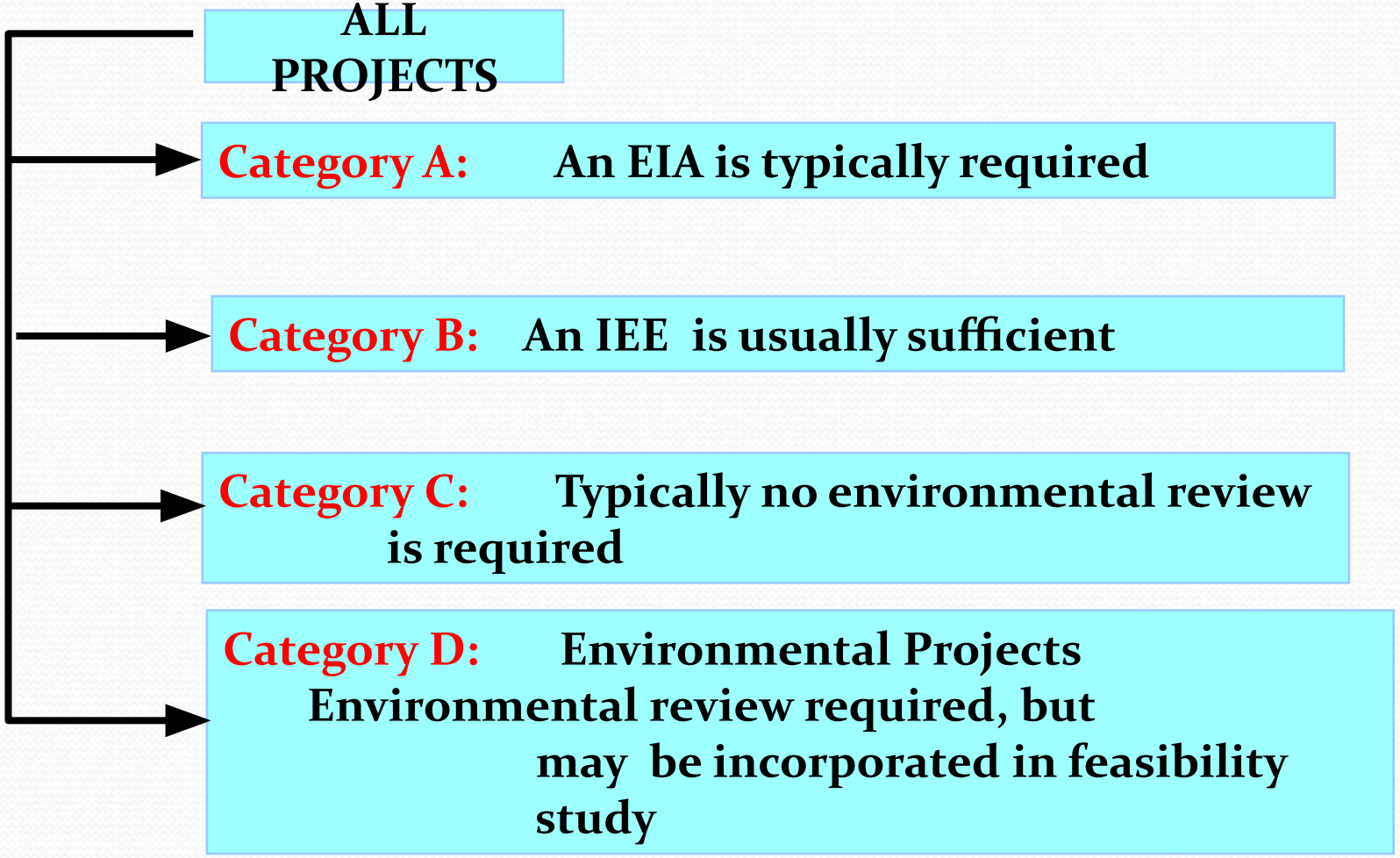
Example Project Screening Criteria (Cont.)

Type of Project	Threshold Scale	Location
3. Industrial and Power		
• Petrochemical Industry	> 100 tons/day (raw material)	
• Oil Refinery	All	
• Chlor-Alkaline Industry	All	
• Natural Gas Separation	100 tons/day (output)	
• Iron/Steel	100 tons/day, batch	
• Cement Industry	All	
• Smelting	> 50 tons/day	
• Pulp Industry	> 50 tons/day	
• Industrial Estates	All	
• Thermal Power Plants	> 10 megawatts	
• Mining	All	

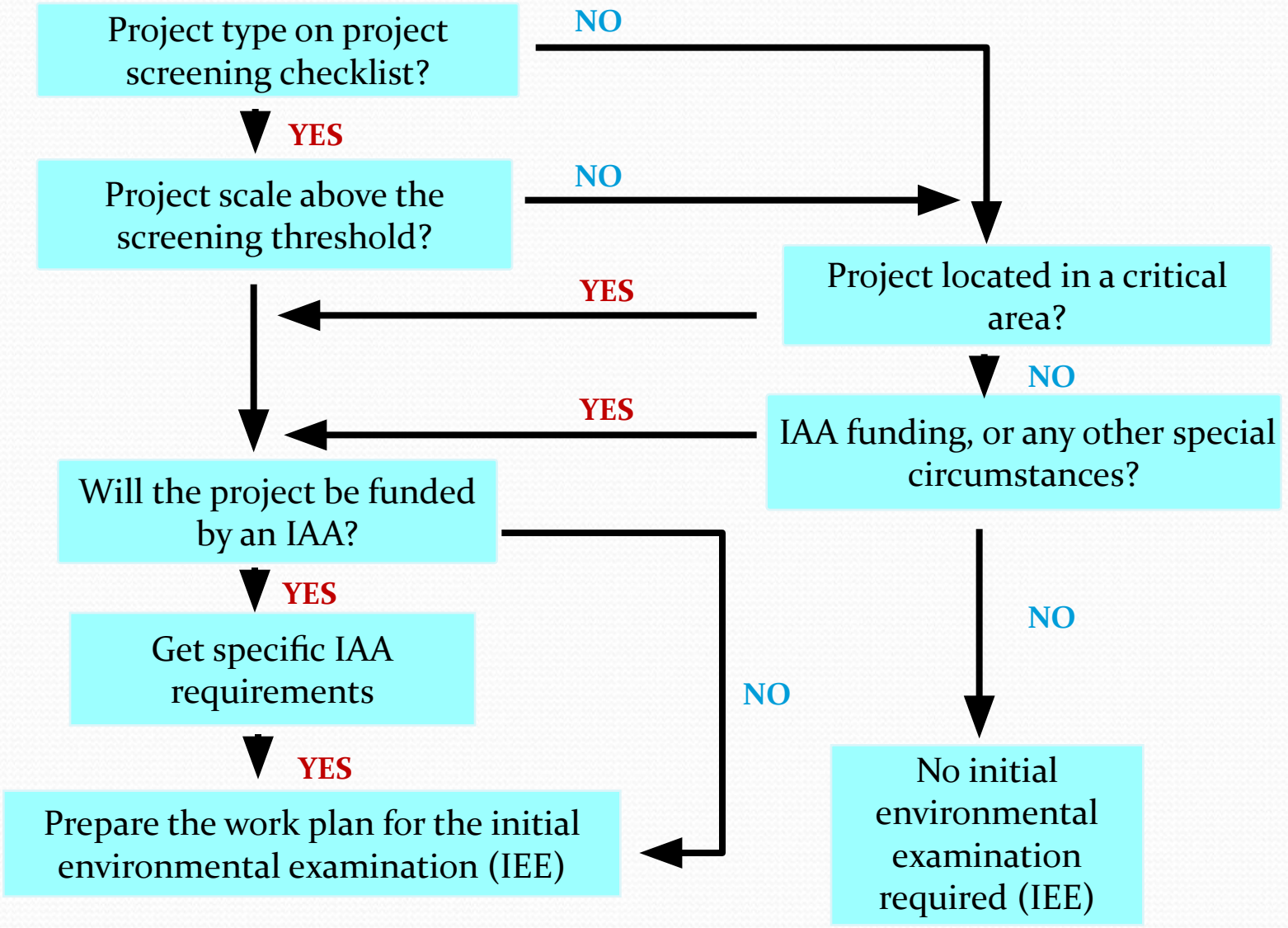
Asian Development Bank (ADB) Screening Categories

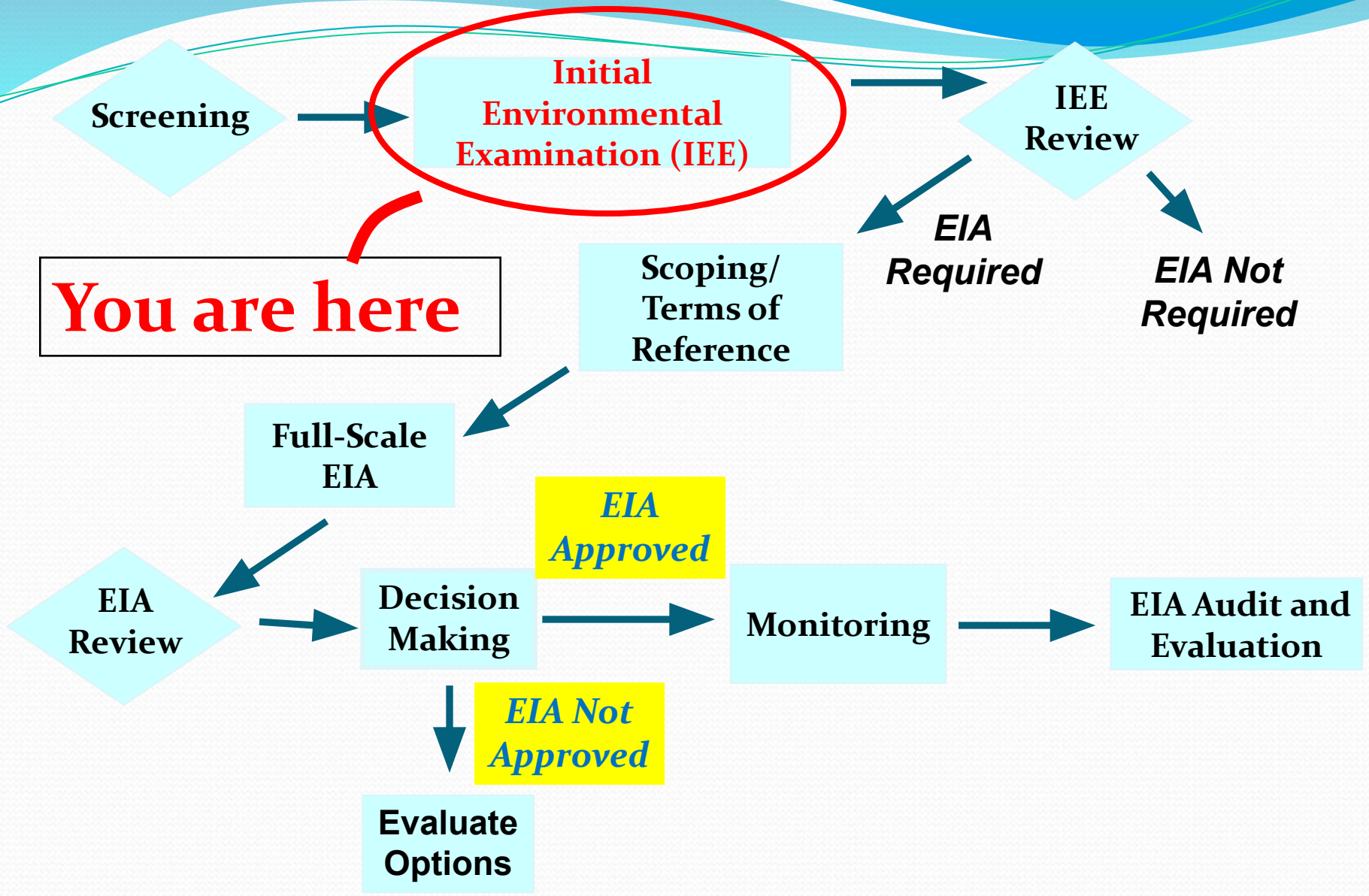


World Bank Screening Categories



Project Screening Flow Chart

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Initial Environmental Examination

Initial environmental examination (IEE) is intended as a low-cost environmental evaluation that makes use of information already available

Purpose of IEE

- Describes the proposed project or activity and examines alternatives
- Identifies and addresses community concerns to extent possible
- Identifies and assesses potential environmental effects
- Directs future action

Objectives of IEE

- Identify all potential environmental concerns relating to a proposed project or activity
- Identify all significant environmental issues (SEIs)
- Resolve simple SEIs
- Develop the focus for follow-up studies based on unresolved SEIs

Possible IEE Outcomes

1. No requirement for further environmental study; proposal not anticipated to have significant impact
2. Limited environmental study needed; environmental impacts are known and can be easily mitigated
3. Full-scale EIA required; impacts unknown or likely to be significant

IEE in the Overall EIA Process

Project Screening

Identifies projects that typically contain potential significant issues

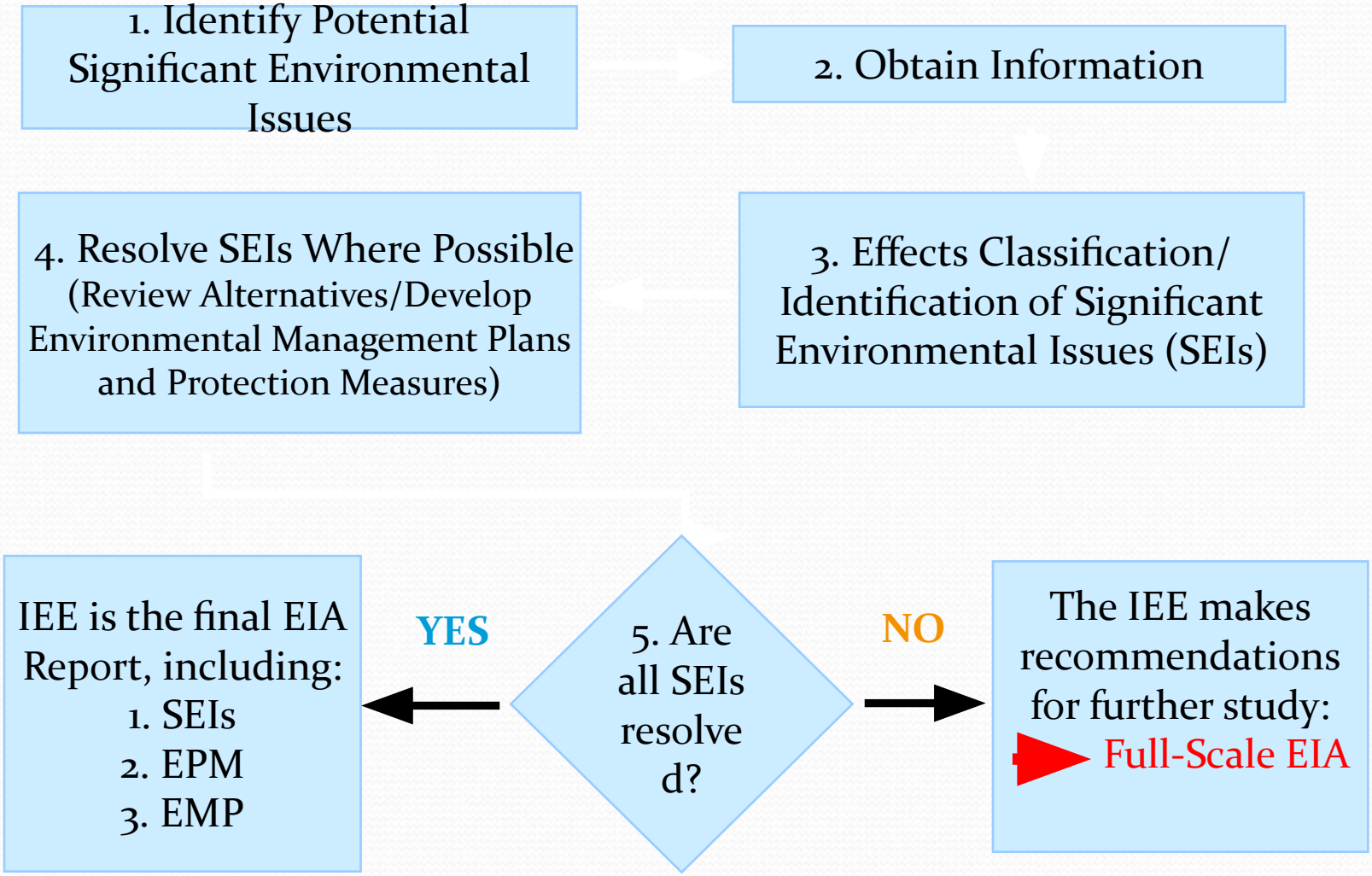
Initial Environmental Examination

1. Identifies potential significant environmental issues associated with a project
2. Grades effects and identifies actual Significant Environmental Issues (SEIs)
3. Resolves simple SEIs
4. Recommends further action for resolving outstanding SEIs

Full-Scale EIA or Other Additional Study

Resolves any remaining significant environmental issues

IEE Flow Chart



Identification of Potential Significant Issues

1. Identify valued environmental/ecosystem components (VECs)

   - Professional judgement/past experience
   - Legislative requirements
   - Stakeholder and community values

2. Identify the potential for impacts to each VEC
3. Identify potential for cumulative impacts (i.e. to the site as a whole and to the region)

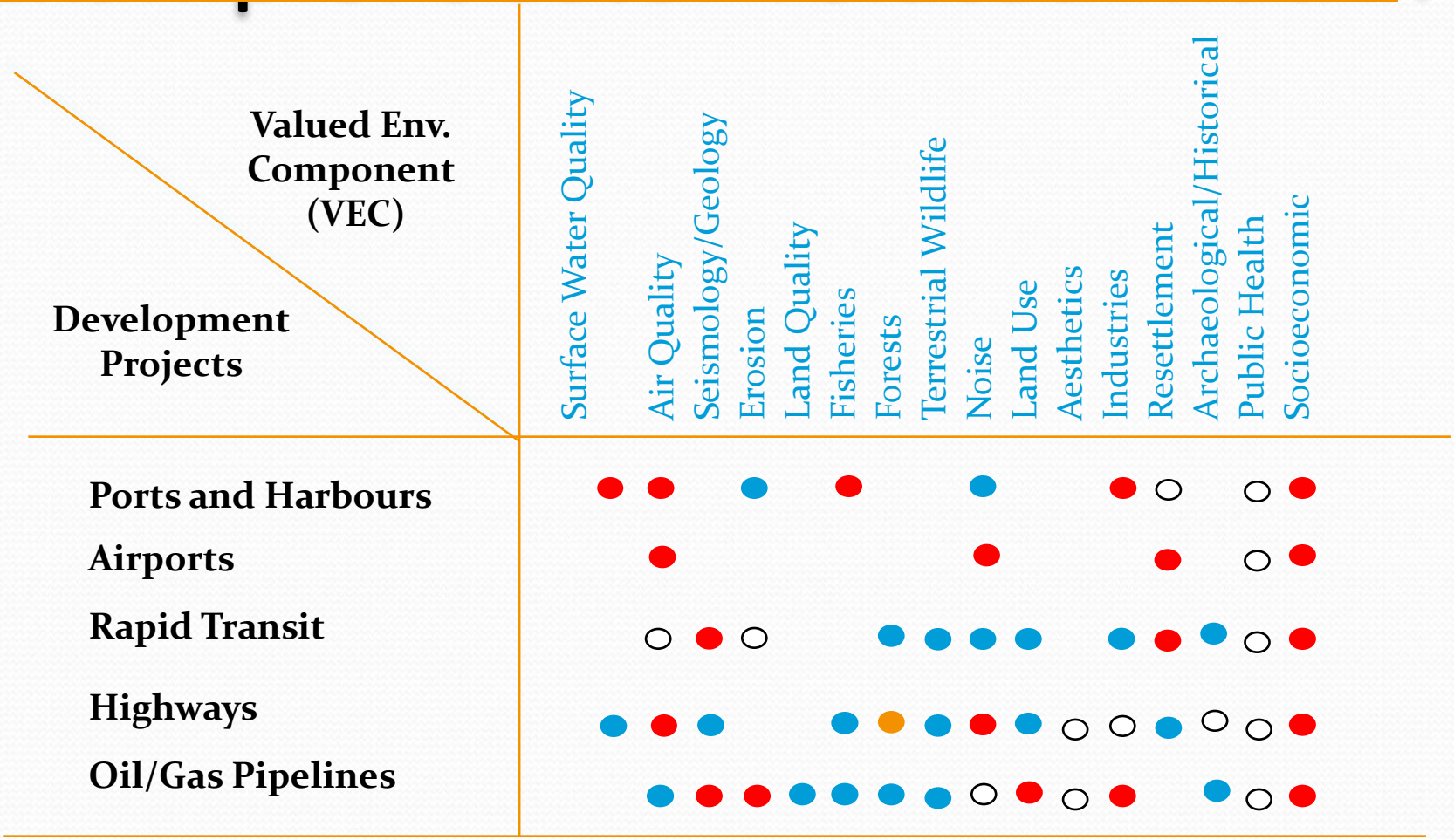
Commonly Considered VECs

- Natural physical resources (e.g., surface and groundwater, air, climate, soil)
- Natural biological resources (e.g., forests, wetlands, river and lake ecology)
- Economic development resources (e.g., agriculture, industry, infrastructure, tourism)
- Quality of life (e.g., public health, socio-economic, cultural, aesthetics)
- National commitments (e.g., endangered species protection)

Methods for Identifying Potential Impacts to VECs

- Matrices
  - Sector-related
  - Project type
- Checklists
- Professional expertise and experience with similar project types
- Combination of techniques

Example: Sector-related matrix



Project Checklist Example

Actions Affecting Resources and Values:

1. Disruption of hydrology
2. Resettlement
3. Encroachment on precious ecology
4. Encroachment on historic/ cultural values
5. Cooling tower obstruction
6. Regional flooding hazard
7. Waste emissions related to siting

Potential Damages:

1. Impairment of other beneficial water uses
2. Social inequities
3. Loss of these values
4. Loss of these values
5. Conflicts with other beneficial water uses
6. Hazard to plant operations
7. Intensification of problems of pollution control

Considerations in Determining Potential Effects

- Impacts to:
  - individual VECs
  - entire site (i.e., impacts to all VECs combined)
  - cumulative impacts to the area (i.e., considering other existing and planned projects)
- Impacts from all phases of the project (i.e., construction, operation, decommissioning)
- Impacts on different time-scales
- Impacts from different orders of impact

Example: Orders of Impact

River Embankment

First Order

Dry Flood Plains

Second Order

Loss of Plain Fisheries

Third Order

Loss of Fisheries Income

Fourth Order

Social Tension and Poverty Intensified

Data Requirements

- Project
  - Type
  - Size
  - Location
- Area of potential impact
  - Physical resources
  - Biological resources
  - Economic development resources
  - Quality of life
  - Other existing and planned projects

Sources of Information

- Existing reports on environmental resources in the area
- Previous assessment reports
  - IEE and EIA reports on similar project types
  - Reports on other projects in the region that may cause similar disturbances
- Regional planning, policy and other reports
- Field studies
- Local citizens and traditional knowledge

Effects Classification

Effects vary in significance, depending on their:

- Nature: positive, negative, direct, indirect, cumulative, synergistic
- Magnitude
- Extent/location: area/volume covered, distribution
- Timing: during construction, operation, decommissioning, immediate, delayed, rate of change

Effects Classification (Cont'd)

- Duration: short-term, long-term, intermittent, continuous
- Reversibility/irreversibility
- Likelihood: risk, uncertainty or confidence in the prediction

Criteria for Evaluating Potential Effects

- Importance of affected resource
- Magnitude and extent of disturbance
- Duration and frequency
- Risk/likelihood of occurrence
- Reversibility
- Contribution to cumulative impacts

Options for Addressing SEIs

1. Resolve SEIs within IEE
   - Number of different strategies for addressing SEIs
   - Strategies chosen will depend on the number, type, and significance of identified SEIs
2. Identify need for future studies to address SEIs (e.g., full-scale EIA or other detailed studies)

Possible Strategies for Resolving SEIs Within the IEE

- Re-evaluate regional plans (e.g., to address cumulative impacts with other planned projects)
- Review project options (i.e., alternatives and modifications)
- Evaluate site mitigation strategies; including compensation strategies
- Likely will use a combination of strategies

Examples of Project Alternatives

- No-build alternative
- Demand alternatives (e.g., using existing energy capacity more efficiency rather than building more capacity)
- Activity alternatives (e.g., providing public transport rather than increasing road capacity)
- Location alternatives

More Examples of Project Alternatives

- Process alternatives (e.g., re-use of process water, reducing waste, different logging methods)
- Scheduling alternatives (e.g., timing of project construction)
- Input alternatives (e.g., use of different raw materials or sources of energy)

Effects Significance Grading

Increasing Severity

No effect

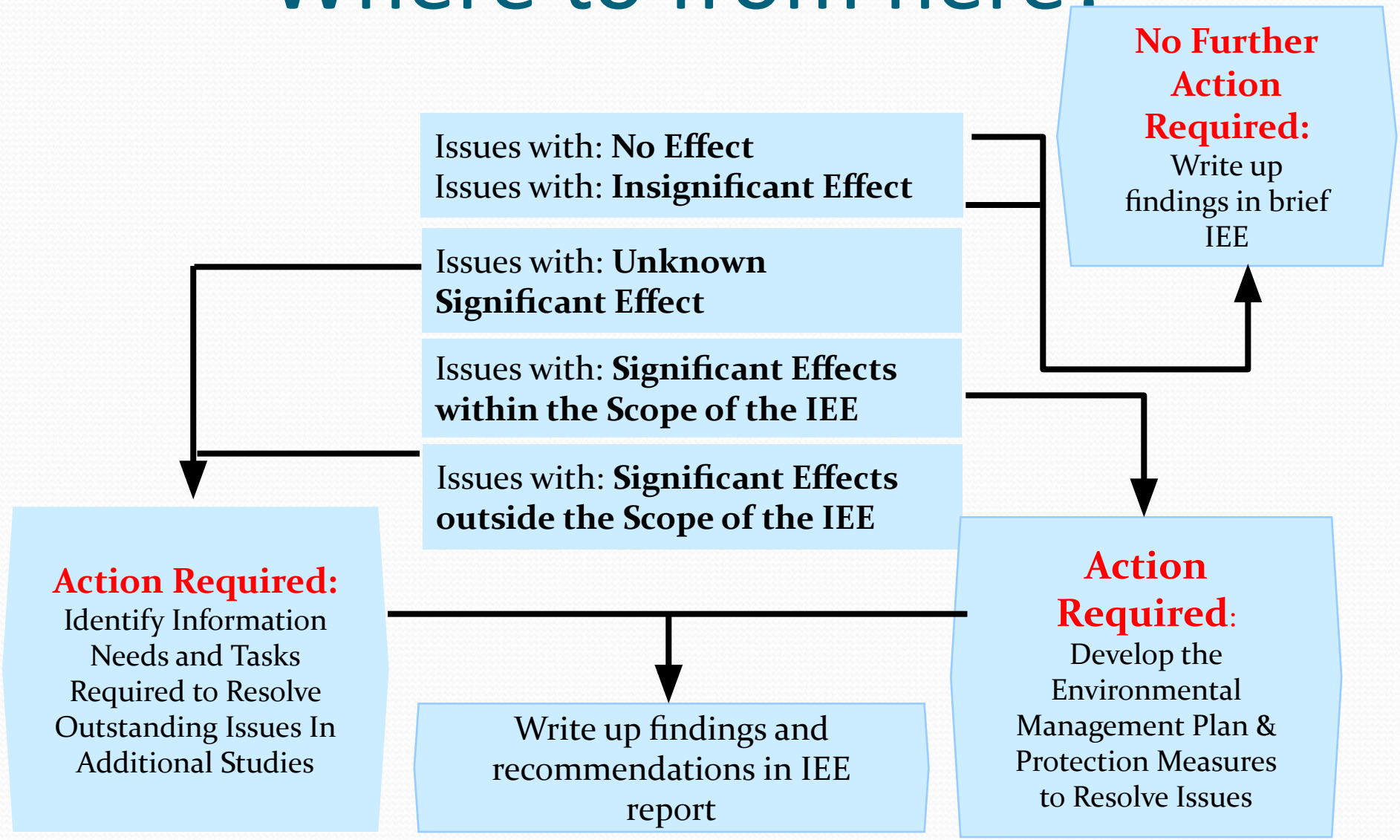
Insignificant effect

Unknown significant effect

Significant effect, resolution is within the scope of the IEE

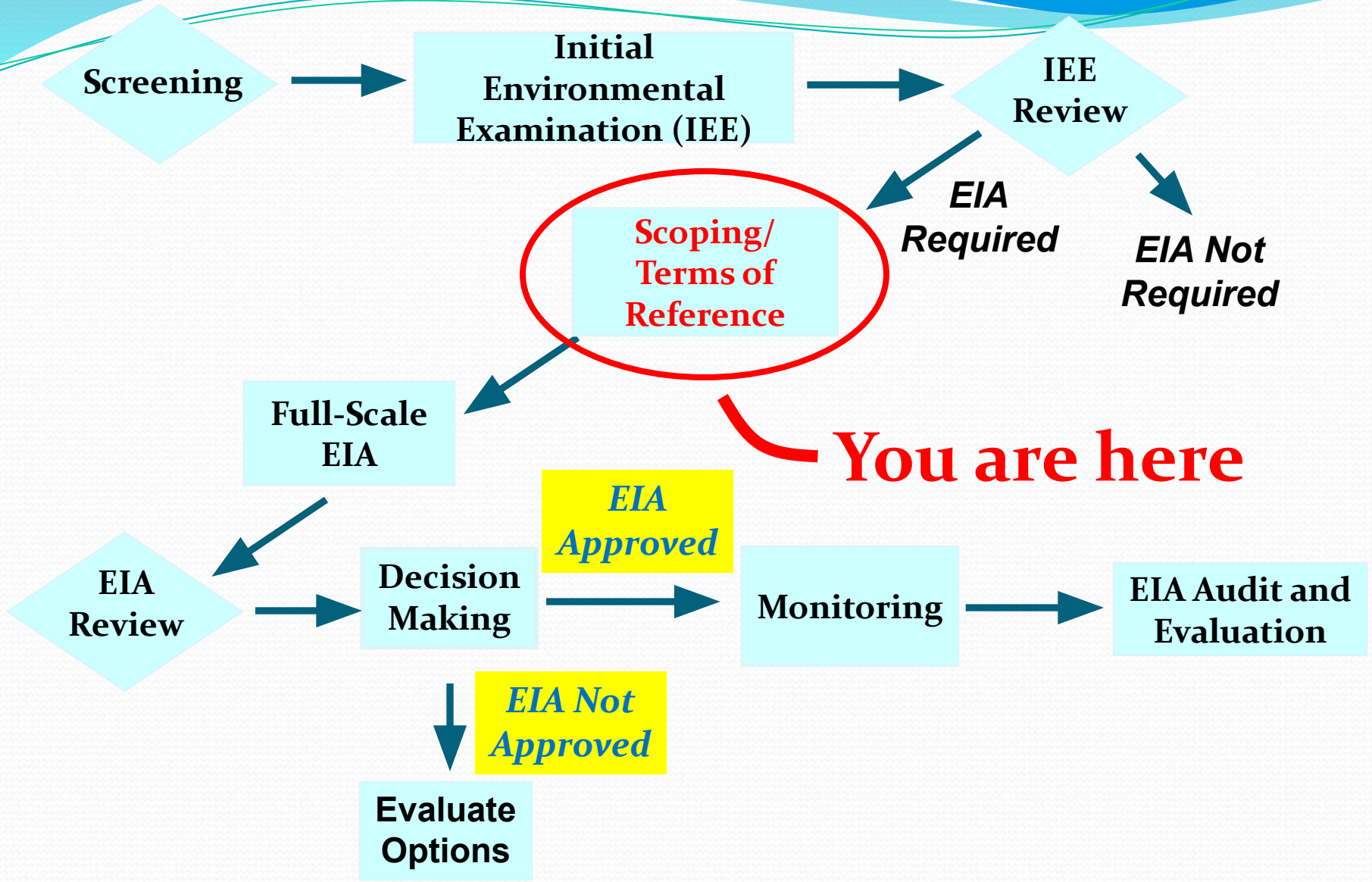
Significant effect, resolution is outside the scope of the IEE

Where to from here?



Example IEE Report Contents

1. Description of the project
2. Description of the environment
3. Screening of potential environmental issues and rationale for their significance grading
4. Environmental protection measures
5. Environmental monitoring and institutional requirements
6. Recommendations for additional studies
7. Conclusions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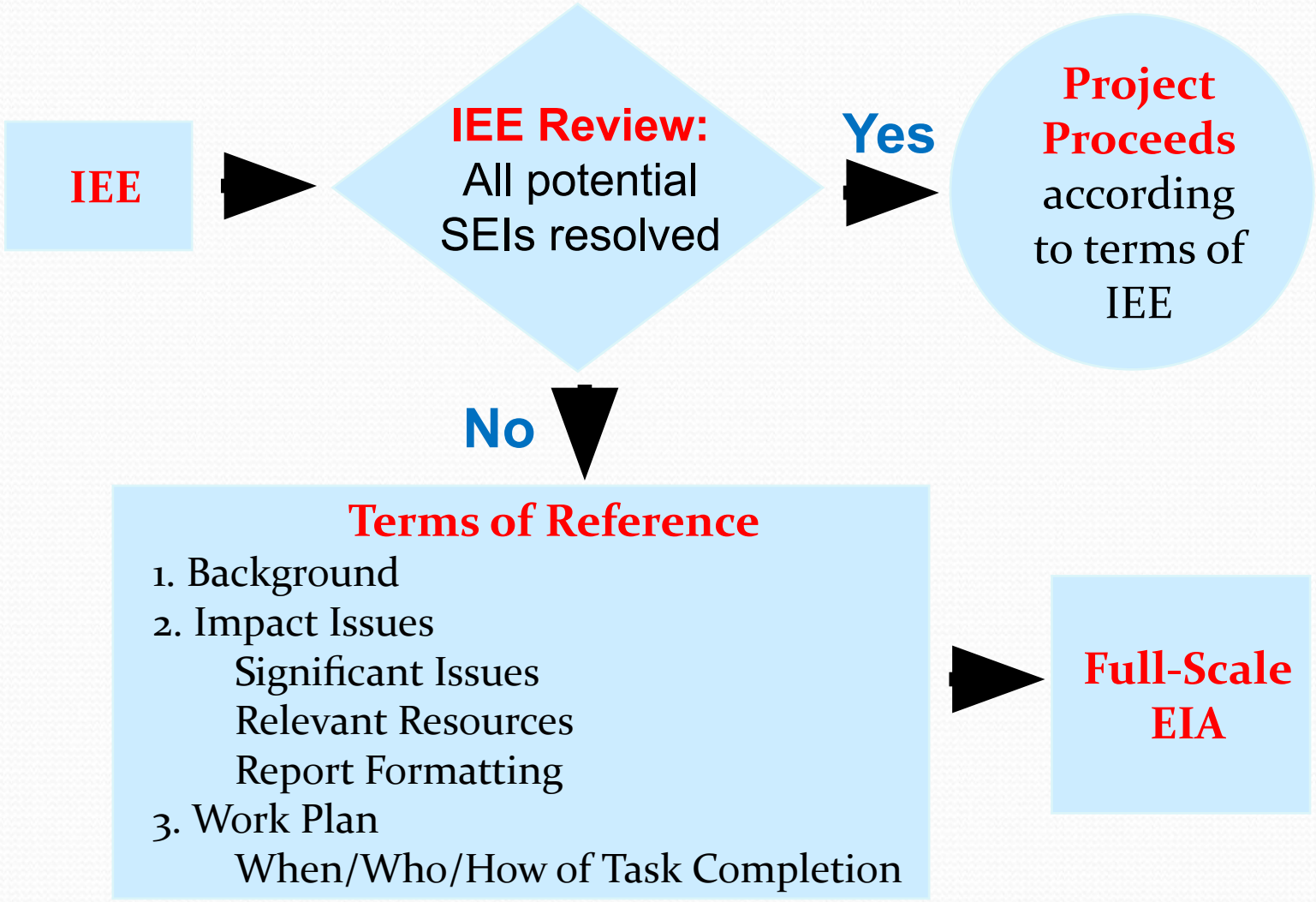
Terms of Reference Context



Scoping

- A process of interaction between government agencies and project proponents

- Identifies:
  - spatial and temporal boundaries for the EIA
  - important issues and concern
  - information necessary for decision making
  - significant effects and factors to be considered

  - Establishes Terms of Reference for full-scale EIA

Importance of Scoping

- Serves to facilitate efficient EIA by identifying appropriate areas for consideration (e.g, key issues, concerns, alternatives)
- Reduces likelihood of deficiencies in EIA (e.g., ensures that important issues are not overlooked)
- Prevents unnecessary expenditures and time delays from oversights or unnecessary areas of study

Terms of Reference Content

Background information section should include:

- Project Description (i.e., type, magnitude, location, alternatives and constraints)
- Environmental Setting (i.e., delineation of study area, listing of environmental resources and sensitive or special value areas)
- Background Reports (e.g., aspects of the environmental setting, previous projects with relevant impacts or resources)

Terms of Reference Content (Cont.)

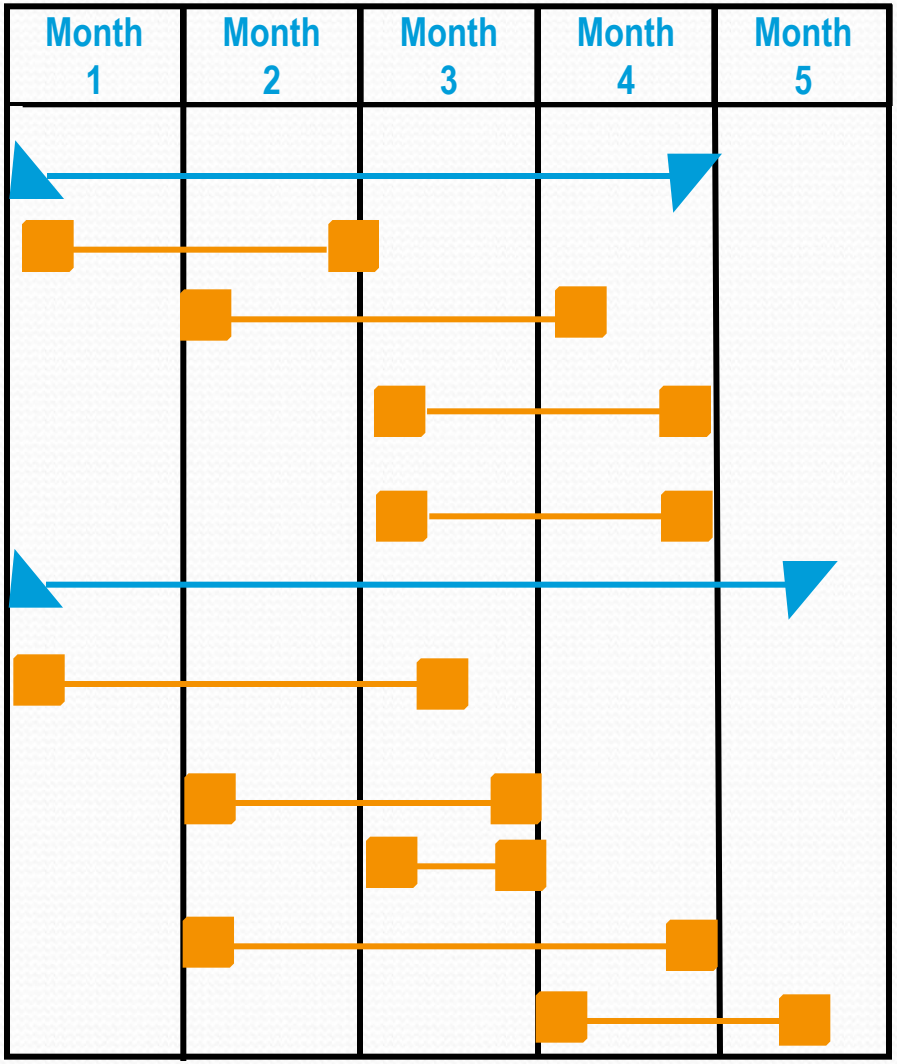
Specific EIA requirements typically include:

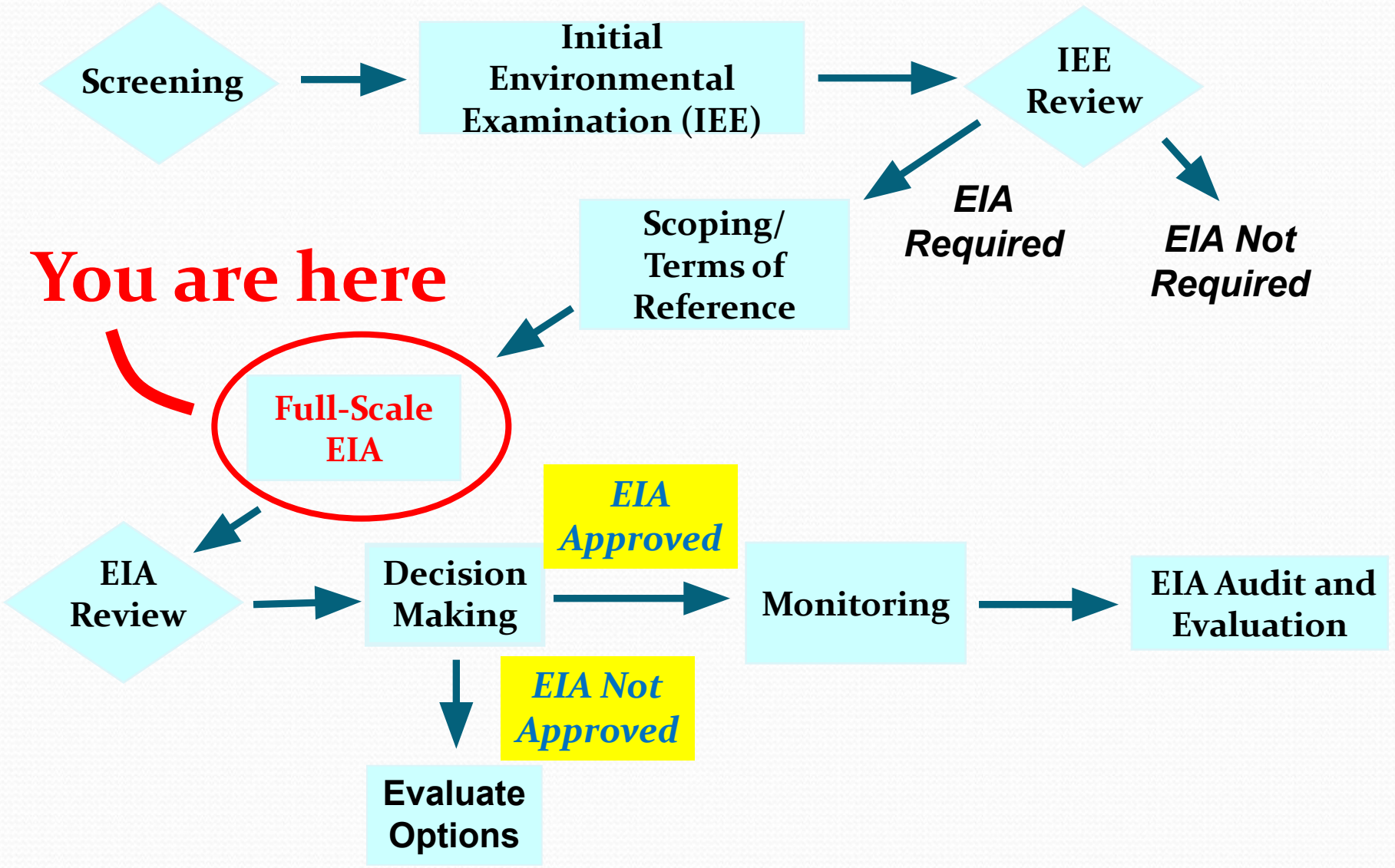
- EIA objectives
- Institutional context (i.e., legal and policy requirements)
- Significant issues of concern (SEIs)
- Required information and data, methodologies for impact assessment
- Process for incorporating public input

Work Plan Example

Detailed Task Assignment

1. Waterlogging and Soil Salinity
2. Field Data: Collate, Fill Gaps, Organize
3. Models: Review, Verify, Reconcile
4. Drainage: Develop Final Criteria, Perform Design
5. Compile Report
6. Land Acquisition and Resettlement
7. Project Proponent Document: Review and Verify
8. Environmental Impact
9. Social Impact and Equity
10. Public Participation
11. Monitoring and Evaluation

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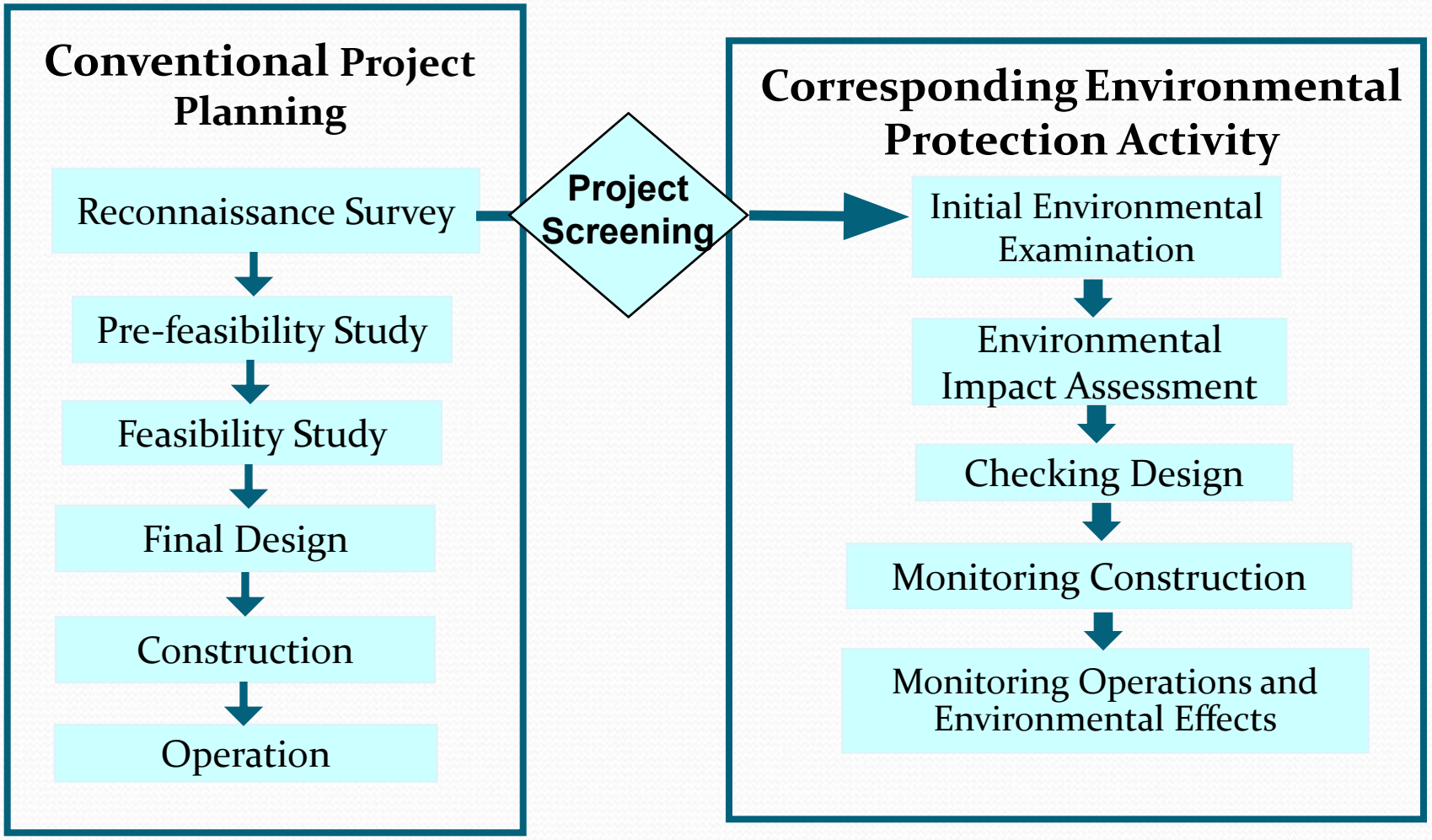
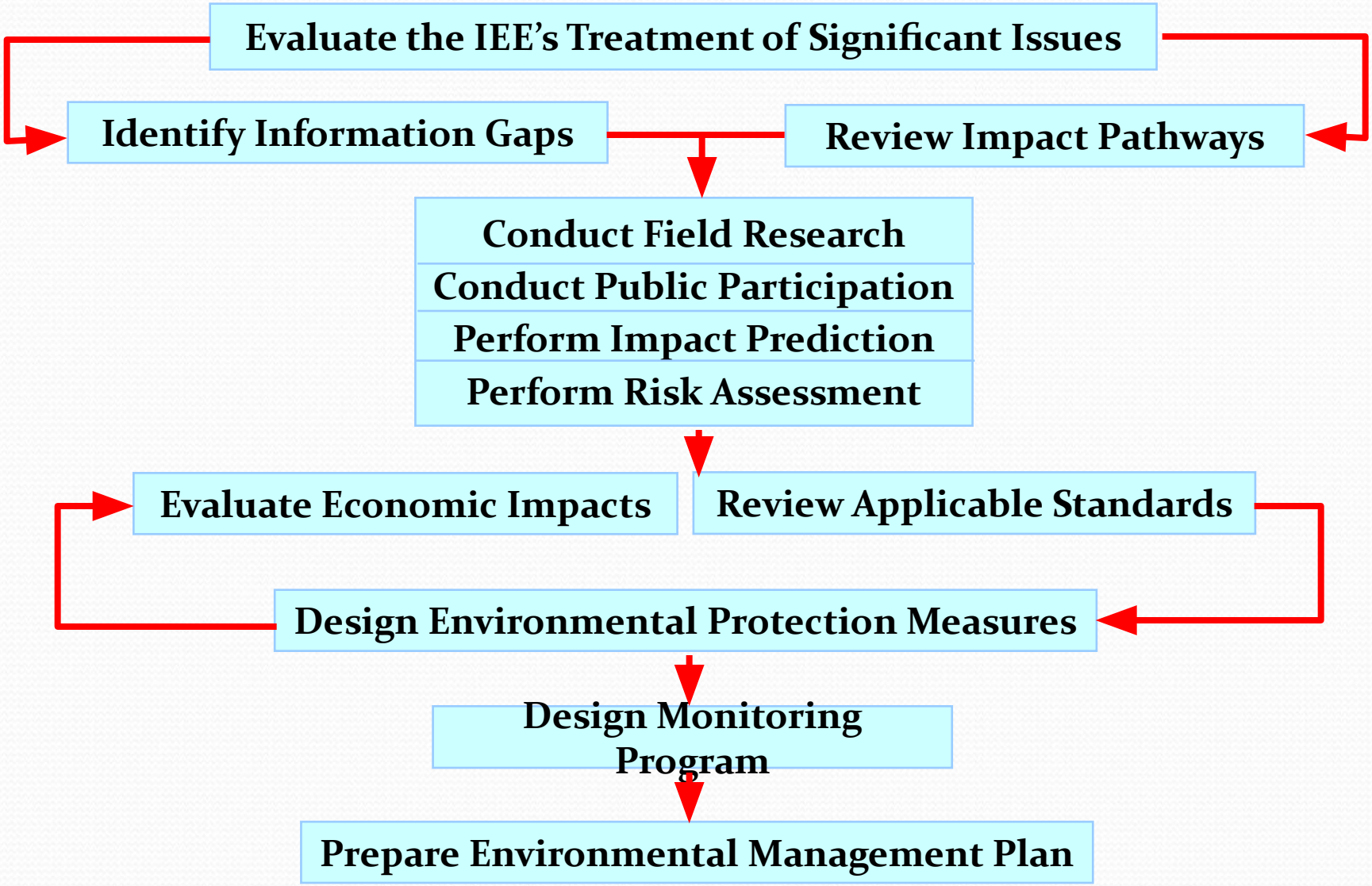
EIA in the Project Cycle

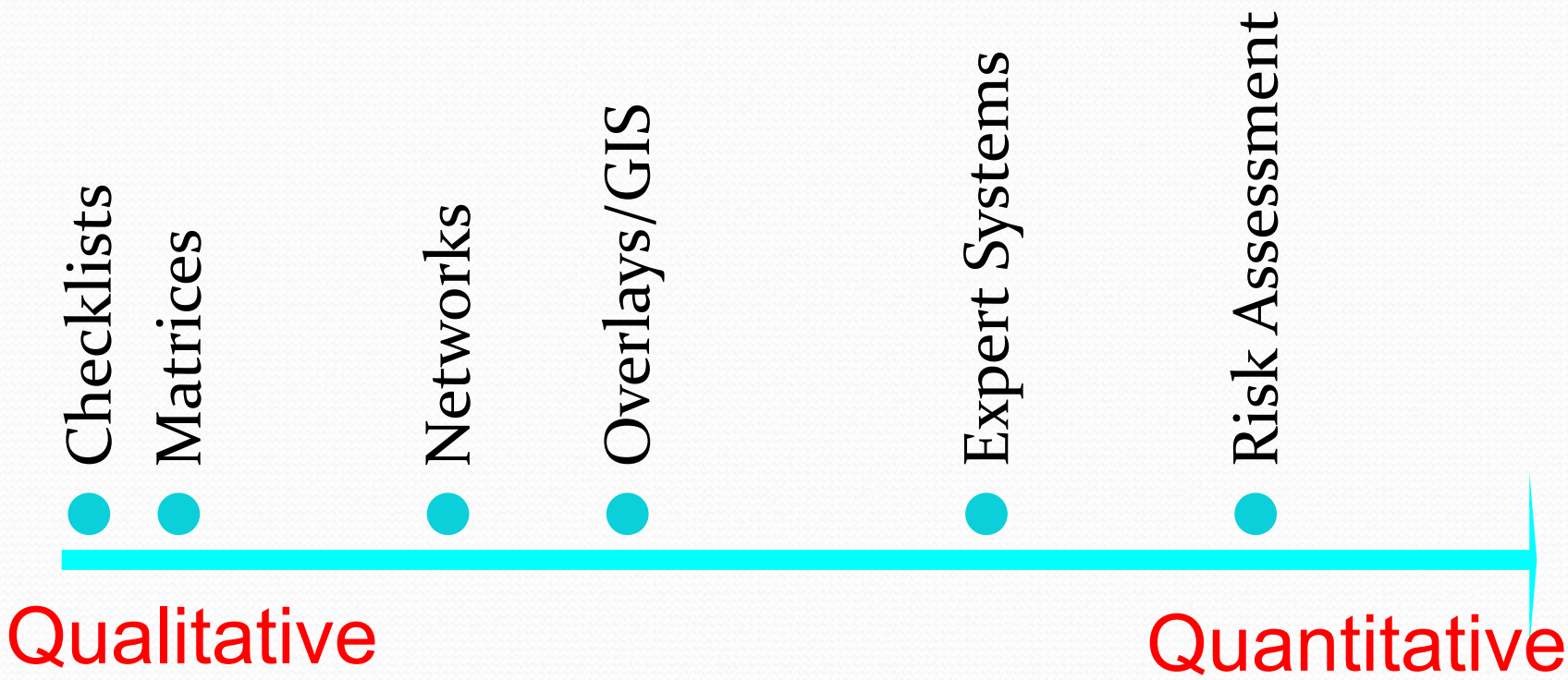



Evaluate the IEE's Treatment of Significant Issues
Identify Information Gaps
Review Impact Pathways
Conduct Field Research
Conduct Public Participation
Perform Impact Prediction
Perform Risk Assessment
Evaluate Economic Impacts
Review Applicable Standards
Design Environmental Protection Measures
Design Monitoring Program
Prepare Environmental Management Plan

Full-Scale EIA Overview

- Input = Outstanding SEIs from IEE
- Assessment phase:
  - Qualitative/quantitative analysis of SEI
  - SEI impact significance
- Mitigation development phase:
  - Select appropriate mitigation measures
  - Residual impact significance

EIA Impact Identification Methods



Selection of Appropriate Methods

- Type and size of proposal
- Type of alternatives being assessed
- Nature of likely impacts
- Experience using EIA methods
- Resources available
- Nature of public involvement
- Procedural/administrative requirements

Checklists

ADVANTAGES

- Simple to understand and use
- Good for site selection and priority setting

DISADVANTAGES

- Do not distinguish between direct and indirect impacts
- Do not link action and impact
- Qualitative

Matrices

ADVANTAGES

- Link action to impact
- Good method for displaying EIA results

DISADVANTAGES

- Difficult to distinguish direct and indirect impacts
- Significant potential for double-counting of impacts
- Qualitative

Networks

ADVANTAGES

- Link action to impact
- Useful in simplified form in checking for second order impacts
- Handles direct and indirect impacts

DISADVANTAGES

- Can become overly complex if used beyond simplified version
- Qualitative

Overlays

ADVANTAGES

- Easy to understand and use
- Good display method
- Good for site selection setting

DISADVANTAGES

- Address only direct impacts
- Do not address impact duration or probability

Expert Systems

ADVANTAGES

- Excellent for impact identification and analysis
- Good for experimenting
- Semi-quantitative to quantitative

DISADVANTAGES

- Heavy reliance on knowledge and data
- Often complex and expensive

Impact Significance Determination

Impact Characteristics (e.g., spatial extent) X **Impact Importance (e.g., value)** = **Impact Significance**

Characteristics Affecting Impact Significance

- Nature of impact (e.g., positive, negative, synergistic)
- Extent and magnitude
- Timing (i.e., construction, operation, closure)
- Duration (i.e., short, chronic, intermittent)
- Reversibility/irreversibility
- Likelihood (i.e., probability, uncertainty)

Some Criteria for Significance

- Importance: the value that is attached to the affected environmental component
- Extent of disturbance: the area expected to be impacted
- Duration and frequency of disturbance
- Reversibility
- Risk: probability of an unplanned incident caused by the project

Assessing Significance

- Considerable expert judgement and technical knowledge are often required to fully understand the nature and extent of environmental impacts

- Categories of significance include:
  - no impact
  - significant impact
  - unknown impact
  - mitigated impact

Guidelines for Assessing Significance

- Use rational and objective methods
- Provide consistency for comparison of project alternatives
- Document values and beliefs used in making judgment decisions
- Apply impact significance criteria, e.g.,
  - Ecological importance/sustainability criteria
  - Social importance
  - Environmental standards

Ecological Importance

- Effect on plant and animal habitat
- Rare and endangered species
- Ecosystem resilience, sensitivity, biodiversity and carrying capacity
- Population viability
- Community viability

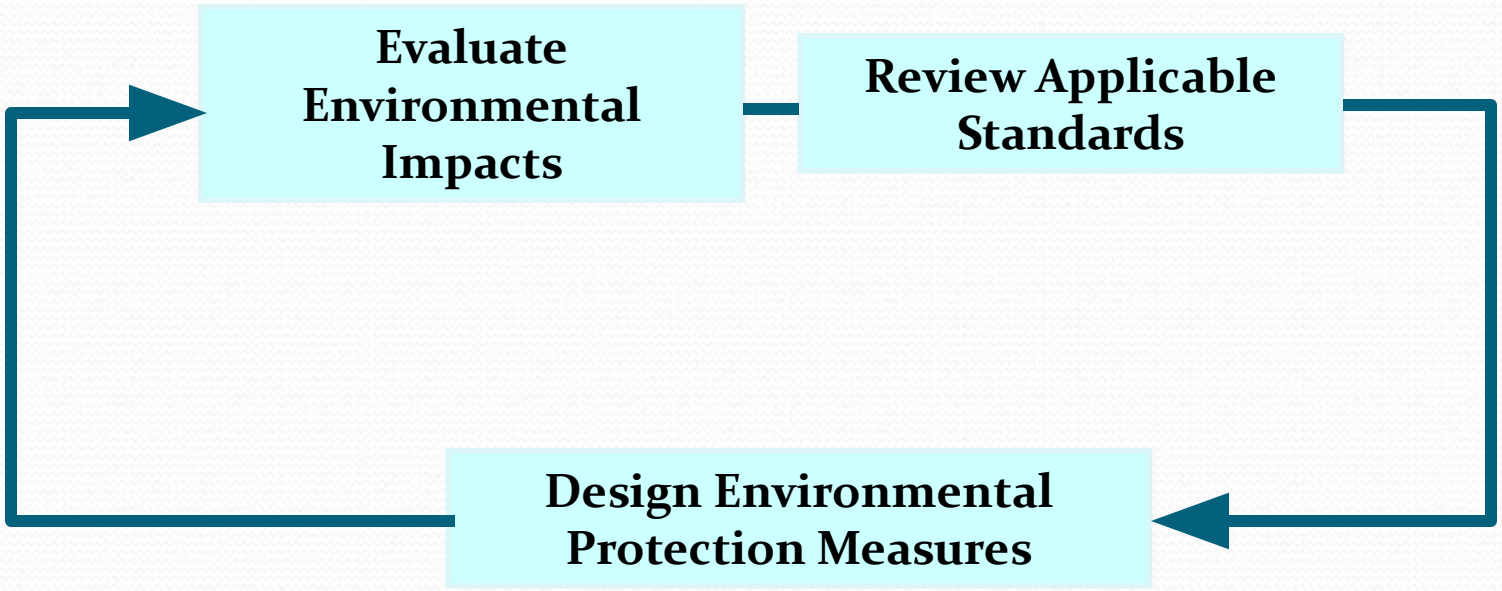
Social Importance

- Effects on human health and safety
- Potential loss of managed resources (e.g., fish, farmland, water)
- Recreation or aesthetic value
- Demands on public resources
- Demands on transportation or other infrastructure
- Demographic effects

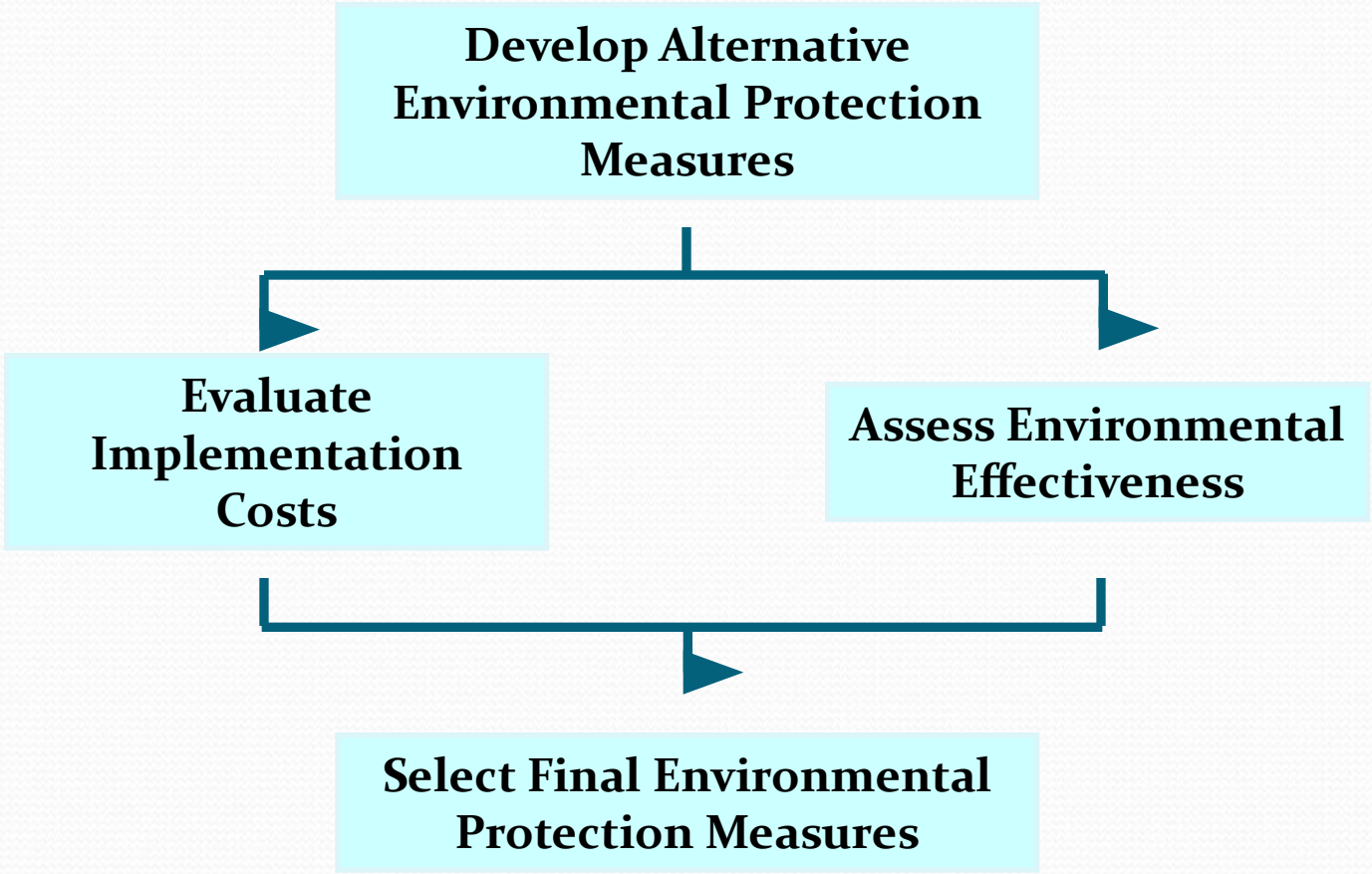
Environmental Standards

- Permit-based limits on effluent discharge concentrations
- Clean air standards, water quality standards
- Plans or policies that protect or limit use of natural resources

Impact Mitigation



Mitigation Development



Understand the Problem

Good understanding of problems is critical to development of effective mitigation measures

- What is the problem?
- When will the problem occur?
- When should the problem be addressed?
- Where should the problem be addressed?
- How should the problem be addressed?
- Who stands to lose or gain?

Mitigation Options

- Alternative ways of meeting society's need for the project
- Changes in project planning and design
- Improving monitoring and management
- Monetary compensation
- Replacing, relocating, rehabilitating

Environmental Management Plan

- Mitigation measures chosen are documented as part of the EMP which specifies how they are to be carried out:
  - State policy and standards
  - Designate responsibility
  - Provide schedule for tasks
  - Allocate responsibility for tasks
  - Include system for progress reporting
  - Include system for monitoring/auditing
  - Develop a contingency plan

EIA Reporting

Variations in titles but all the same content:

- Environmental Impact Assessment report (EIA report)
- Environmental Impact Statement (EIS)
- Environmental Assessment report (EA report)
- Environmental Effects Statement (EES)
- Local usage; often shortened to just EIA

Effective Reporting

- Assists the project proponent to plan (e.g., changes to the project design or scheduling recommended as mitigation measures)
- Assists decision makers in deciding whether to approve or reject proposal, and if approved with what conditions
- Helps the public to understand core issues of concern

EIA Report Contents

- Executive summary
- Objectives of the proposal
- Description of proposal and alternatives
- Relationship to current land use policies
- Description of expected conditions
- Evaluation of impacts for each alternative
- Mitigation and monitoring plans
- Appendices

Executive Summary

- Definition: A well written stand-alone document which contains the information necessary for the reader to understand the critical environmental issues and how the issues are to be addressed and resolved
- Audience: targeted at decision makers and international funding bodies
- Special Requirements: international funding bodies often require executive summaries to be submitted in English

Executive Summary (Cont.)

What the executive summary MUST contain:

- a summary of impacts for each SEI
- background information including base maps
- offsetting, enhancement, and mitigation measures for minimizing negative impacts
- recommendations and conclusions
- summary of the environmental management plan

Project Information

- Status of project
- Planning, design and implementation strategies
- Requirements for materials, water, energy, equipment
- Planned processes and products
- Visual aids (e.g., maps)
- Options (e.g., siting, layout)
- Summary of technical, economic and environmental features

Evaluating Impacts for Each Alternative

- Assessment of impacts
- Data and predictive methods used
- Uncertainty and gaps in knowledge
- Compliance with standards
- Criteria used to assess significance
- Proposed impact avoidance or mitigation measures

Environmental management and monitoring plans

- Describe proposed mitigation measures
- Contain schedule for implementation
- Assign responsibility for implementation
- Detail a monitoring program
- Detail proposed reporting and review procedures

Appendices

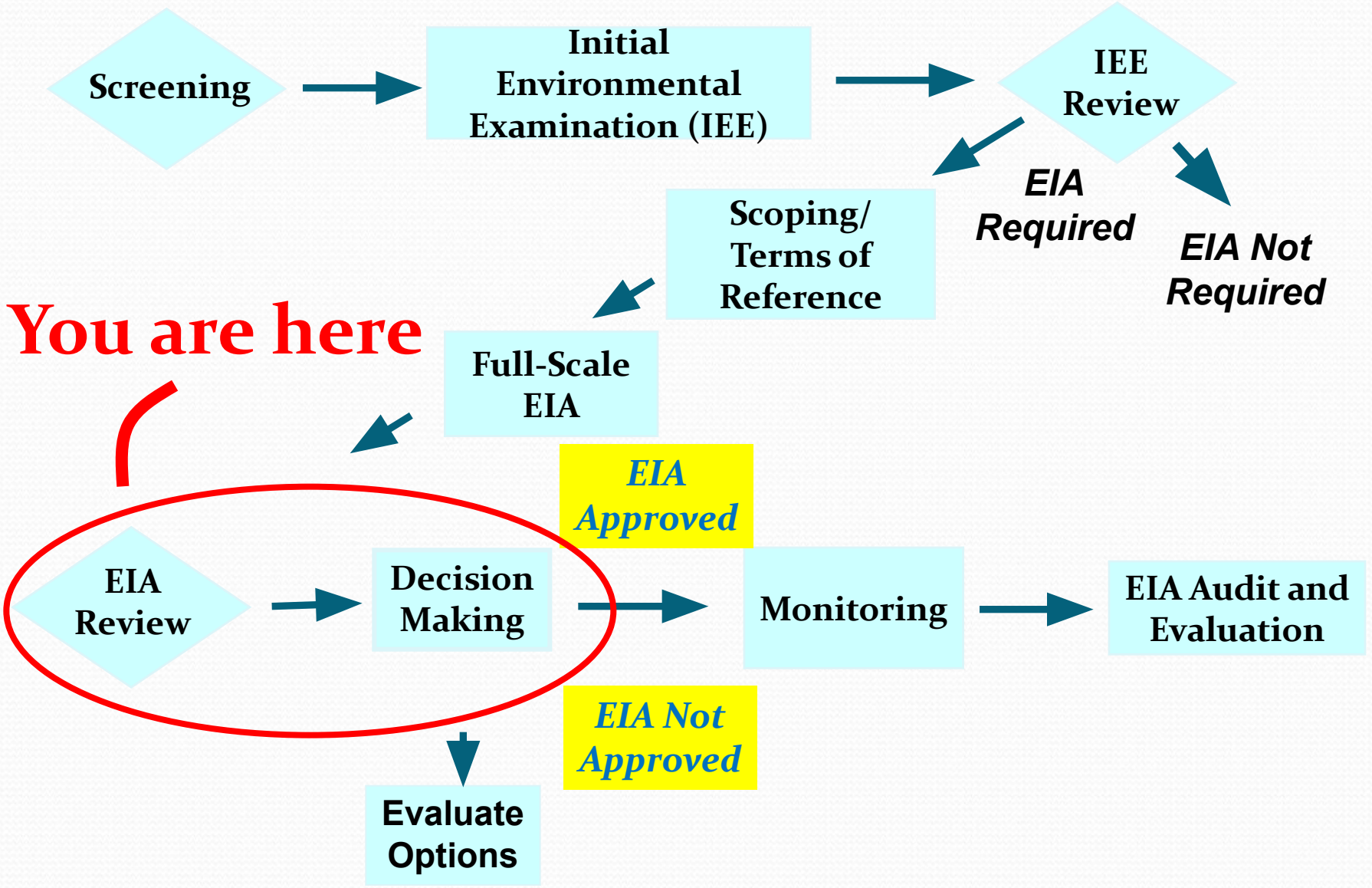
- Technical information
- Glossary and Acronyms
- Public involvement summary
- Information sources/references
- Details of study team
- Terms of Reference

Common reporting shortcomings

- Object of activity described too narrowly
- Incomplete description of activity
- Alternatives do not account for the environment
- Key problems not described
- Sensitive environment aspects overlooked
- Standards and legislation are not described or alternatives do not comply with them
- Some mitigating measures not considered

Common Reporting Shortcomings (Cont.)

- Best alternative not described or described insufficiently
- Serious impacts are not mentioned or not correctly described
- Outdated or ineffective prediction models used
- Impacts are not compared with standards or targets
- Incorrect conclusions drawn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EIA Review

Determines whether the EIA report is an adequate assessment of environmental concerns and is of sufficient relevance and quality for decision making.

EIA Review Objectives

- Determine whether EIA report provides an adequate assessment
- Collects range of stakeholder opinion regarding the acceptability of the EIA report and of the proposed project or activity based on the EIA findings
- Ensures EIA compliance with established procedures (e.g., Terms of Reference, existing plans and policies)

Critical Areas of Review

- Compliance with the Terms of Reference
- Examination of alternatives, environmental setting, impact analysis, mitigation, and impact management and monitoring
- Sufficiency and accuracy of information
- Use of scientifically-defensible analytical techniques
- Conduct of the EIA; completeness and comprehensiveness of the assessment process
- Sufficiency of information provided for decision-making purposes

Review Methods

- General statistics
- Project specific checklists
- *Ad hoc* processes
- Expert opinion by accredited reviewers
- Public review
- Panels of inquiry, independent commissions
- Legal approaches

Review Step-by-Step

- Set the intensity of the review (e.g., scale and depth)
- Select review methods and identify review criteria; make sure to include public input
- Select reviewers
- Conduct the review
- Determine remedial options
- Publish review report

Decision Making

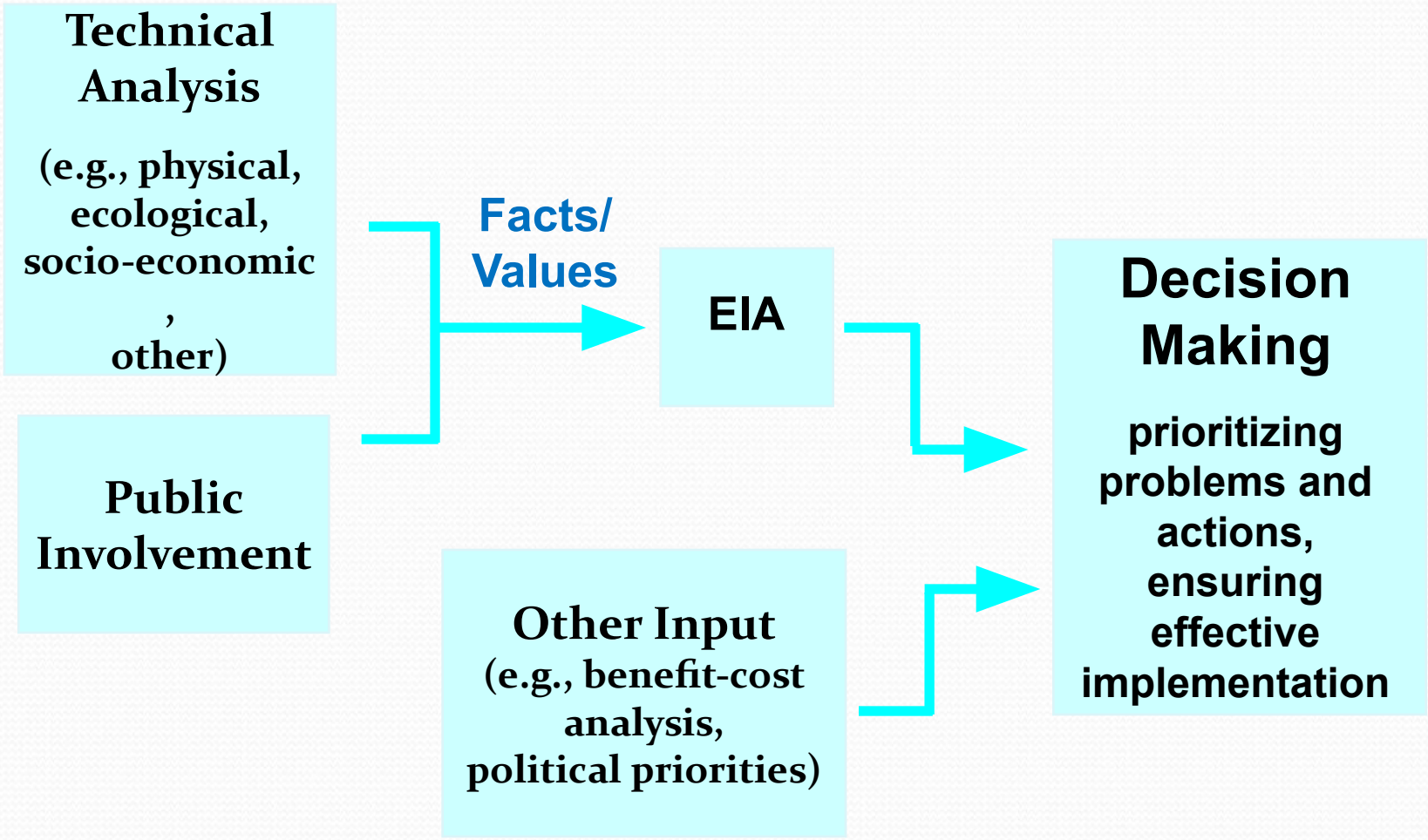
- EIA is an ongoing process of review, negotiation and incremental decision making
- Ultimately, an administrative or political decision is made whether to proceed or not to proceed with a proposed project or activity
- Function of the EIA report is to provide objective assessment of issues to inform and facilitate the decision-making process

Requirements for Decision Makers

Decision makers need an understanding of:

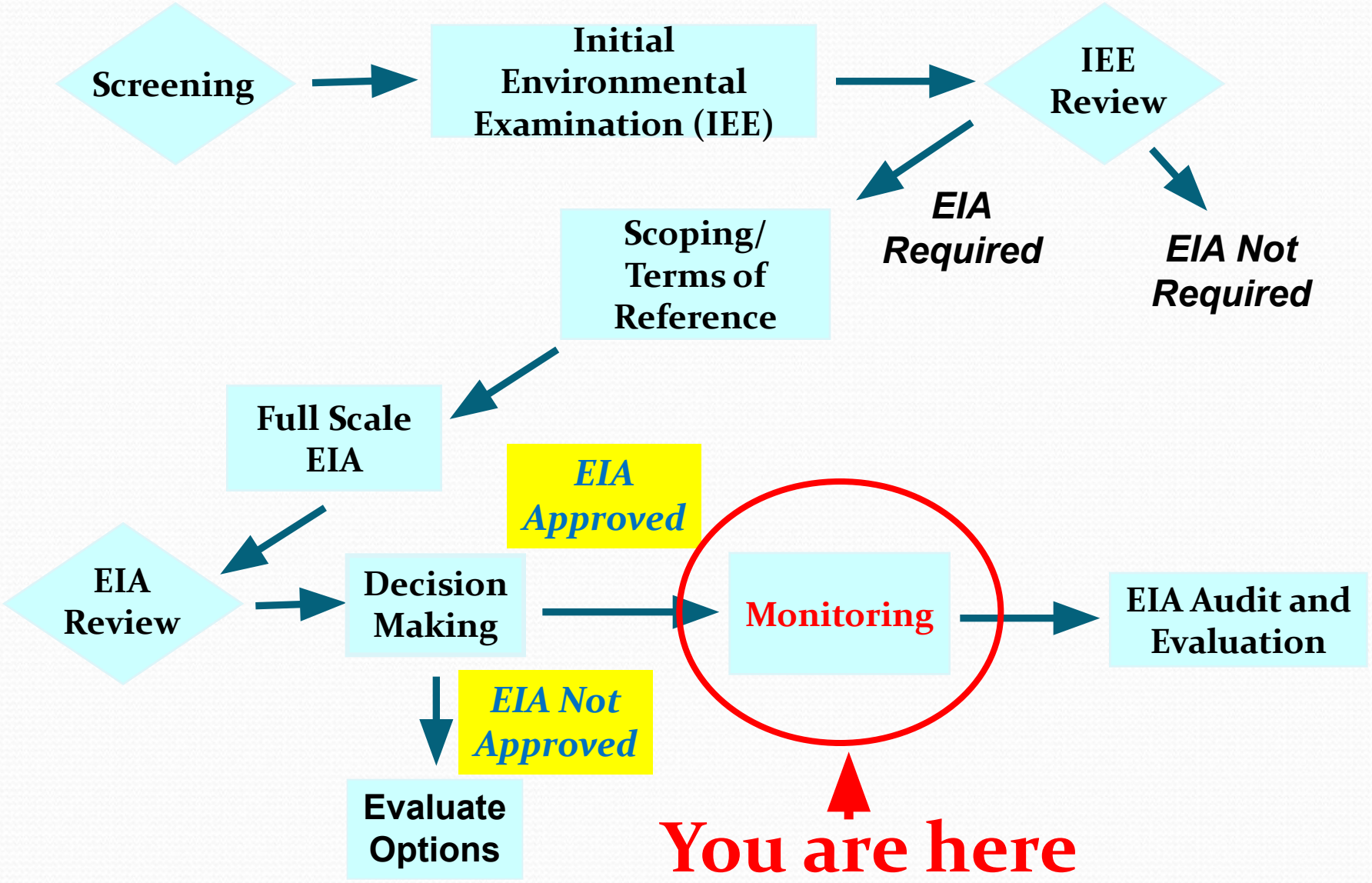
- Principles and practices of sustainable development
- EIA aims, concepts and processes
- EIA guidelines, policy, law and conventions
- EIA implementation within the decision-making agency or organization
- Public involvement processes

Decision-Making Inputs

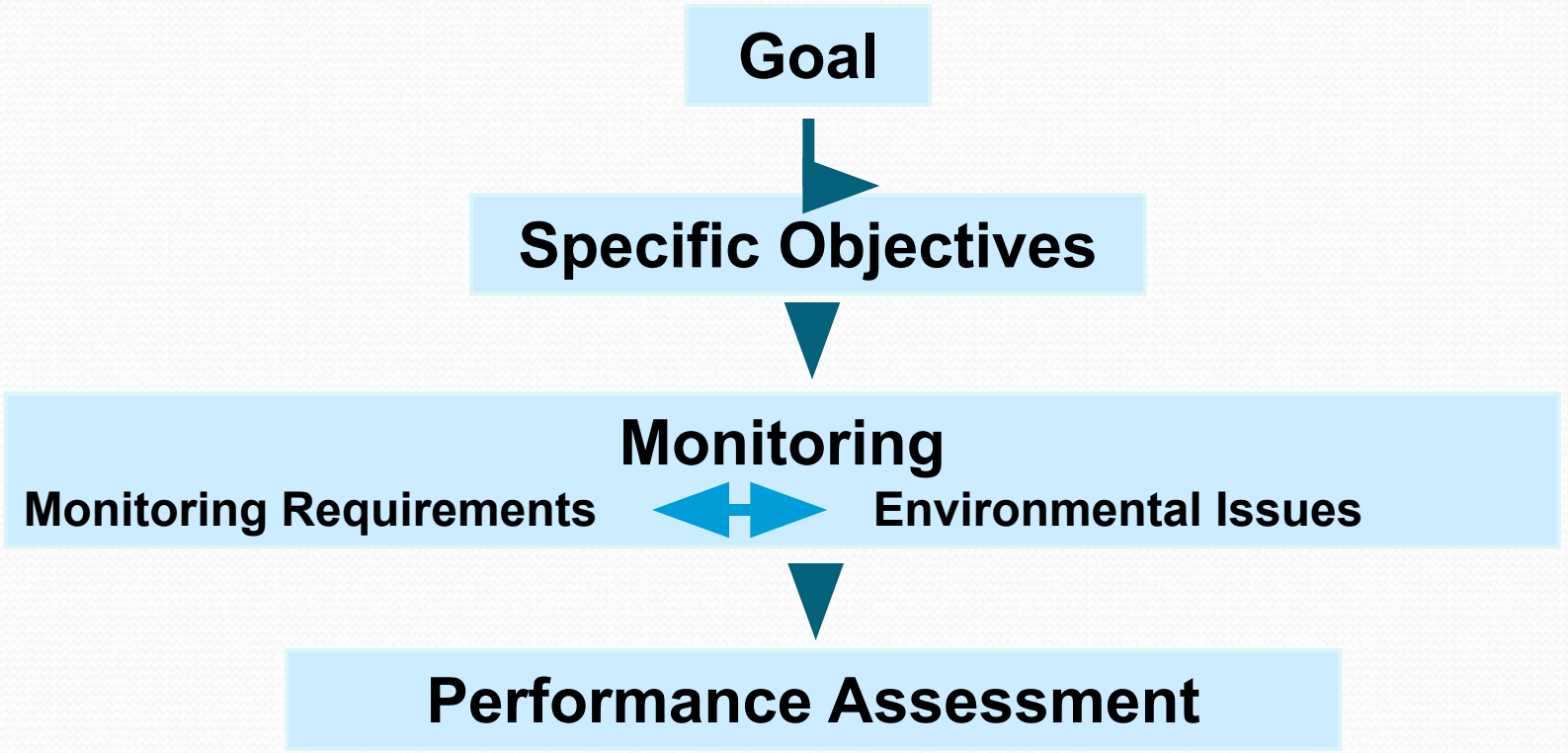


Possible Decision Outcomes

- Approval
- Approval with conditions
- Approval subject to ongoing investigation
- Further investigation required
- Request for a supplementary, or new, EIA report
- Rejection


Screening
Initial Environmental Examination (IEE)
IEE Review
EIA Required
EIA Not Required
Scoping/ Terms of Reference
Full Scale EIA
EIA Approved
EIA Review
Decision Making
Monitoring
EIA Audit and Evaluation
EIA Not Approved
Evaluate Options
You are here

Environmental monitoring and performance assessment



Monitoring and performance assessment goal:

To demonstrate to governments and the public that the project or activity complies with the environmental quality objectives determined through the EIA process and achieves good environmental performance.

Specific Objectives

- Detect short- and long-term trends
- Recognize environmental changes and analyze causes
- Measure impacts and compare with predicted impacts
- Assess effectiveness of mitigation measures
- Improve the monitoring system
- Improve practices and procedures for environmental assessment

Performance Assessment

From monitoring program:

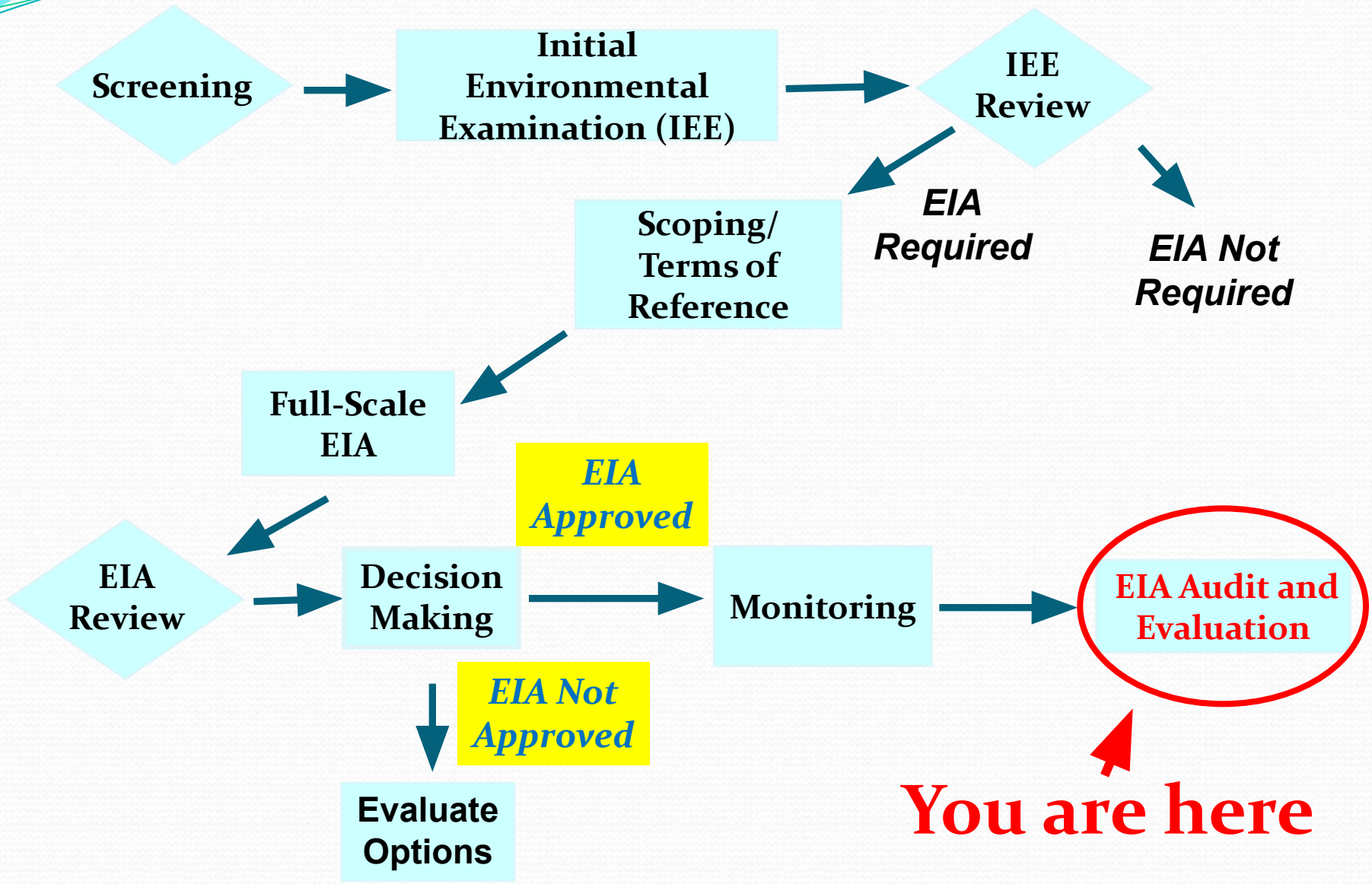
- identify trends, causes and impacts
- assess performance and compliance

From the assessment:

- modify practices and procedures for environmental protection
- modify monitoring program

Post-EIA Monitoring Report

PROJECT PHASE	MONITORING ACTIVITY
FINAL DESIGN STAGE	A. INCORPORATION OF EPMs IN THE FINAL PROJECT DESIGN B. INCORPORATION OF EPMs INTO CONSTRUCTION CONTRACTS C. COMPLETION OF OPERATIONS MANUAL
CONSTRUCTION STAGE	A. ENVIRONMENT CONSTRUCTION SUPERVISOR B. SCHEDULED REPORTS FROM SUPERVISOR C. ENVIRONMENTAL PROTECTION AGENCY SPOT CHECKS ENVIRONMENTAL SUPERVISOR PERFORMANCE
PROJECT ACCEPTANCE	THE THREE PARTIES : ENVIRONMENTAL CONSTRUCTION SUPERVISOR, PROJECT PROPONENT AND ENVIRONMENTAL PROTECTION AGENCY; SIGN A STATEMENT THAT THE PROJECT MEETS EIA REQUIREMENTS
OPERATIONS STAGE	A. PERFORMANCE MONITORING B. PERFORMANCE REPORTING C. FOLLOW-UP ACTION, IF REQUIRED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EIA Not Approved
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You are here

EIA Audit

EIA audits are a management tool to:

- Determine impacts
- Check that conditions arising from EIA are being met
- Test accuracy of EIA predictions
- Identify areas where EIA could have been improved
- Compile lessons learned for future EIAs

Concluding Thoughts

Important points to remember are:

- EIA is a process which should have influence at many stages and over a considerable period of time; it is not an activity aimed at producing a single set of results for use at one specific decision-making stage;
- The EIA process should be iterative and adaptive; scoping and assessment should continually evolve throughout the entire process as more information becomes known (i.e., circular process).

Concluding Thoughts (Cont.)

Additional points to remember are:

- The EIA process needs to be inclusive and transparent
- The process should not be seen as an administrative task; EIA is a powerful management tool to be used to make informed and justifiable decisions
- Follow-up to review development results is essential to continually improve and strengthen the EIA process