



Sample Guidelines:
**Cumulative Environmental
Impact Assessment
for
Hydropower Projects in Turkey**



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for
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December 2012

Ankara

DISCLAIMER

This document was prepared under the WorldBank Analytical Advisory Activity called 'Turkey Watershed Management – P129244' under Component 2: Cumulative Environmental Impact Assessment (CEIA) Technical Assistance Study', which was supported by ESMAP (Energy Sector Management Assistance Program) funds. This guideline document was prepared as an annex of the 'Advisory Note on Cumulative Environmental Impact Assessment' which was submitted to Republic of Turkey Ministry of Environment and Urbanization, General Directorate of EIA, Permitting and Inspection in June 2012. The guidelines were prepared with a special focus on hydropower plant projects and intended to be used as a supplementary document to the national regulation on Environmental Impact Assessment. This is not an official document and is not replacing any national regulation or WB's operational policy on safeguards.



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List of Abbreviations

CEIA	Cumulative Environmental Impact Assessment
EBRD	European Bank of Reconstruction and Development
EC	European Commission
EIA	Environmental Impact Assessment
EU	European Union
GIS	Geographic Information Systems
HEPP	Hydroelectric Power Plant
IAIA	International Association for Impact Assessment
IFC	International Finance Corporation
IFI	International Finance Institution
LAC	Limits of Acceptable Change
MoEU	Ministry of Environment and Urbanization
MoFWA	Ministry of Forestry and Water Affairs
PSS	Project Specific Standards
SEA	Strategic Environmental Assessment
VEC	Valued Ecosystem Component
WPCR	Water Pollution Control Regulation

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1

Introduction



Guidelines to Cumulative Environmental Impact Assessment (CEIA) has been prepared within the scope of a CEIA technical assistance study (CEIA study) supported by the World Bank. The CEIA study was developed based on the need to assess the cumulative impacts of hydropower projects in Turkey and was conducted in coordination and cooperation with the relevant departments of the Ministry of Environment and Urbanization (MoEU) and the Ministry of Forestry and Water Affairs (MoFWA).

The Government of Turkey promoted investments in hydroelectric power plant (HEPP) projects as a policy priority in response to concerns about the environmental and climate change impact of other power generation technologies, as well as with an eye to compliance with EU regulations and targets. The rapid growth in investments raises concerns about the associated impacts (such as minimum environmental flow, temporary/permanent roads opened for the investment, etc.) and the significance of the cumulative impact of multiple HEPP projects on the river basins.

1.1 OBJECTIVES AND TARGET GROUP

The general objectives of the guidelines are to improve or strengthen the EIA process and implementation, provide support for studies related to Strategic Environmental Assessment (SEA) Regulation and future SEA processes, and promote the sustainable development of natural resources as well as enhance basin management planning. The specific objectives of the guidelines are the following:

- Provide an overview of the current understanding of the practice of CEIA;
- Establish the foundation for CEIA studies to be conducted;
- Enhance the quality and content of project-level EIAs by incorporating cumulative impact assessment considerations;
- Provide guidance on CEIA scope and methodology;
- Improve the scoping and reviewing processes; and
- Inform all relevant stakeholders.

The target group consists of all relevant stakeholders, and in particular experts from the MoEU, consultants who carry out EIAs, members of the review committees, and project owners.

1.2 SCOPE AND RELATION TO EIA LEGISLATION/PROCESS

The target group consists of all relevant stakeholders, and in particular experts from the MoEU, consultants who carry out EIAs, members of the review committees, and project owners.

This guidance document aims to assist with the execution of CEIAs within the scope of the EIA process. It is not a legal document and should not be used to supplement EIA (and future SEA) legislation. The guidelines is not intended to be formal or prescriptive, but is designed to help EIA practitioners or consultants develop a project-specific approach and to consider impacts as an integral part of the EIA process.

EIA legislation includes provisions covering the EIA process and the general format for the EIA application file. The project-specific format to be used for EIA reports is provided by the MoEU and was developed following public participation and scoping processes/meetings. This guideline provides the basis for incorporating the assessment of cumulative impacts into an EIA.

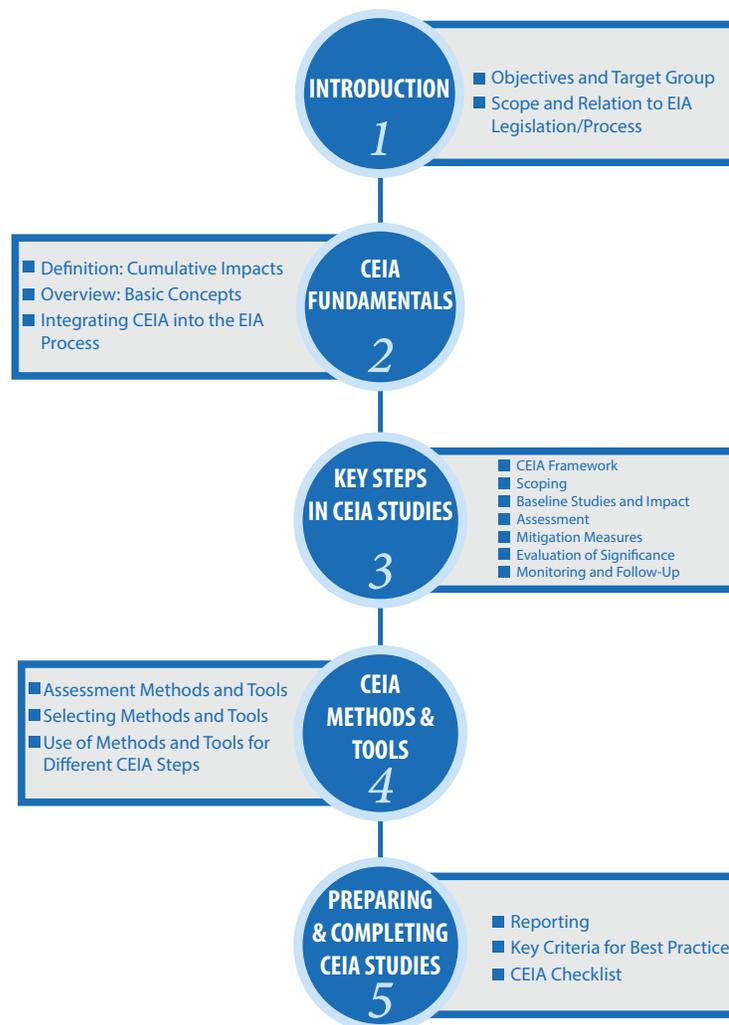
The guideline is intended to provide general assistance to EIA consultants by providing background information on CEIAs and suggestions for possible approaches. It is based on a pilot basin case study, which is used to offer an understanding of the major terms and approaches associated with CEIA. The pilot study serves mainly as a model in the development of this CEIA guideline for Turkey and contributes to a better understanding of CEIA concepts and principles, and the linkages and related needs regarding SEA. Upper Ceyhan Basin was selected as the case study basin based on meetings and discussions with the MoEU. The short study time, data availability, and project variation in the region were all considered in the selection of this basin.

1.3 STRUCTURE OF THE GUIDELINE

The guideline is made up of five main chapters, including this introduction. Chapter 2 covers fundamental CEIA concepts, with definitions for cumulative impacts, as well as an overview of basic concepts. Some methods for integrating CEIA into the project-level EIA process are also provided. Chapter 3 discusses the key steps for conducting a CEIA study: scoping, baseline studies and impact assessment, development of mitigation measures, evaluation

of significance, and monitoring and follow-up. Chapter 4 reviews the methods and tools used for CEIA. It includes an overview of these methods and tools, the criteria and approach for selecting among them, and their general usability at different stages of the CEIA process. The guideline concludes by providing key best practice criteria, together with a checklist of major issues to be considered in CEIA, and methods for effectively communicating results to the relevant stakeholders (most importantly, decision makers).

The structure of this guideline is summarized below in the form of a flowchart, which aims to offer the user a visual representation in order to identify specific topics of interest covered.





2

CEIA Fundamentals



2.1 DEFINITION OF CUMULATIVE IMPACTS

Cumulative impacts are changes to the environment caused by an action (project or project activity) in combination with other past, present, and future human actions. A CEIA is an assessment of these impacts. It should be noted that the terms “impact” and “effect” are often used interchangeably in this guideline. In general, both of these terms aim to describe any change that the project may cause in the environment.

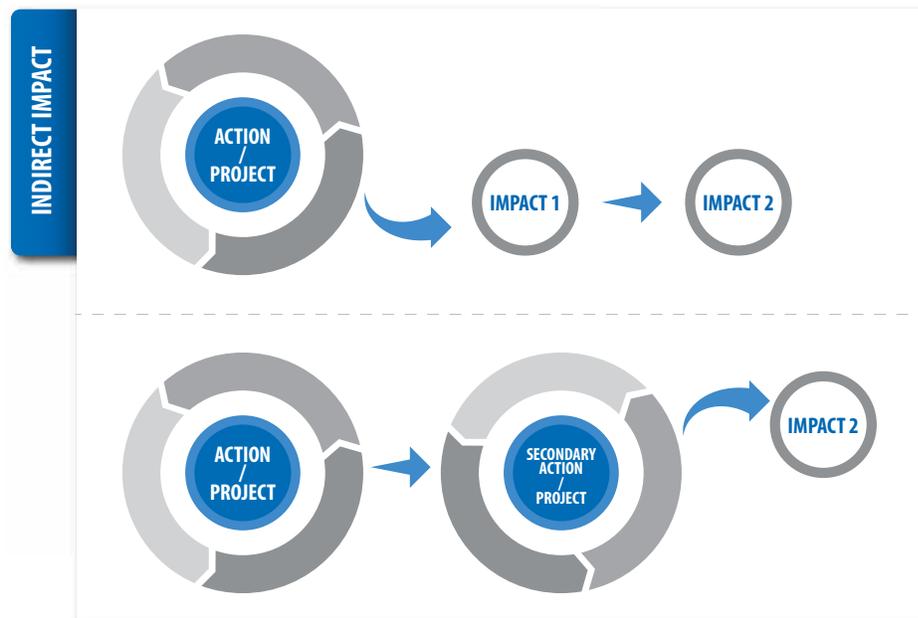
In practice, assessment of cumulative impacts requires consideration of other assessment concepts, which are different from the conventional approaches used in EIA. Some of these concepts are the following:

- Assessment of impacts during a longer period of time into the past and future;
- Consideration of impacts on valued ecosystem components (VECs) due to both the project of concern and interactions with other past, existing, and reasonably foreseeable future actions;
- Evaluation of significance in the consideration of other than just local and direct effects (such as indirect impacts, cumulative impacts, and impact interactions); and
- Assessment of impacts over a larger (i.e., “regional”) area.

Cumulative impacts occur as interactions—between actions, between actions and the environment, and between components of the environment. These pathways between a source and an effect are often the focus of an assessment of indirect or cumulative impacts. The magnitude of the combined effects along a pathway can be equal to the sum of the individual effects (additive effect) or can be an increased effect (synergistic effect). Thus, indirect, cumulative, and interactive impacts can be defined as follows.

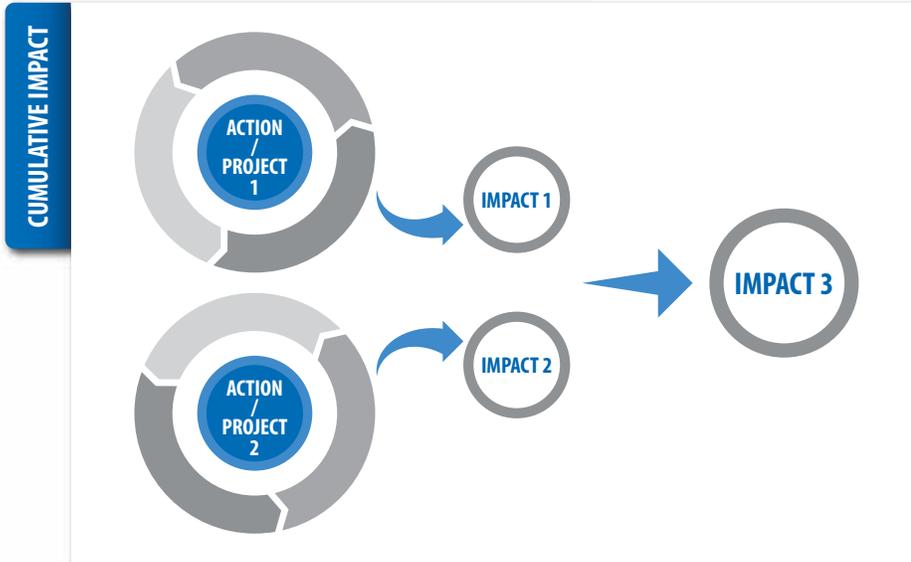
Indirect Impacts (Secondary Impacts)

These impacts are not directly caused by the project, but arise partly as a result of the project. Indirect impacts occur in complex pathways or away from the project (e.g., a change in fish species composition in a stream after use of a diversion weir due to a decrease in the flow and change in water quality).



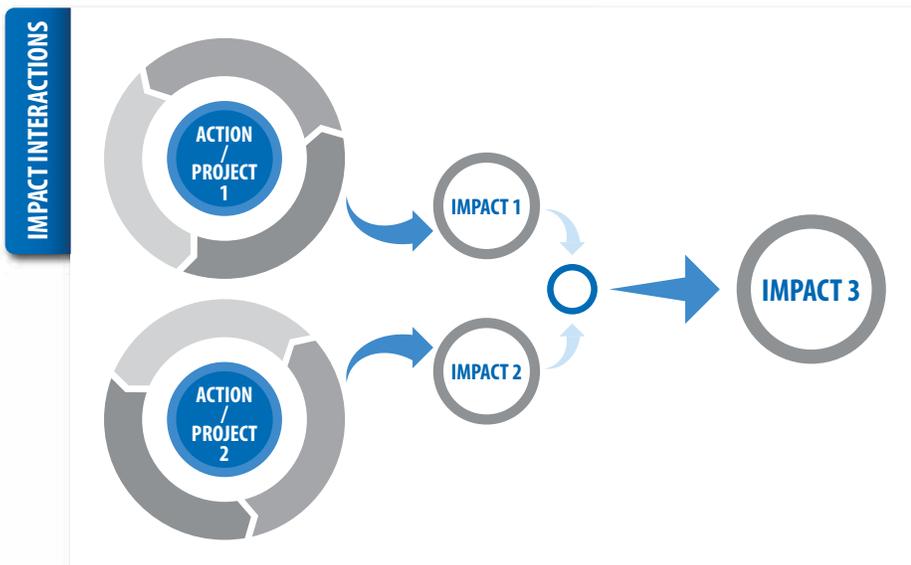
Cumulative Impacts

These impacts are incremental effects of past, present, or future activities combined with the proposed project (e.g., a habitat lost because of quarries used for cascading dams in a river basin).



Impact Interactions/Interactive Impacts

These impacts are the results of reactions between impacts of proposed projects or other actions (e.g., emissions from one project reacting with emissions from an existing development).



Cumulative impacts can occur in various ways such as physical-chemical transport, gradual disturbance and loss of land and habitat, spatial and temporal crowding, and growth inducing potential. An example of physical-chemical transport is air emissions, which are transported away from the action causing them and which might interact with another action. Cumulative effects can occur when too much is happening within too small an area and in too brief a period of time. Spatial crowding results in an overlap of impacts of various actions, such as noise from a highway adjacent to an industrial site. Temporal crowding may occur if impacts on a VEC from different actions overlap in time.

Cumulative impacts are not necessarily very much different from impacts examined in an EIA; in fact, they are generally the same. Many EIAs focus on a local scale in which only the footprint or area covered by each project component is considered. A CEIA further enlarges the scale of the assessment to an almost regional level. For the practitioner, the challenge is to determine how large an area around the action should be assessed, for how long, and how to practically assess the often complex interactions among the actions. In all other ways, CEIA is fundamentally the same as EIA and often relies on established EIA practice.

2.2 OVERVIEW OF BASIC CONCEPTS

The basic concepts of importance in a CEIA, apart from the cumulative impacts, are the valued ecosystem components, area of influence, and limits of acceptable change. All these constitute the main issues in defining the study area, the cumulative impacts, and their significance.

2.2.1. Valued Ecosystem Components (VECs)

VECs are the main objects of the cumulative impact assessment process. VECs are defined as any part of the environment that is considered important by the proponent, public, scientists, and government involved in the assessment process. Importance may be determined on the basis of cultural values or scientific concern. (Hegmann et al., 1999)

VECs are selected once there is an understanding of (i) the project works and activities; (ii) the environment likely to be affected; and (iii) the potential interactions between project works and activities and the environment.

Generally, during VEC selection the following issues are taken into account:

- Abundance at the site and local and regional study areas
- Ecological importance
- Native species
- Exposure
- Sensitivity
- Ecological sustainability
- Human health
- Socioeconomic importance
- Conservation status
- Data availability
- Importance to society in terms of cultural heritage

The Turkish EIA Regulation addresses this issue to some extent without necessarily specifying VECs. In Annex V of the EIA Regulation there is a list of sensitive areas or regions. This list includes the areas that must be protected in accordance with relevant Turkish legislation and due to international agreements to which Turkey is a signatory. It also lists those areas

BOX 1

Sample VECs for a Hydropower Project

Environmental Component	Subcomponent	Parameter	Example of VECs
 Air	Ambient Air Quality	PM ₁₀ Greenhouse gases	- Closest residential area/receptor - Terrestrial environment
 Noise	Ambient Noise Levels	Noise levels	- Closest residential area/receptor - Terrestrial environment
 Water	- Ambient Water Quality - Hydrological Changes - Agricultural and Domestic use	Flow rate Parameters in Water Pollution Control Regulation (WPCR) Table 1	- Public water users - Aquatic environment - Downstream riverbed
 Habitats & Wildlife	- Ecological Sustainability - Terrestrial Habitats - Aquatic Life	Species diversity Species population	- Flora species - Fish species - Amphibians - Reptiles - Birds - Mammals
 Land Use	- Natural Use - Human Use	Land loss Degree of change	- Agriculture - Grazing - Forest
 Protected Areas	—	—	- National parks - Wildlife preservation and development areas - Wetlands - Cultural heritage sites

that must be protected in general (including areas protected by regional environmental plans, agricultural areas of certain types, wetlands, water resources such as lakes, rivers, groundwater, and areas of ecological importance). For individual cases, specific VECs must be identified, including protected areas but not limited to, which would be assessed and could be monitored.

2.2.2. Area of Influence

As is the case with EIA, one basic concern when conducting CEIA is the spatial area for which the study or assessment would be conducted. This area forms one of the important boundaries for the study (i.e., spatial extent) and should be considered during the scoping phase. The minimum study area for conducting EIA and/or CEIA for a project is known as the area of influence of the project. It can also be called the impact area of the project.



Determination of spatial boundaries is one of the key stages in the CEIA process. It is especially challenging to find the appropriate balance between the practical constraints of time, budget, and available data, and the need to adequately address complex environmental interactions that, theoretically, could extend for considerable distances and well into the future.

International financial institutions (IFIs) pay special attention to impact area determination, as do many authorities, since this is explicitly specified in many standards and guidelines. It is a concept that should be covered during the scoping phase with ever-increasing refinement as the precise locations are identified. Area of influence is defined in the International Finance Corporation's (IFC's) Performance Standard 1 (IFC, 2012) as follows:

“Where the project involves specifically identified physical elements, aspects, and facilities that are likely to generate impacts, environmental and social risks and impacts

will be identified in the context of the project's area of influence. This area of influence encompasses, as appropriate:

- The area likely to be affected by:
 - i. the project and the project owners activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project;
 - ii. impacts from unplanned, but predictable developments caused by the project that may occur later or at a different location; or
 - iii. indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.
- Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.
- Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned, or reasonably defined developments at the time the risks and impacts identification process is conducted."

The European Bank for Reconstruction and Development (EBRD) reiterates the approach in its Environmental and Social Policy, PR-1 Environmental and Social Appraisal and Management, Item 6 as follows:

Environmental and social impacts and issues will be appraised in the context of the project's area of influence. This area of influence may include one or more of the following, as appropriate:

- 1 The assets and facilities directly owned or managed by the project owner that relate to the project activities to be financed (such as production plant, power transmission corridors, pipelines, canals, ports, access roads and construction camps).*
- 2 Supporting/enabling activities, assets, and facilities owned or under the control of parties contracted for the operation of the clients business or for the completion of the project (such as contractors).*
- 3 Associated facilities or businesses that are not funded by the EBRD as part of the project and may be separate legal entities yet whose viability and existence depend exclusively on the project and whose goods and services are essential for the successful operation of the project.*
- 4 Facilities, operations, and services owned or managed by the project owner, which is part of the security package committed to the EBRD as collateral.*
- 5 Areas and communities potentially impacted by: cumulative impacts from further planned development of the project or other sources of similar impacts in the geographical area, any existing project or condition, and other project-related developments that can realistically be expected at the time due diligence is undertaken.*
- 6 Areas and communities potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area of influence does not include potential impacts that would occur without the project or independently of the project.*

The area of influence for a project might be different for various types of potential impacts and different environmental components (physical, biological, social). For example, the impact area of a HEPP project for water quality would differ from that for air quality. For water quality, this area would cover upstream and downstream of the dam and HEPP sites and how far downstream would have to be decided on a case-by-case basis. For air quality, the impact would be mainly dust generation during construction and the area of influence would cover the vicinity of the construction sites, material borrow areas, and access roads.



The complexity of the relationships beyond those purely at the physical level often results in considerable reliance on best professional judgment and risk considerations. An adaptive approach should be followed when setting boundaries for each environmental component in which the first boundary, often arrived at by an educated guess, may later change if new information suggests that a different boundary is required.

The Turkish EIA Regulation also requires the determination of the project impact area in the General EIA Format provided as Annex III of the EIA Regulation. In this regulation, area of influence is defined as the area in which the environment would be positively or negatively affected due to all phases of the project, including before operation, during operation, and after closure.



2.2.3. Limits of Acceptable Change (LAC)

Thresholds are an essential consideration for both cumulative impact assessment and management, as they play a key role in determining the significance of impacts. Thresholds are limits beyond which cumulative change becomes a concern and can be expressed in terms of goals or targets, standards and guidelines, carrying capacity, or limits of acceptable change (LAC). Scientific data and societal values are reflected, to various degrees, in each term.

A threshold can be the maximum concentration of a certain pollutant beyond which health is adversely affected, or a maximum amount of land cleared from its existing natural state before visual impacts become unacceptable. Drawing conclusions

about cumulative effects, such as the significance of effects, requires some limits of acceptable change to which

incremental effects can be compared. Theoretically,

if the cumulative effects of all combined actions in a region do not exceed a limit or threshold,

the action would be considered acceptable. In

practice, however, the assessment of cumulative effects is often hindered by a lack of such

thresholds. This is particularly true for terrestrial components of ecosystems. Contaminants

affecting human health and constituents in air and water are usually regulated; therefore, thresholds

useful for assessment purposes are defined by regulation or available in guidelines.



Carrying capacity is the maximum level of use or activity that a system can sustain without undesirable consequences. This is related to the ambient conditions of the environmental

component of concern and is highly dependent on the values and context involved. Ecological carrying capacity reflects biophysical limits, while social or recreational carrying capacity may be determined largely by user perception and levels of satisfaction associated with a specific activity.

The concept of LAC shifts the focus from identifying appropriate levels of use to describing environmental conditions that are deemed acceptable. The advantage of this approach is that once acceptable conditions have been described, the appropriate combination of levels of use and maintenance interventions required to sustain those conditions can be determined. (Stankey et al. 1985, Wight, 1994)

There is not always an objective technique for determining appropriate thresholds, and professional judgment must usually be relied upon. When an actual capacity level cannot be determined, analysis of trends can assist in determining whether goals are likely to be achieved or patterns of degradation are likely to persist. In the absence of defined thresholds, the practitioner can either suggest an appropriate threshold, consult various stakeholders, government agencies, and technical experts (best done through an interactive process such as workshops), or acknowledge that there is no threshold, determine the residual effect, and let the reviewing authority decide if a threshold is being exceeded. (Hegmann et al., 1999)



2.3 INTEGRATING CEIA INTO THE PROJECT-LEVEL EIA PROCESS

The assessment of cumulative impacts should not be thought of as separate from the EIA process. Indeed, the assessment of such impacts should be an integral part of all stages of the process. The potential for these impacts to occur should be considered during the following stages:

- Scoping
- Collection of baseline data
- Assessment of impacts
- Development of mitigation measures
- Analysis of alternatives
- Development of management and monitoring plans

Under ideal conditions, assessment of cumulative impacts should be an iterative process, similar to that used in the assessment of direct impacts. In both cases, the results of the assessment process should contribute to the design of mitigation measures.

The key stage for integrating CEIA into the EIA process is during scoping. Scoping (or focusing) involves the identification of key concerns, thereby ensuring that the assessment remains focused and the analysis remains manageable and practical.

Scoping is a well-established first step in good EIA practice and is essential to determining the assessment's terms of reference. This is the stage at which the requirements for the EIA study's boundaries are decided upon. In Turkey, such decisions include, but are not

limited to, the EIA report format, which is the output of the scoping process in the Turkish EIA system, and the EIA consultant team composition. The EIA report format is based on the EIA application file submitted to the MoEU and the results of public participation and scoping meetings.

During the scoping phase, the project activities to be considered (including the project schedule) and the impact area must be defined even without considering the cumulative impacts. Some information on baseline conditions in the area as well as the project description are provided in the EIA application files during regular implementation. A list of generic impacts is also considered.

Although scoping is not unique to CEIA, the larger regional nature and complexity of assessing cumulative effects means that scoping must be more strictly applied to avoid assessing more than is necessary. A first step in this direction is to focus only on those effects to which the action under review may actually be contributing. For example, although continued reductions in wildlife habitat may be a regional concern, there may be no reason to investigate these effects if the action under review does not contribute to these long-term reductions (for example, a single small-scale pipeline may cause a slight and temporary loss of habitat for some species, while a network of logging roads may cause more significant long-term changes).

In this context, the following requirements for considering the cumulative impacts of projects might be incorporated into the EIA terms of reference for carrying out EIA studies:

- Define project activities along with other existing, in progress, or planned projects (for the reasonably foreseeable future) in the region that could contribute to cumulative effects on VECs. For uncertain cases, scenarios can be developed that include (i) definite future actions, (ii) definite future actions plus probable future actions (still involving some uncertainty), (iii) definite future actions plus probable and less probable future actions (with a higher degree of uncertainty);

- Identify the area of influence for the project (which may vary for different types of potential impacts);
- Identify the time boundary for the study, especially with regard to considering actions in the reasonably foreseeable future (e.g., a concomitant construction period or operation). Scenarios can be developed to identify temporal boundaries as well, particularly when there is uncertainty;
- Identify possible VECs in the region in or close to the project's area of influence;
- Identify the VECs in the area of influence that should be considered in the study based on information related to current or anticipated future conditions, the existence of protected species or habitats, and the presence or anticipated presence of other human activities that would (adversely) affect the VECs; and
- Identify project-specific standards (PSS), including relevant regulatory and/or international thresholds and standards (providing information on the carrying capacity and LAC if possible).

Once requirements related to the assessment of cumulative impacts are incorporated into the project-specific EIA format, the adequacy of the cumulative impacts assessment in the EIA report should be checked during the review phase. This phase must ensure that cumulative impacts are addressed in the project EIA.

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3

Key Tasks in CEIA Studies

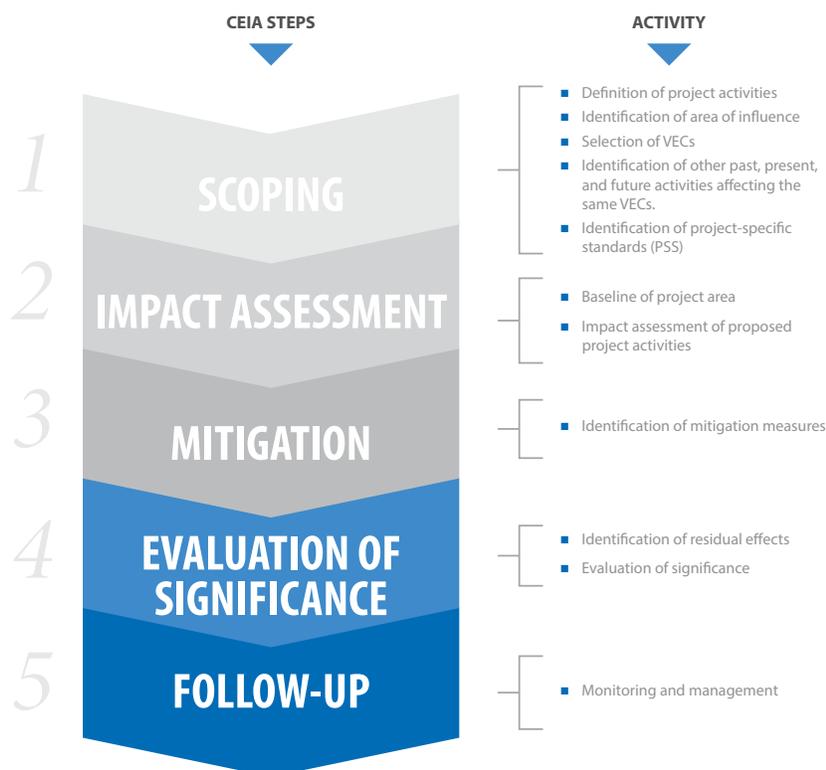
A decorative grid of 14 columns and 10 rows of squares, with the squares in the top row being smaller than the others.

3.1. CEIA FRAMEWORK

CEIAs build on what has been learned and applied in common EIA practice. However, experts must know in what ways assessing cumulative effects differ. The basic tasks involved in CEIA are recognized and examined in this section.

BOX 2

CEIA Steps and Unique Tasks for Each Step



In theory, all aspects of a CEIA are completed concurrently with the EIA, resulting in an assessment approach that makes no explicit distinction between the two. In practice, however, the substantive work for a CEIA is often done after the initial identification of

effects have been completed for an EIA. In this way, the early identification of direct project effects lays the foundation for cumulative effects to be assessed. Thus, a project-specific EIA could be done first, followed by a CEIA. The Assessment Framework is suitable for assessing actions of any size.

In a CEIA for a single project, the following steps should be followed:

- 1 Determine if the project will have an effect on a VEC;
- 2 If such an effect can be demonstrated, determine if the incremental effect acts cumulatively with the effects of other actions, either past, existing, or future.
- 3 Determine if the effect of the project, in combination with the other effects, may cause a significant change now or in the future in the characteristics of the VEC after the application of mitigation measures for that project.

With the exception of the consideration of future actions, the above are identical to the requirements of a sound EIA process. A key step in accomplishing the above is examining the effect on the VEC until the incremental contribution of all actions, and of the project alone, to the total cumulative effect is understood. It should be noted that an assessment of a single project must determine if that project is incrementally responsible for adversely affecting a VEC beyond an acceptable point. Therefore, although the total cumulative effect on a VEC, due to many actions, must be identified, the CEIA must also make clear to what degree the project under review alone is contributing to that total effect. Regulatory reviewers may consider both of these contributions in their deliberations on project applications.

During the completion of a CEIA, the five steps of the framework are usually completed in order. However, earlier steps may be repeated during an assessment if new information suggests that earlier assumptions and conclusions were incorrect. It is also possible that the results of post-project monitoring of effects may indicate that further assessment is required.

3.2. SCOPING

In the Turkish EIA Regulation, the scoping process comprises three stages: (i) preparation of the EIA application file; (ii) holding of a public participation meeting; and (iii) a briefing to the Evaluation Committee and the identification of the special format and scope. In this section, the term scoping covers all three stages.

Scoping (or focusing) involves the identification of key concerns and VECs to ensure that the assessment remains focused and the analysis remains manageable and practical. This step assists with determining if the action under review has the potential to contribute to any cumulative effects.

VECs should be identified and proposed by the EIA team (EIA preparer). The final decision regarding the VECs to be addressed in the study, as well as the extent of the baseline studies and methodology to be used for assessing cumulative impacts, could be decided by the EIA scoping committee, which includes the EIA team, the competent authority and regulatory agency experts, and the project owner.

Professional judgment is required to achieve an optimum balance between the minimum required by legislation and ideal goals. This approach is known as best professional practice. Scoping is a well-established first step in good EIA practice and is essential to establishing the assessment's format.

A first step in this direction is to focus only on those effects to which the action under review may actually be contributing. For example, although continued reductions in wildlife habitat may be a regional concern, there may be no reason to investigate these effects if the action under review does not contribute to these long-term reductions (e.g., a single water tunnel of a HEPP project may cause a slight and temporary loss of habitat for some species, while a cascade of HEPP projects may cause more significant long-term changes).

BOX 3

Scoping of Cumulative Impacts

Scoping of regional cumulative effects is often completed after the scoping of local (i.e., direct) effects in an EIA. In this case, information and conclusions from the EIA may assist with scoping for the CEIA, such as the action description, environmental baseline, identification of issues and VECs, types of effects caused, conclusions about the significance of effects, and mitigation measures. Although local effects may not have been scoped in the EIA on as large a scale as required for a CEIA, the results provide a useful starting point.

The Assessment Framework identifies five tasks that must be done during scoping for a CEIA:

- 1 Definition of the project activities
- 2 Identification of the area of influence
- 3 Selection of VECs
- 4 Identification of other past, present, and future activities effecting the same VECs
- 5 Identification of project-specific standards (PSS)

If performed in this order, the expert will be able to make decisions in one step that will guide the decisions for the next. However, this does not always have to be the case. In some situations (for example, when very large areas have been digitally mapped by remote sensing), it may be more practical to first establish the area of influence, then identify other issues and actions, and finally, select the VECs. In practice, elements of each of the five steps are often completed concurrently during the earliest stages of scoping. As scoping progresses, it quickly becomes clear what conclusions will be reached.

3.2.1. Definition of Project Activities

Project activities refers to specifically identified physical elements, aspects, and facilities to be achieved within the scope of the project; and activities that are likely to generate impacts and environmental and social risks. These activities also include the activities of subcontractors and other activities required for associated facilities.

BOX 4

Associated Facilities

Associated facilities are the facilities that are not funded as part of the project, but that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.

3.2.2. Identification of Area of Influence

As with conducting an EIA, a fundamental concern associated with a CEIA is the spatial area in which the study or assessment will be conducted. This area forms one of the important boundaries (spatial extent) of the study and should be considered in the scoping phase. The minimum study area for conducting an EIA and/or a CEIA for a project is defined as the area of influence of the project. This can also be called the impact area of the project.

BOX 5

Area of Influence and Project Activities for Hydropower Projects

The proposed footprint of HEPP projects (i.e. dam reservoirs, water channels or tunnels, weirs, etc.) including associated facilities such as access roads, camp sites, crushers, concrete plants, power transmission lines, excavated material storage sites, waste storage sites, wastewater treatment facilities, or sources of materials such as quarries and borrow pits should be considered in the area of influence for project activities.

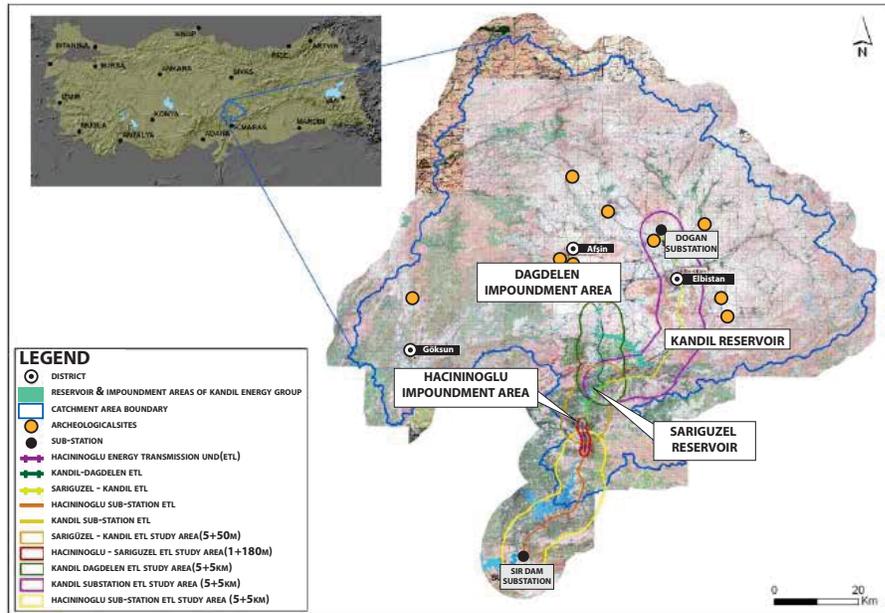
During the CEIA process, activities required for the displacement of existing roads for construction of dam reservoirs should also be considered indirect project activities. Furthermore, other hydropower projects planned for the same river, or other intended projects that would use and affect the same resources, should be considered during CEIA.

Determination of spatial study boundaries is one of the key stages during the CEIA process. It is especially challenging to find the appropriate balance between the practical constraints of time, budget, and available data and the need to adequately address complex environmental interactions that, theoretically, could extend for considerable distances and well into the future.

The use of maps is the starting point for determining the area of influence. Map overlays depicting existing settlement and land use patterns as well as proposed project activities can be used to provide a spatial portrayal of impacts on communities, their land base, and other natural resources.

Area of Influence of HEPP Projects on Upper Ceyhan River

BOX 6



The area of influence covers, as appropriate:

- 1 Areas potentially impacted by the project and the project owner's activities and facilities that are directly owned, operated, or managed (including by contractors) and that are a component of the project;
- 2 Areas potentially impacted by unplanned but predictable developments caused by the project that may occur later or at a different location;
- 3 Affected Communities whose livelihoods are affected by indirect project impacts on biodiversity or the ecosystem;
- 4 Areas potentially impacted by cumulative impacts from additional planned development or other sources of similar impacts in the geographical area, any existing project or condition, and other project-related developments that can realistically be expected at the time that due diligence is undertaken; or
- 5 Areas and communities potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.

BOX 7

Setting Spatial Boundaries in CEIA

Any of the following rules of thumb may be used to assist in setting spatial boundaries. It is important to understand that establishing boundaries is often an iterative process in which a boundary may initially be identified without all the necessary information available, and subsequently modified if new information becomes available.

- Establish a local study area in which the obvious, easily understood, and often mitigable effects will occur.
- Establish a regional study area that includes the areas where there could be possible interactions with other actions. Consider the interests of other stakeholders.
- Consider the use of several boundaries, one for each environmental component and associated type of impact, as this is often preferable to one boundary.
- For terrestrial VECs such as vegetation and wildlife, ensure boundaries are ecologically defensible wherever possible (e.g., winter range boundaries for assessing effects on critical wildlife habitat).
- Expand boundaries sufficiently to address the cause-effect relationships between actions and VECs.
- Characterize the abundance and distribution of VECs at a local, regional, or larger scale if necessary (e.g., for very rare species), and ensure that the boundaries take this into account.
- Determine if geographic constraints may limit cumulative effects within a relatively confined area near the action.
- Characterize the nature of pathways that describe the cause-effect relationships to establish a "line of inquiry" (e.g., effluent from a pulp mill to contaminants in a river to tainting of fish flesh and finally to human and wildlife consumption).
- Set boundaries at the point at which cumulative effects become insignificant.
- Be prepared to adjust the boundaries during the assessment process if new information suggests this is warranted and to defend any such changes.

3.2.3. Selection of VECs

VECs are selected once there is an understanding of (i) the project works and activities; (ii) the environment likely to be affected; and (iii) the potential interactions between project works and activities and the environment. Generally, VEC selection considers the following:

- Abundance in the site and local and regional study areas
- Data availability
- Ecological importance
- Native species
- Exposure
- Sensitivity
- Ecological sustainability
- Human health
- Socioeconomic importance
- Conservation status
- Importance to society in terms of cultural heritage

3.2.4. Identification of Activities Affecting the Same VECs

Other past, present and future actions might have caused or may cause impacts and may interact with impacts caused by the action under review. Thus, all these actions need to be identified in the CEIA.

Habitat-based VEC Identification

Habitat-based ecological studies are more appropriate than species-specific studies in terms of identification of target VECs.

Several studies in line with the EU Habitat Directive regarding habitat classification in Turkey were recently conducted during the EU accession period.

BOX 9

Sample VEC Table for HEPP Projects on Ceyhan River

Environmental Component	Subcomponent	Parameter	Proposed VECs
 Air	Ambient Air Quality	SO ₂ NO ₂ PM ₁₀	<ul style="list-style-type: none"> - Closest residential area/receptor - Terrestrial environment
 Water	<ul style="list-style-type: none"> - Ambient Water Quality - Ecological Sustainability - Agricultural and Domestic use 	Water Pollution Control Regulation (WPCR) Table 1 Water Flow	<ul style="list-style-type: none"> - Public water users - Existing Afsin A and B TPPs - Proposed Afsin C, D and E TPPs - Aquatic environment - Terrestrial environment
 Ecology	—	—	<ul style="list-style-type: none"> - Fish species (Pearl Fish ("Alburnus orontis" listed as EN in IUCN Red List) - Amphibians (Night Frog ("Bufo viridis" listed as LC in IUCN Red List) - Reptiles - Birds - Mammals (Lesser Mole Rat ("Spalax (Nannospalax) leucodon" listed as VU in IUCN Red List) - Vegetation (e.g. Heraclium marashicum) - Forest - Wetlands (e.g. Ceyhan River)
 Wildlife	—	—	Korcoban Nature Conservation Area, which lies 20 km away from the study area.
 Landscape	—	—	<ul style="list-style-type: none"> - Aesthetics - Cultural heritage sites (e.g. Ortakli and Dogan Tumulus within transmission corridor of Kandil Energy Group Projects)
 Settlement	<ul style="list-style-type: none"> - Air quality (dust and noise) - Livelihoods of local communities 	—	<ul style="list-style-type: none"> - Closest residential area/receptor - Terrestrial environment

The selection of future actions to consider should at least reflect concrete conditions and at best the most likely future scenario. Rigid adherence to minimum regulatory requirements however is increasingly becoming unacceptable to many stakeholders if there is reason to believe that at least some reasonably foreseeable projects could have a significant cumulative effect in combination with the project under review. In addition, precedent-setting court and panel decisions on project approvals will continue to promote change regarding what is and is not expected and acceptable practice. Experts are therefore encouraged to consider the opportunity to also include reasonably foreseeable actions. The final decision for the assessment is often at the expert's discretion or under the direction of the regulatory authority.

Foreseeable future actions would primarily include those projects that have received some form of official approval (e.g. a positive EIA decision, a production license for HEPPs, official site allocation, etc.); are in the regulatory review process for approval; and are included in an approved development plan (e.g. regional development plan, master plan, etc.).

Selection of Other Actions

BOX 10

Spatial Criteria

Actions with footprints within the regional study area(s) that may affect the VECs being assessed. Footprints include associated components (e.g., access roads, power lines) and include air or areas of land or water.

Actions outside the regional study area if it is likely that any of their components may interact with other actions or VECs within that area.

Time Criteria

Past: Actions that are abandoned but still may cause effects of concern.

Existing: Currently active actions.

Future: Actions that may yet occur

Past Actions

Past actions are no longer active yet continue to represent a disturbance to VECs (e.g., ongoing effects of an abandoned gravel pit on terrain or a plume of solvents from an abandoned wood preserving factory on a nearby aquifer). It is possible that the effects may no longer be readily observable (e.g., review of maps or aerial photos show little evidence of the action). However, significant changes may remain to ecological processes and VECs. In practice, past actions often become part of the existing baseline conditions. It is important, however, to ensure that the effects of these actions are recognized.

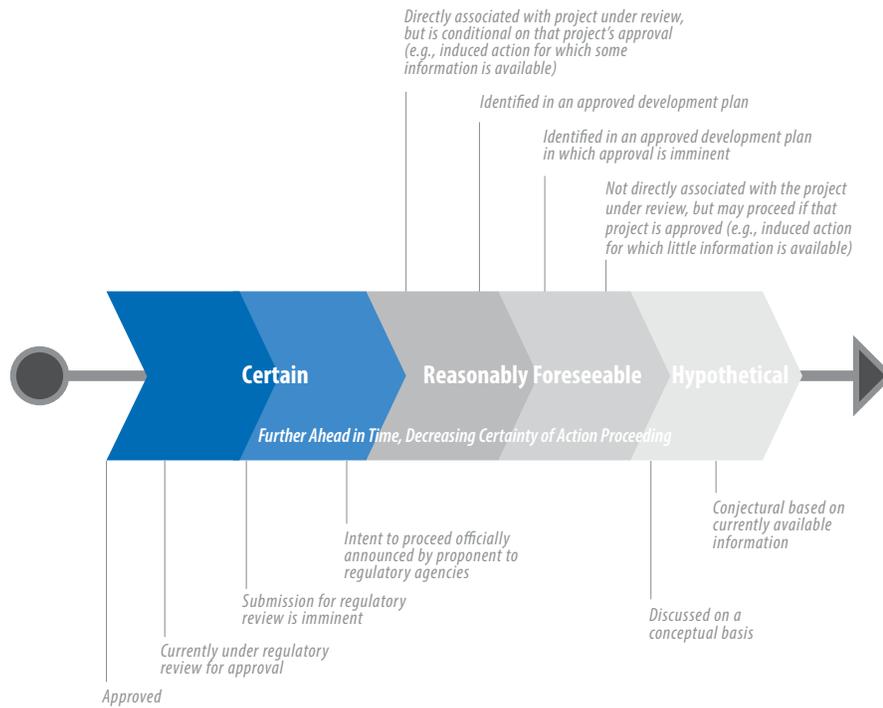
Future Actions

Selection of future actions must consider the degree of certainty regarding whether the action will actually proceed. Figure 1 lists criteria that may be used in the selection process.

BOX 10

Selection of Other Actions (cont'd)

Figure 1



The figure categorizes actions into three types:

Certain

The action will proceed or there is a high probability the action will proceed.

Reasonably Foreseeable

The action may proceed, but there is some uncertainty about this conclusion (the Canadian Environmental Assessment Agency's Operational Policy Statement Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act recommends that at least these types of projects be considered).

Hypothetical

There is considerable uncertainty as to whether the action will ever proceed.

BOX 11

Selected Actions for CEIA of HEPP Projects on Ceyhan River

Projects Under Assessment	Other Existing Projects	Planned or Foreseen Projects
<ul style="list-style-type: none"> ■ Dagdelen HEPP ■ Kandil HEPP ■ Sariguzel HEPP ■ Hacininoglu HEPP 	<ul style="list-style-type: none"> ■ Kartalkaya HEPP ■ Ayvali HEPP ■ Menzelet HEPP ■ Sir HEPP ■ Goksu Irrigation Project ■ Afsin A TPP ■ Afsin B TPP ■ Adatepe Irrigation Project (under construction) ■ Kilavuzlu HEPP (under construction) 	<ul style="list-style-type: none"> ■ Karakuz HEPP ■ Kavaktepe HEPP ■ Hasanali HEPP ■ Dogutlu HEPP ■ Geben HEPP ■ Kisik HEPP ■ Afsin C TPP ■ Afsin D TPP ■ Afsin E TPP

3.2.5. Determination of PSS and LAC

Definition of the legal framework is one of the key steps in the impact assessment process. The legal framework establishes the boundaries for allowable impact types and impact levels. In addition, investors and/or project owners can also apply their own standards, if any, beyond the legislative requirements.

In this context, the legal framework is comprised of two components: (i) the legal register and (ii) project-specific standards (PSS). The legal register lists relevant regulations and standards whereas PSS provide legal limits and other limitations according to international standards as well as the project owner's standards, which might be specific to the project (i.e. based on expert opinion and/or public concern/consultations).

BOX 12

Critical Habitats Criteria

In addition to legislative quantitative standards, some international finance institutions have defined qualitative limitations for activities in critical habitats. For example, IFC (Guidance Note 6 of 2012) defines critical habitats according to five criteria and establishes a framework of preliminary requirements that clients must fulfill before implementing any activity.

PSS are determined primarily based on national environmental legislation. For the subjects on which national legislation lacks regulations with respect to international standards, relevant international requirements and guidelines, as well as suggestions from review and evaluation committee members and other stakeholders could be taken into consideration.

BOX 13

Sample Legal Register

National Law			EU Directive		VEC
Code / Number	Section	Description	Code / Number	Description	
Published in the Official Gazette dated 08/11/1983 and numbered 18132.	Article 9 Article 20 Annex 1 (Clause 30)	Environmental Law (Environmental law regarding the protection of the environment and reduction of environmental aspects and impacts resulting from various activities. The law introduces several implications for natural and legal persons that cause environmental pollution. It includes the "polluter pays" principle, the right to punish or shut down the polluting facilities, and the need to inform authorities of planned changes in the production process or facility. If the facility, shop, or operation does any more than perform or manage administrative functions, this regulation will apply to it since most activities generate waste (even if only municipal waste), or create emissions. This law has been amended several times, with the latest dated 04/26/2006 no. 5491 (amendment directly introduced in the existing text). The latest articles include requirements for setting up environmental management units in facilities that are polluting and/or harming the environment. The law also introduces new articles regarding fines for pollution from ships.)			Environment General
Published in the Official Gazette dated 05/17/2005 and numbered 25818.	Article 14 Article 15	Regulation on the Protection of Wetlands The regulation addresses the protection and development of all wetlands including those that are covered by the Ramsar Convention. Facilities that started operations before the regulation was published are allowed to continue their operations in these areas until 01/01/2007 provided they follow the instructions of the Ministry. For all new facilities carrying out activities in and around wetlands, the regulation applies directly. Among others, filling and drying of natural wetland areas that are larger than 8 hectares are not allowed. For areas that are smaller than 8 hectares, a permit should be obtained.	2000/60/EC	Directive 2000/60/EC of the European Parliament and of the Council Establishing a Framework for the Community Action in the Field of Water Policy, Water Framework Directive	Ecology

BOX 14

Sample Project-Specific Standards

ID	Issue	Relevant Legislation	Limit Value/Liabilities	Remark																				
1	Domestic wastewater	<p>Water Pollution Control Regulation (WPCR) (OG dated December 31, 2004 and numbered 25687)</p> <p>Regulation on Septic Tanks Constructed in Districts without Sewerage System (RSTCDSS) (OG dated March 19, 1971 and numbered 13783)</p>	<p>Wastewater discharged from package wastewater treatment plants in camp sites/compressor stations will comply with the criteria provided in the following table.</p> <p>Table 21.1 in WPCR (for wastewater discharged into surface water bodies)</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Unit</th> <th>2-hour composite sample</th> <th>24-hour composite sample</th> </tr> </thead> <tbody> <tr> <td>Biochemical Oxygen Demand (BOD)</td> <td>mg/L</td> <td>50</td> <td>45</td> </tr> <tr> <td>Chemical Oxygen Demand (COD)</td> <td>mg/L</td> <td>180</td> <td>120</td> </tr> <tr> <td>Suspended Solids</td> <td>mg/L</td> <td>70</td> <td>45</td> </tr> <tr> <td>pH</td> <td>-</td> <td>6-9</td> <td>6-9</td> </tr> </tbody> </table>	Parameter	Unit	2-hour composite sample	24-hour composite sample	Biochemical Oxygen Demand (BOD)	mg/L	50	45	Chemical Oxygen Demand (COD)	mg/L	180	120	Suspended Solids	mg/L	70	45	pH	-	6-9	6-9	
		Parameter	Unit	2-hour composite sample	24-hour composite sample																			
Biochemical Oxygen Demand (BOD)	mg/L	50	45																					
Chemical Oxygen Demand (COD)	mg/L	180	120																					
Suspended Solids	mg/L	70	45																					
pH	-	6-9	6-9																					
2	Excavated Material	<p>Regulation on Control of Excavated Material and Construction and Demolition Waste (RCEMCDW) (OG dated March 14, 1991 and numbered 20814)</p>	<p>Article 14: Vegetative top soil shall be temporarily stored in places with slope less than 5%.</p> <p>Loss of vegetative top soil shall be prevented, and shall be used for landscaping after construction.</p>																					
		<p>Regulation on Landfilling of Waste RLW) (OG dated March 26, 2010 and numbered 27533)</p>	<p>Unused excavated material shall be transported to a Class III disposal site.</p> <p>Excavated material shall be transported to a Class III disposal site by companies having a license for carrying excavated material, acquired from the MoEU.</p>																					
3	Air Quality	<p>Regulation on Assessment and Management of Air Quality (RAMAQ) (OG dated June 6, 2008 and numbered 26898)</p> <p>Regulation on Control of Industry-Sourced Air Pollution (RCISAP) (OG dated July 3, 2009 and numbered 27277)</p>	<p>Annex-2 to RCISAP – Air quality modeling is required if dust emission due to excavation along the platform exceeds 1 kg/hour.</p> <p>Table 2.1 of Annex-2 to RCISAP – Limit values for ground level PM₁₀ and settleable dust concentrations up to the year 2014 are provided as follows.</p> <table border="1"> <thead> <tr> <th rowspan="2">Parameter</th> <th rowspan="2">Unit</th> <th colspan="2">Limit Value (until 2014)</th> </tr> <tr> <th>Short-term</th> <th>Long-term</th> </tr> </thead> <tbody> <tr> <td>PM₁₀</td> <td>µg/m³</td> <td>100</td> <td>60</td> </tr> <tr> <td>Settleable Dust</td> <td>mg/m³.day</td> <td>390</td> <td>210</td> </tr> </tbody> </table>	Parameter	Unit	Limit Value (until 2014)		Short-term	Long-term	PM ₁₀	µg/m ³	100	60	Settleable Dust	mg/m ³ .day	390	210	<p>For dust emissions from construction activities along the line, the mass flow rate of emissions is not expected to exceed 1 kg/hour since only one excavator will be working along a certain segment of the platform; therefore, there will not be very extensive dust-emitting activity.</p>						
Parameter	Unit	Limit Value (until 2014)																						
		Short-term	Long-term																					
PM ₁₀	µg/m ³	100	60																					
Settleable Dust	mg/m ³ .day	390	210																					

In addition to PSS, one other concept worth discussing in the context of CEIA is that of limits of acceptable change (LAC), which relates to the carrying capacity of the environmental resources or acceptable environmental conditions. In other words, any new activity in the study area will be assessed together with existing and planned activities, and should be approved provided that it does not lead to a significant negative change in existing conditions.

In addition to activity-specific emission and discharge standards, national legislation includes limit values for ambient air quality and quality standards for inland water bodies. Such standards can be used to define LAC for emissions to air and water. For example, Table 1 of the Water Pollution Control Regulation sets quality standards for inland water bodies, and four quality categories – known as “classes” – are defined with respect to levels of pollutants. LAC would therefore be categorized in Class III for the ultimate development of a basin if the existing status of the basin is Class II.

3.3. BASELINE STUDIES AND IMPACT ASSESSMENT

3.3.1. Baseline Studies

A common concern among project proponents is the level of effort and resources (i.e., time and budget) required to collect adequate data to assess regional cumulative effects. While early scoping is required to ensure that the assessment is focused on the most important VECs, it also ensures that data collection is limited to only that which is required to address these issues.

In some cases, the collection of data for some environmental components, such as water quality, air quality, and noise levels, provides baseline data that often captures the collective effects of existing actions. Experts must have a clear understanding of how data will be used in support of a clearly defined and scientifically defensible analysis. As a rule, it is not advisable to embark on costly data collection and analysis without careful consideration of the results it may yield.

The level of information collected may not be as detailed as in an EIA because of the much larger area covered (in addition, the type of data required may change as the scale of the assessment changes). For example, soil and vegetation field studies may be relatively intensive within the proposed project footprint and involve on-site mapping for the identified VECs. However, for regional study areas of thousands of hectares, analysis may have to be based on satellite imagery or existing vegetation surveys completed on very broad scales. Therefore, the methodology to be suggested by experts as baseline data collection becomes critical for successful CEIA. In this regard, suggested methodologies should be identified in detail and thoroughly presented during the scoping phase.

BOX 15

Ecosystem Evaluation and Water Use Rights Studies

The Turkish Ministry of Environment and Urbanization (MoEU) has requested two special studies for HEPP Projects during the national EIA process, namely the Ecological/Ecosystem Evaluation Study and Water Use Rights Study. The output of these two studies form major components of baseline studies.

3.3.2. Identification of Impacts

Cumulative effects occur as interactions between actions, between actions and the environment, and between components of the environment. These pathways between a cause (or source) and an effect are often the focus of an assessment of cumulative effects. The magnitude of the combined effects along a pathway can be equal to the sum of the individual effects (additive effect) or can be an increased effect (synergistic effect).

Identification of potential impacts that may affect VECs is an important step as it helps the expert begin to understand one of the most fundamental assessment questions: what is affecting what? Good scoping in the initial stages of the study will focus assessment on the most likely pathways of concern.

One approach to accomplishing this common step is to first identify environmental components (e.g., air, water) that may be affected by various project components (e.g., land clearing, combustion emissions) for the project being assessed. Environmental components that may be affected by other actions in the region of interest can then be identified. Scoping could then proceed to focus on the relationships between specific impacts from various actions and specific VECs. The next section describes one practical means of accomplishing such impact assessment.

3.3.3. Impact Assessment

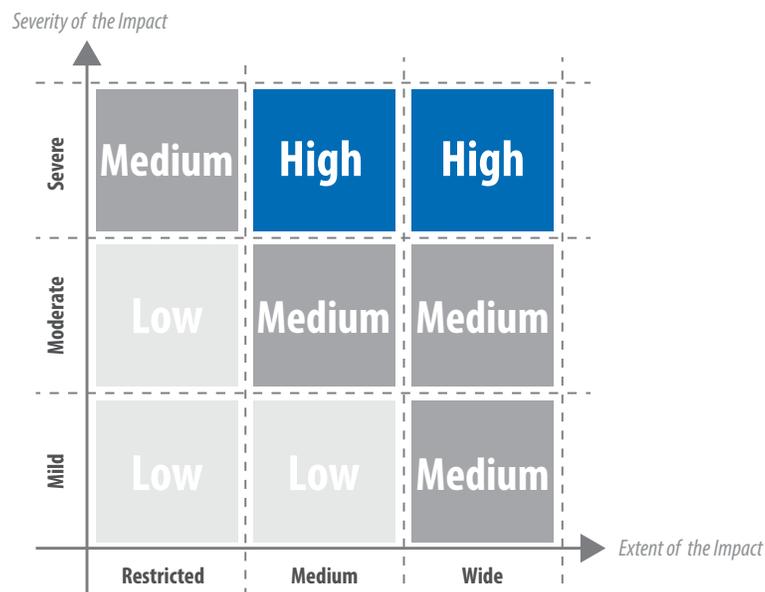
The analysis of cumulative effects should focus on assessing effects on selected VECs. Several approaches are available to help the expert assess cumulative impacts. However, there is no one single approach that should always be used, nor necessarily one type of approach for specific effects or types of actions. Instead, the expert must select an appropriate approach or assessment tool from a collection or toolbox of possible approaches. The appropriate method is the one that best provides an assessment of the effects on the VECs being examined.

An Interaction Matrix is a tabulation of the relationship between two quantities. Matrices are often used to identify the likelihood of whether an action will affect a certain environmental component or to present the ranking of various effect attributes (e.g., duration, magnitude) for various VECs. Matrices are an example of one tool that can be used during scoping to identify the potentially strongest cause-effect relationships, and later to concisely summarize the results of an assessment. Matrices, however, only show the conclusions made about interactions and cannot themselves reveal the underlying assumptions, data, and calculations that led to the result shown. Matrices are therefore a simplistic representation of complex relationships and should be accompanied by a detailed explanation as to how the interactions and rankings were derived (e.g., in a “decision record”).

A CEIA can also use a matrix to rank the strength of the interactions between each action in the regional study area and regional VECs (e.g., how strong is the effect on a VEC due to the overlapping of effects from two different actions?). The interactions can be qualitatively ranked (e.g., 1 = low to 5 = high on a 5-point scale), or use a number that represents a physical quantity. The first type of ranking is currently the more commonly used in assessments. It may also be necessary to return and examine relationships ranked as negligible or low if later information suggests they may be more important, or if the public has considerable interest in the issue.

BOX 16

Evaluation Matrix Used for HEPP Projects on Ceyhan River



The major activities and impacts of the projects will be identified for the construction and operation phases. Each impact is rated "severe," "moderate," or "mild" with respect to severity, and "wide," "medium," or "restricted" with respect to the extent of the impact. While the severity indicates the importance and magnitude of the impact, the extent indicates the geographical size of the impact area. The result of the assessment, which is either "high," "medium," or "low," presents the overall significance. It should be noted that the geographical extent of an impact does not necessarily indicate the likelihood of cumulative impacts.

For the construction and operation phases, cumulative impacts would be considered separately for physical, biological, and socioeconomic environments. In each case the projects can be categorized into three groups, namely, project(s) under assessment, other projects that have impacts on VECs, and finally, planned or foreseen projects. These groups of projects might be assessed within three scenarios, namely, Scenarios A, B, and C as illustrated in Box 17.

BOX 17

Scenarios for HEPP Projects on Ceyhan River

SCENARIO C		
SCENARIO B		
SCENARIO A		
Projects Under Assessment	Other Existing Projects	Planned or Foreseen Projects
<ul style="list-style-type: none"> ■ Dagdelen HEPP ■ Kandil HEPP ■ Sariguzel HEPP ■ Hacininoglu HEPP 	<ul style="list-style-type: none"> ■ Kartalkaya HEPP ■ Ayvali HEPP ■ Menzelet HEPP ■ Sir HEPP ■ Goksu Irrigation Project ■ Afsin A TPP ■ Afsin B TPP ■ Adatepe Irrigation Project (under construction) ■ Kilavuzlu HEPP (under construction) 	<ul style="list-style-type: none"> ■ Karakuz HEPP ■ Kavaktepe HEPP ■ Hasanali HEPP ■ Dogutlu HEPP ■ Geben HEPP ■ Kisik HEPP ■ Afsin C TPP ■ Afsin D TPP ■ Afsin E TPP

In addition, the accumulation pathways of the cumulative impacts will be used for the assessment. While some impacts of multiple projects accumulate in an additive manner, some impacts can be synergistic. These impacts, which are termed “interactive” impacts, produce a total impact greater than the sum of the individual impacts. For instance, environmental impacts that can accumulate in an additive manner include those such as changes in water temperature or concentrations of dissolved gases, erosion, sedimentation, and habitat losses. On the other hand, synergistic pathways allow for interactions among multiple impacts through processes such as bioaccumulation. For example, aquatic organisms may be exposed to pulses of pollutants for longer periods of time in an impoundment than in a free-flowing river, thus increasing the potential for the bioaccumulation of contaminants.

Where an HEPP project has a number of effects, the potential for interaction among them can lead to cumulative impacts along this pathway.

BOX 18

Impact Assessment Tools for CEIA

Impact Models

Impact models have been used extensively in EIAs and may be adopted for CEIAs as they provide a concise description of cause-effect relationships that occur between an action and the surrounding environment. The impact model approach involves testing the validity of a statement, similarly to testing a scientific hypothesis. The advantage of using impact models is that they provide a simplified perspective of complex systems, allowing for step-by-step analysis of each interaction in a cause-effect relationship. They also facilitate the description of cause-effect relationships over large areas. Impact models have three parts: an impact statement, a pathways diagram, and linkage statements. The assessment of the model involves two steps: linkage validation and pathway assessment and evaluation.

Numerical Models

Numerical models are algorithms that are used to simulate environmental conditions. The most common use of these models is to predict the state of a physical or chemical constituent by using a computer-based application to assess air and water quality, water volume flows, and airborne deposition on soils and vegetation. Terrestrial and aquatic organisms are relatively more difficult to model than effects on air and water systems due to uncertainties in predicting their behavior and physiological responses. Air and water modeling has typically followed a cumulative effects approach: the distances in which airborne or waterborne constituents are typically transported have often necessitated a regional perspective. Because of this, the use of readily available numerical models may provide an adequate assessment response to cumulative effects on air and water quality. In some assessments, the spatial boundaries of the airshed or watershed modeled have been used as an overall regional study area if it adequately addresses effects on other environmental components.

Spatial Analysis Using GIS

Spatial analysis using a Geographic Information System (GIS) involves assessing the effects of the action under review on a component of the entire surrounding environment in which all the actions and natural features are combined together into one representative model of the landscape (this may be done on a scenario-by-scenario basis). The essential feature of a GIS is that it correlates measures of disturbance to various actions, and then relates those disturbances to the occurrence of VECs. This allows the creation of a model representing certain cause-effect relationships. Furthermore, relatively large areas can be readily examined (assuming adequate descriptive data in spatial form is available) and quantitative results produced. Typical GIS applications include the determination of the following:

- area of land cleared (causing removal of vegetation and disturbance to soils);
- distances between (or overlap of) effects on other actions or natural features;
- length and density of road access—area of land in which wildlife are subject to sensory alienation;
- area of wildlife habitat lost or of reduced capability;
- degree of habitat fragmentation, and changes in any of the above between assessment scenarios.

Indicators

Indicators provide a specific measure of the effects on a VEC. An indicator may sometimes actually be the VEC itself. Indicators used in a CEIA may differ from those used in an EIA if indicators for local effects do not adequately represent effects at a larger spatial scale or longer timeframe. For example, in the case of a pulp mill where suspected contamination of a river is an issue, the VEC for the assessment would be water quality. An indicator for local effects (i.e., as used in the EIA) could be dissolved oxygen to measure effects a few kilometers downstream. An indicator for regional effects (i.e., as used in the CEIA) could be dioxin concentrations in fish 200km downstream where a small fishing community lies along the river. Indicators can measure attributes of human-caused disturbances (e.g., road densities, area cleared) or attributes of the surrounding environment (e.g., fragmentation indices, biodiversity indices, length of edge).

BOX 19

Impact Identification and Assessment Table/Matrix

VECs	Impact	Subsection	Impact Type	Extent and Severity	Severity
Air	Formation of anaerobic conditions in the HEPP reservoirs and emissions of greenhouse gases resulting from inundated terrestrial vegetation and flora	Scenario A	Additive	Restricted & Mild	LOW
		Scenario B	Additive	Medium & Moderate	MEDIUM
		Scenario C	Additive	Medium & Moderate	MEDIUM
Water	Land, surface water, and groundwater contamination due to improper handling and treatment of domestic wastewater generated from the personnel	Scenario A	Interactive	Restricted & Mild	LOW
		Scenario B	Interactive	Medium & Mild	LOW
		Scenario C	Interactive	Wide & Mild	MEDIUM
	Decrease in water flow in sections where water is diverted between dams and power plants, and subsequent water quality change due to existing wastewater discharge from settlements	Scenario A	Interactive	Medium & Moderate	MEDIUM
		Scenario B	Interactive	Medium & Moderate	MEDIUM
		Scenario C	Interactive	Medium & Moderate	MEDIUM
Soil	Soil contamination due to improper handling and disposal of solid waste	Scenario A	Additive	Restricted & Moderate	LOW
		Scenario B	Additive	Medium & Moderate	MEDIUM
		Scenario C	Additive	Medium & Moderate	MEDIUM

3.4. MITIGATION MEASURES

Managing cumulative effects in a CEIA requires, as a start, the same type of mitigation and monitoring that would be recommended for an EIA. Mitigating a local effect as much as possible is the best way to reduce cumulative effects; however, to be most effective, mitigation and monitoring must be long term and regionally based. This can be costly, require a few years to complete, and require broader data collection and greater involvement in decision making than has historically been the case with EIAs.

Mitigation measures can be applied to developments other than the proposed development. Several administrative jurisdictions and stakeholders will usually fall within an assessment's regional study area. In many cases, the cooperation of these other interests may be required to ensure that recommended mitigation is successfully implemented.

BOX 20

No Net Loss as a Mitigation Measure

The concept of “no net loss” has been suggested by some international institutions as an appropriate mitigation measure in response to concerns regarding regional cumulative effects. No net loss requires that any land or water body disturbed from its pre-action condition be replaced with an area of equivalent capability to ensure that the ability of the habitat to support wildlife or fish is maintained in the region (this includes the option of increasing the productivity of the existing habitat). This concept presents two challenges as an effective approach to offsetting the cumulative loss of terrestrial habitat:

- 1** To essentially create more land, existing land must be converted (e.g., through habitat modification). However, it is typically converted to conditions that benefit one or a few select species (e.g., rare or game species). By implication, this may be detrimental to other species and may not represent a habitat of equivalent capability to support the full range of species originally supported by the lost habitat.
- 2** There may be no remaining land within a reasonable distance of the action to be modified (i.e., within a distance in which beneficial effects would be attributable to the action). This is particularly true for regions with extensive private land holdings or existing disturbances, land that would be inaccessible to wildlife, and when vegetation climax conditions are required.

BOX 21

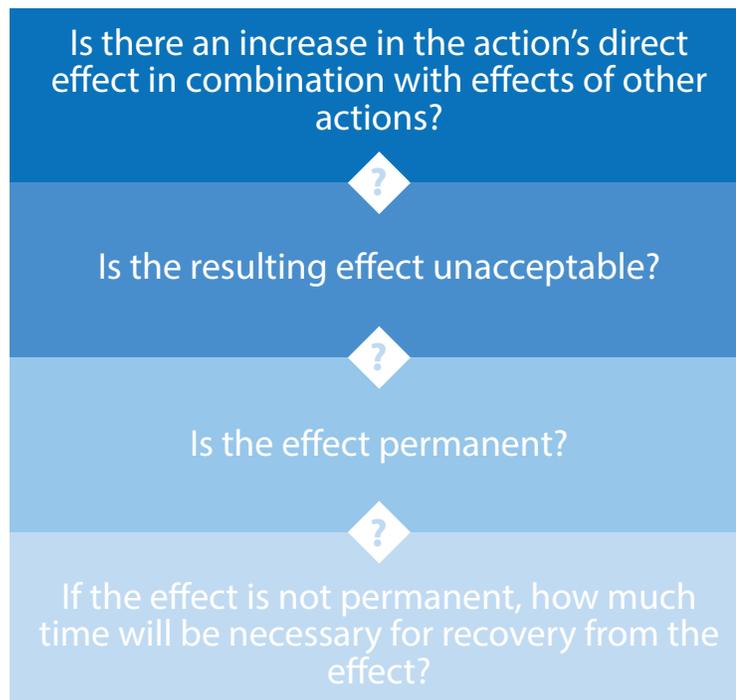
Analysis of Residual Impact (Impact Remaining after Mitigation)

VECS	Impact	Subsection	Impact Type	Extent and Severity	Mitigation Measures	Residual Impact	Residual Severity
Air	1. Formation of anaerobic conditions in the HEPP reservoirs and emissions of greenhouse gases resulting from inundated terrestrial vegetation and flora. 2. Stack gas emissions from TPPs.	Scenario A	Additive	Restricted + Mild	1. The vegetation in the area to be inundated should be cleared prior to flooding. 2. TPPs should be equipped with appropriate and adequate emission reduction systems	Low-level greenhouse gas emissions	Restricted + Mild
		Scenario B	Additive	Medium + Moderate			Medium + Mild
		Scenario C	Additive	Medium + Moderate			Medium + Mild
Water	Land, surface water, and groundwater contamination due to improper handling and treatment of domestic wastewater generated by the personnel	Scenario A	Interactive	Restricted + Mild	Domestic wastewater will be collected in septic tanks in accordance with the relevant national standard and then transferred to the nearest municipality treatment plant.	No residual impact	N.A.
		Scenario B	Interactive	Medium + Mild			N.A.
		Scenario C	Interactive	Wide + Mild			N.A.
Water	Decrease in water flow in sections where water is diverted between dams and power plants, and subsequent water quality change due to existing wastewater discharge from settlements.	Scenario A	Interactive	Medium + Moderate	Development of wastewater infrastructure in nearby settlements which have direct discharge to sections of the Ceyhan River where water flow decreases due to diversion	Low residual impact due to discharge of treated wastewater	Low
		Scenario B	Interactive	Medium + Moderate			Low
		Scenario C	Interactive	Medium + Moderate			Low
Soil	Soil contamination due to improper handling and disposal of solid waste	Scenario A	Additive	Restricted + Moderate	Domestic solid waste will be collected in closed containers at the project sites and handled by related municipalities at their waste disposal sites. Domestic solid waste will be transported to the waste disposal sites by trucks with the necessary licenses.	No residual impact	N.A.
		Scenario B	Additive	Medium + Moderate			N.A.
		Scenario C	Additive	Medium + Moderate			N.A.

3.5. EVALUATION OF SIGNIFICANCE

Determining the significance of residual effects (i.e., effects after mitigation) is probably the most important and challenging step in EIA. The determination of significance for CEIAs is fundamentally the same; however, it may be more complex due to the broader nature of the elements being examined. A cumulative effects approach requires the determination of the extent of further effects that can be sustained by a VEC before it suffers irreversible changes to its condition or state.

Conclusions surrounding the significance of residual effects should be defensible through some explanation of how the conclusions were reached. The following is an example of one approach: questions are structured so as to guide the expert through a series of steps, eventually leading to a conclusion on significance. The questions follow a basic line of inquiry as follows:



These questions are expanded upon below, specifically to address the nature of two different types of VECs;

(i) Biological Species VECs

- How much of the population may have its reproductive capacity and/or the survival of individuals affected? Or, for a habitat, how much of the productive capacity of the habitat may be affected (e.g., <1%, 1-10%, >10%)?
- What degree of recovery of the population or habitat is possible, even with mitigation (e.g., complete, partial, none)?
- How soon could restoration to acceptable conditions occur (e.g., <1 year or 1 generation, 1-10 years or 1 generation, >10 years or >1 generation)?

(ii) Physical-chemical VECs

- How much could changes in the VEC exceed those associated with natural variability in the region? What degree of recovery of the VEC is possible, even with mitigation?
- How soon could restoration to acceptable conditions occur?

The cumulative impact on a VEC may be significant even though each individual project-specific assessment of that same VEC concludes that the impacts are insignificant. Project-specific assessments with CEIA components can assist in drawing such conclusions as they must consider the implications of other actions also affecting the VECs. However, the inclusion of these (and sometimes the analytical approach used) requires the consideration of various factors that may influence the determination of significance (some of which have not always been an issue in assessments lacking a cumulative effects component). These factors include the following:

- Exceedance of a threshold
- Effectiveness of mitigation
- Size of study area
- Relative conservation status and endemism of species
- Contribution of impacts from the project (under review)
- Relative contribution of impacts of other actions
- Significance of local impacts
- Magnitude of change relative to natural baseline conditions
- Degree of existing disturbance

To determine the significance of cumulative impacts, some limits of acceptable change, to which incremental impacts of an action may be compared, are needed. Theoretically, if the combined effects of all actions within a region do not exceed a certain limit or threshold (limits beyond which an impact becomes a concern), the cumulative impacts of an action are considered acceptable. In practice, the assessment of cumulative impacts is often hindered by a lack of such thresholds. This is particularly true for terrestrial components of ecosystems. Contaminants affecting human health and constituents in air and water are usually regulated; therefore, thresholds useful for assessment purposes are defined by regulation or available in guidelines.

As a result, thresholds are not always readily available and so professional judgment must usually be relied upon. When an actual capacity level cannot be determined, analysis of trends can assist in this respect. In the absence of defined thresholds, the practitioner can

- i. suggest an appropriate threshold;
- ii. consult various stakeholders, government agencies, and technical experts; or
- iii. acknowledge that there is no threshold, determine the residual impact, and let the reviewing authority decide if a threshold is being exceeded.

3.6. MONITORING AND FOLLOW-UP

The purpose of follow-up is to verify the accuracy of environmental assessments and determine the effectiveness of mitigation measures. In practice, follow-up usually takes the form of monitoring and the establishment of environmental management measures. According to the Turkish EIA Regulation, a monitoring program should be prepared for all projects subject to this Regulation. The monitoring program should be as specific as possible in both EIA and CEIA in order to have measureable and comparable data on hand that would help illustrate trends and allow decision makers to take any further action for mitigating adverse impacts.

The project proponent's responsibilities should be based on the contribution to cumulative environmental impacts of the specific action taken, given the understanding that it would usually be unreasonable for a single proponent to monitor effects caused by all other proponents. The situations in which follow-up is required include those where the following conditions apply:

- There is some uncertainty about the environmental impacts of other actions, especially imminent ones;
- The assessment of the action's cumulative impacts is based on a new or innovative method or approach; or
- There is some uncertainty about the effectiveness of the mitigation measures for cumulative impacts.

BOX 22

Sample Monitoring Program in the Scope of CEIA for a HEPP Project

Phase	What <i>parameter is to be monitored?</i>	Where <i>is the parameter to be monitored?</i>	How <i>is the parameter to be monitored / type of monitoring equipment?</i>	When <i>is the parameter monitored--periodical or continuous measurement?</i>
CONSTRUCTION	Excavated material disposal method	Excavation and storage sites	Site observation and document review whether or not disposal area and the method are approved by the related municipality	Daily by construction staff
	Construction waste disposal method	Construction and storage sites	Site observation	Daily by construction staff
	Domestic solid waste disposal method	Storage sites	Site observation, environmental audits	Daily control by construction staff; quarterly audits by the Environmental Consultant
	Domestic wastewater disposal method	Septic tank	Measurement of wastewater level in septic tanks	Daily by construction staff
	Occupational health and safety measures	Construction site	Internal HSE audits to check the requirements of the Regulation on Occupational Health and Safety	Daily by construction staff, quarterly audits by the Environmental Consultant
	Change of flow regime and water quality	Ceyhan River	Site observation and water sampling upstream and downstream of the projects as well as analyses	Daily observation by construction staff for routine control, monthly water sampling and analyses by the Environmental Consultant
	Erosion and landslide	Project Sites (particularly at excavation sites)	Site observation	Daily by construction staff
OPERATION	Noise and vibration	Nearest neighboring sensible receptor	Noise measurement with a calibrated sound level meter	Monthly measurements (measurements should be performed more frequently depending on the complaint of the public)
	Domestic solid waste disposal method	Operation and maintenance sites	Site observation, quarterly environmental audits	Daily recordings and monthly assessment of the solid waste generated. Quarterly audits by the Environmental Consultant.
	Domestic wastewater disposal method	Septic tank	Measurement of wastewater level in septic tanks	Daily by operational staff
	Flood risk	Spillways and rivers	Site observation and level measurement in reservoir	During maximum flow rate (fall and winter seasons when maximum precipitation is observed)
	Disturbance of aquatic life	Downstream of projects on the Ceyhan River	Site observation for compensation water released and measurement, if needed.	Daily by operational staff



4

Methods & Tools for CEIA Studies



Determining the cumulative environmental consequences of a development entails a wider, regional perspective than for direct and immediate impacts of the project. The requirements of cumulative impact assessment (i.e. resource sustainability, relevant/sufficient geographic and time boundaries) should be met by:

- Identifying geographical boundaries in line with the possible impacts of both the project of concern, existing projects, and other reasonably foreseeable/planned projects/developments in the region;
- Selecting time boundaries in line with the economic life of the projects including both construction and operation activities; and
- Assessing the significance of impacts on the resources not only on a local scale, but on a regional scale, taking into consideration the sustainability of resources and their benefits to the local, regional, and national economy.

4.1. OVERVIEW OF ASSESSMENT METHODS AND TOOLS

Various methods being used in project-level EIA studies can be used to assess cumulative environmental impacts as well. An overview of these methods is provided in this guideline, based on international experience with CEIA studies.

The methods and tools described here generally fall into two groups:

- Scoping and impact identification methods - these identify how and where an indirect or cumulative impact would occur.
- Evaluation methods - these predict the magnitude and significance of impacts based on their extent and severity.

During the EIA process, a combination of methods can be used, or certain approaches can be adopted, at different stages of the study. An overview of the methods or tools that could be used for identifying the impacts and establishing either descriptive or quantitative assessments is provided in Table 4.1. For each method, information is included on its strengths and weaknesses.

Table 4.1. Overview of Assessment Methods and Tools for CEIA Studies

Type of Method/ Tool	Brief Description	Strengths	Weaknesses	Usability for Impact Identification	Usability for Impact Evaluation
Expert opinion and past experience (in addition to establishing scenarios as necessary)	Combining scientific/ technical opinions of experts and past experience (previous studies and their findings) both for VEC determination and impact assessment and management (different experts can be involved for different types of VECs and impacts). Scenarios can be established based on past experience and expert opinion for evaluation of the impacts and reasonably foreseeable projects	<ul style="list-style-type: none"> – Versatile and easy to apply – Particularly valuable for complex effects that cannot easily be modeled and which might not otherwise be identified – Can consider cumulative impacts as an integral part of the assessment 	<ul style="list-style-type: none"> – Misleading if expertise not adequate for the task – Can be unrepresentative of the action being assessed 	Yes	Yes
Consultation and questionnaires	Surveys with relevant stakeholders as a means of gathering information about a wide range of actions, including those in the past, present, and future which may influence the impacts of a project	<ul style="list-style-type: none"> – Flexible – Considers potential impacts early on – Can be focused to obtain specific information 	<ul style="list-style-type: none"> – Open to errors of subjectivity – Questionnaire can be time consuming and there is a risk of poor response 	Yes	No
Checklists	General lists providing a systematic way for ensuring that all relevant issues are considered	<ul style="list-style-type: none"> – Simple to understand and use – Good for site selection and priority setting – Can be standardized for similar types of projects 	<ul style="list-style-type: none"> – Do not distinguish between direct and indirect impacts – Do not link action and impact – Process of incorporating values can be controversial 	Yes	No

Table 4.1. Overview of Assessment Methods and Tools for CEIA Studies

Type of Method/ Tool	Brief Description	Strengths	Weaknesses	Usability for Impact Identification	Usability for Impact Evaluation
Matrices	Matrices link action to impact and provide a good display for results	<ul style="list-style-type: none"> – Provides a good visual summary of impacts – Can be adapted to identify and evaluate (to some degree) indirect and cumulative impacts – Matrices can be weighted (impacts ranked to assist with evaluation) 	<ul style="list-style-type: none"> – Can be complex and cumbersome to use – Potential for double-counting of impacts 	Yes	Yes
Networks	Networks link action to impact and can handle indirect and secondary impacts	<ul style="list-style-type: none"> – Mechanism of cause and effect made explicit – Use of flow diagrams can assist with understanding impacts 	<ul style="list-style-type: none"> – No spatial or temporal scale – Diagrams can become too complex 	Yes	No
Modeling (conceptual, habitat suitability, quantitative)	Analytical tools which enable quantification of cause-effect relationships by simulating environmental conditions	<ul style="list-style-type: none"> – Can deal with circumstances that are specific to the action being assessed – Quantifies effects (cumulative or direct) – Geographical and time frame boundaries are usually explicit – Addresses specific cause-effect relationships 	<ul style="list-style-type: none"> – Often requires investment of time and resources – Use of complex models requires a detailed understanding of the science, and may require considerable data – Hidden errors can arise from inappropriate assumptions/ approximations in models – Depends on baseline data available 	No	Yes
Spatial Analysis/ Geographic Information Systems (GIS), Visual analysis and simulation	Spatial analysis tool for identifying where the cumulative impacts of a number of different actions may occur and impact interactions. It can also superimpose a project's effect on selected receptors or resources to establish areas where impacts would be most significant to envision the impact sources together as well as with the VECs as applicable for mainly spatial analysis	<ul style="list-style-type: none"> – Easy to understand – Good display method – Excellent for impact identification and analysis – Good for experimenting – Useful for visual and other spatial impacts (e.g., photo-montages, computer-graphic images, overlay maps) – GIS flexible and easy to update – Can consider multiple projects and past, present, and future actions 	<ul style="list-style-type: none"> – GIS can be, complex to use, expensive, and time consuming – Addresses only direct impacts (of various activities on VECs) – Heavy reliance on knowledge and data 	Yes	Yes

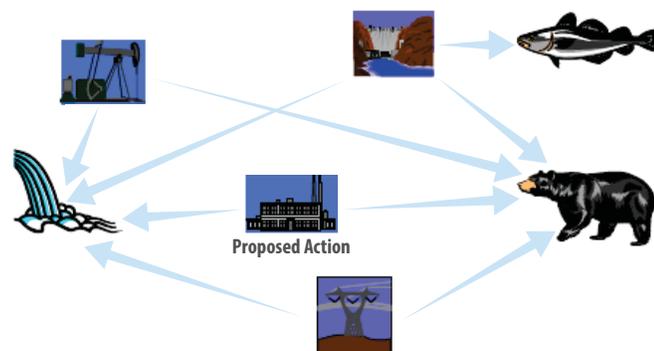
4.2. SELECTION OF ASSESSMENT METHODS AND TOOLS

As mentioned before, analysis of cumulative effects should focus on assessing effects on selected VECs (see Figure 4-1). Several approaches/methods are available for assessing cumulative impacts. However, there is no one single method that should always be used, nor necessarily one type of method for specific impacts or types of actions. The appropriate method is the one that best provides an assessment of the effects on the VECs being examined.

Figure 4-1 aims to illustrate that CEIA should be looked at from the VECs point of view, in which the combined/cumulative impacts of various actions on each VEC (e.g., bear, fish, and water quality) are assessed (arrows indicate that the action causes an effect on the VEC). In this regard, although the fish, which is a VEC in the area of influence of the proposed action, is affected by one of the other actions, it should not be considered because it is not affected by the proposed action under review.

FIGURE 4-1

Focusing on Impacts on VECs (Hegmann et al., 1999)



There are a number of factors that will influence the approach adopted for the assessment of cumulative impacts for a particular project. The method should be practical and suitable for the project given the data, time, and financial resources available. It should also be able

to provide a meaningful conclusion from which it would be possible to develop mitigation measures and monitoring activities as necessary. Key points to consider when choosing the method(s) include the following:

- Stage of the assessment (e.g., scoping, baseline data collection, analysis)
- Types of VECs
- Types of actions considered
- Nature of the impact(s)
- Availability and quality of data
- Available level of expertise
- Availability of resources (time, finance, infrastructure and staff)

As a result, the method chosen should not be complex, but should aim to present the results in a way that can be easily understood by the developer, the decision maker, and the public.

4.3. USE OF METHODS AND TOOLS FOR DIFFERENT CEIA TASKS

The methods or tools listed in Table 4.1 could be used to establish either descriptive or quantitative assessments. Predictions related to future impacts resulting from multiple actions may be problematic due to the absence of detailed information, but identification of changes in the VECs can be useful.

In this regard, these methods and tools can be used for various tasks when conducting CEIA studies. The methods and their applicability for various tasks are provided in Table 4.2 below. In addition, at the end of Table 4.2, the approaches that can be used for some of the CEIA tasks described in Chapter 3 are provided.

Table 4.2 Applicability of Assessment Methods and Tools for Different CEIA Tasks

Type of Methods/Tools	Applicability in CEIA Tasks/Steps
Expert opinion and past experience (in addition to establishing scenarios as necessary)	<ul style="list-style-type: none"> – Scoping – Baseline studies and impact assessment – Developing mitigation measures – Evaluating significance – Developing monitoring and management plan
Consultation and questionnaires	<ul style="list-style-type: none"> – Scoping – Baseline studies – Developing mitigation measures – Developing monitoring and management plan
Checklists	<ul style="list-style-type: none"> – Scoping – Baseline studies and impact assessment
Matrices	<ul style="list-style-type: none"> – Scoping – Baseline studies and impact assessment – Developing mitigation measures – Evaluating significance
Networks	<ul style="list-style-type: none"> – Scoping – Impact assessment
Modeling (conceptual, habitat suitability, quantitative)	<ul style="list-style-type: none"> – Baseline studies and impact assessment
Spatial Analysis/Geographic Information Systems (GIS), Visual analysis and simulation	<ul style="list-style-type: none"> – Scoping – Baseline studies and impact assessment – Developing monitoring and management plan
Review of available planning documents, investment programs, public permits to identify reasonably foreseeable future actions	<ul style="list-style-type: none"> – Scoping – Baseline studies and impact assessment
Indicators of VECs and their functions representing the importance of the VECs and possible changes in their condition	<ul style="list-style-type: none"> – Scoping – Baseline studies and impact assessment
Mitigation for incremental impacts using past experience, best available techniques, good/best practices, and expert opinion	<ul style="list-style-type: none"> – Developing mitigation measures
Environmental Management Systems as a means of systematic management of the significant impacts identified	<ul style="list-style-type: none"> – Developing monitoring and management plan
Coordination between the project proponents and relevant competent authorities to manage local and regional cumulative impacts	<ul style="list-style-type: none"> – Developing monitoring and management plan
Documentation/reporting of CEIA and using these reports to improve future practice	<ul style="list-style-type: none"> – Scoping – Baseline studies and impact assessment – Developing mitigation measures – Evaluating significance – Developing monitoring and management plan



5

Preparation & Reporting of CEIA Studies



There are various approaches to conducting CEIA studies and best practices have been derived from international experience with these approaches. The Canadian Environmental Assessment Agency and EC Directorate General of Environment, Nuclear Safety and Civil Protection published guidelines regarding CEIA implementation, which are also referred to in this guideline. In more recent years, the International Association of Impact Assessment (IAIA) also published best practice steps for CEIA implementation. This guideline aims to provide basic guidance for consultants conducting CEIA studies.

Insofar as the cumulative assessment meets relevant legislative requirements, is technically and scientifically sound, and addresses the key issues related to the action under review, any type of analysis could be considered relevant. In this regard, the following issues might be worthy of consideration:

- The ultimate objective of a CEIA is to provide information to decision makers to allow them to make more informed decisions.
- Assessing cumulative effects is possible, despite the challenges, and approaches are improving.
- Expectations as to what CEIAs can accomplish must not exceed what can technically be done, what is scientifically known about environmental conditions, and what is possible within the existing regulatory review process.
- Cumulative effects methods are currently available.
- The availability of information may determine how a CEIA could be done and the methods that could be used to predict impacts.
- CEIAs may provide useful information for a basin management planning process.
- Mitigation measures provided during a CEIA can be broader than may typically be proposed in a project-level EIA.
- As more assessments are conducted for various projects within a region or country, the amount of available data grows.
- The process of assessing cumulative impacts under regulatory review currently represents an opportunity to address concerns having a broad scope and with long-term changes to the environment.

5.1. REPORTING OF CEIA FINDINGS

Reporting of the findings seems to be the final step of any EIA process and not only in CEIA. In fact, reporting should be an integral part of the studies being conducted and should be done throughout the studies. Preparation of the CEIA generally goes through the following working steps:

- Establishing and documenting the content of the cumulative impact assessment together with the regulatory authority and the study team, ensuring that the terms of reference and format for the study meet the concerns of the regulatory authorities and key stakeholders (scoping).
- Preparing a complete description of the proposed project.
- Focusing on the assessment of the most important issues and effects (identified through consultation with stakeholders).
- Reviewing, if available, assessments done for similar types of projects, ideally in a similar geographic area, which may provide valuable baseline data and information.
- Assessing the impacts of the project as typically done for an EIA (i.e., assess relatively local and direct effects on VECs caused by the project under review).
- Expanding the results and conclusions obtained in each step of assessment in parallel to the CEIA steps. This may be done during each step as the EIA progresses or after much of the EIA has been completed.
- Using the CEIA tasks or steps provided in this guideline to form the basis of the assessment approach, and using the CEIA Checklist and Key Criteria to ensure that important issues are considered.
- Ensuring that conclusions are defensible and that the presentation of results can be readily interpreted and is usable by decision makers.

The results of the CEIA might be reported either in the EIA report itself or as a separate document. Selection between these options depends on the approach to cumulative impacts of the regulatory authority and the practitioners (i.e., as inseparable from the EIA or as a unique and different view) and the practicality of this approach. In this regard, the following options can be considered:

- Integrating the assessment into each topic section in the EIA report (e.g. as a sub-section in each major section assessing impacts on major environmental components such as water, air, etc.);
- Producing a separate CEIA chapter in the EIA report (generally the most common approach);
- Producing a stand-alone document, separately bound from the EIA report.

CEIAs may deal with relatively complex issues so the consultants preparing CEIAs must ensure that the methodological approach and assessment results can be interpreted and understood by decision makers and stakeholders. Therefore, reports must clearly communicate the results of the assessments so as to facilitate their consideration on project approval. Visualization tools such as maps and network diagrams are often used, but it should be considered that the repetitive use of tables and maps (especially if inadequately explained) is no substitute for a concise and readily defensible conclusion based on the data and analysis applied in the assessment.

The CEIA should explicitly state a summary of management options and their consequences. These would include the mitigation measures to be employed and any compensation programs and follow-up studies (monitoring and management programs) to be conducted. Moreover, it is important to explain why these management features are proposed and by whom they would be carried out.

In addition to the above, it may also be useful to include a summary setting forth the overall impacts, which should be considered cumulatively for individual receptors. This could be presented in tabular format, focusing on the receptor.

To effectively communicate the results of the CEIA the following reporting tools can be used:

- **Tables** to organize data and summarize the results of calculations.

- **Matrices** (a table in which the table entries are rankings) to summarize the scale of effects. These rankings can take three different forms: qualitative (e.g., low and high), quantitative (i.e., numbers that correspond to an absolute physical quantity), or indices (i.e., non-dimensional numbers that provide a point of relative comparison).

- **Figures, maps, and photographs** to illustrate the information. Maps, especially those derived from a GIS, are powerful tools for portraying disturbance and environmental conditions over a wide region. Photographs and photomontages also help to provide a visual orientation.

- **Text**, including a description of the analysis and interpretation of the results.

Whichever tool is used to report the assessment, it is important that the assumptions are given clearly. It is also useful to describe the process of the analysis and interpret the results.

5.2. KEY CRITERIA FOR BEST PRACTICE

The criteria for best professional practice in conducting a CEIA, as outlined in the Cumulative Effects Assessment Practitioners Guide of Canada, Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions of the European Commission, and the IAIA sources, is summarized below.

- The study area should be large enough to allow assessment of VECs that may be affected by the action being assessed. This may result in an area that is considerably larger than the action's footprint and each VEC may have a different study area.
- Other actions that have occurred, already exist, or may yet occur that may also affect the same VECs should be identified. Future actions that are approved within the study area should be considered (officially announced and reasonably foreseeable actions) if they may affect those VECs and there is enough information about them to assess their impacts.
- The incremental additive effects of the proposed action on the VECs should be assessed. If the nature of the impact interaction is more complex (e.g., synergistic), then the impacts should also be assessed on that basis.
- The total impacts of the proposed action and other actions on the VECs should be assessed.
- These total impacts should be compared to thresholds or policies, if available, and the implications for the VECs should be assessed.
- These impacts should be analyzed by quantitative techniques, if available, based on best available data. This should be enhanced by qualitative discussion based on best professional judgment.
- Measures for mitigation, monitoring, and impact management should be recommended. These measures may be required at a regional scale (possibly requiring the involvement of other stakeholders) to address broader concerns regarding VECs.
- The significance of residual impacts should be clearly stated and defended.

The degree to which the above-mentioned criteria are met can change from case to case based on the CEIA framework available (in terms of data, information, and regulatory and technical requirements). In this regard, the objective is to use these criteria to achieve fundamentally sound CEIA study practice.

5.3. CEIA CHECKLIST

Consideration of the following questions, primarily during scoping, can ensure that the study incorporates the key factors to be considered during CEIA.

- Is the proposed project within a relatively undisturbed landscape or an already-disturbed landscape?
- Do topographic or other constraints spatially limit the impact that the project may have on VECs?
- Are there any unmitigated direct impacts (i.e., impacts only of the proposed project)?
- Is there any ongoing significant impact of past actions?
- Do the nearest existing projects to the proposed action have an impact on the same VECs?
- Have any actions been officially announced by other project proponents in the same region with the intent to start the EIA process?
- Have any issues or VECs already been identified in the EIA or by local stakeholders that maybe of concern beyond the footprint of the proposed project?
- Are any ecological species locally or regionally rare?
- Are there any environmentally sensitive areas that may be disturbed?

- Would the proposed project contribute to a loss of habitat (terrestrial or aquatic) that may affect the VECs in the study area?
- Is there reliable information that describes the VECs and their habitats?
- Is there adequate information available about other actions to determine if they are contributing to other than negligible impacts on the same VECs?
- Are indicators available to assess impacts on VECs?
- Are there indicators of significance, other than thresholds, that should be considered?
- Could the action induce other actions to occur (such as road access)?
- Can a historical baseline be described against which consecutive changes can be compared?
- Are certain analytical approaches mandatory for assessing impacts on some VECs?
- Are quantitative thresholds available for any of the VECs?
- Are qualitative thresholds available that describe intended land use (e.g., land use plans)?
- Is the standard application of mitigation adequate to mitigate significant impacts?
- Can reclamation reduce the duration of land disturbance and hasten the recovery of environmental components to pre-disturbance conditions?
- Is habitat of equivalent capability available elsewhere to compensate for lost habitat?
- Is there an opportunity to initiate a regional-level mitigation (or compensation) of impacts?
- What is required for monitoring and impact management as follow-up?



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