Consideration Of Cumulative Impacts In EPA Review of NEPA Documents

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1. INTRODUCTION

The combined, incremental effects of human activity, referred to as cumulative impacts, pose a serious threat to the environment. While they may be insignificant by themselves, cumulative impacts accumulate over time, from one or more sources, and can result in the degradation of important resources. Because federal projects cause or are affected by cumulative impacts, this type of impact must be assessed in documents prepared under the National Environmental Policy Act (NEPA). The purpose of this guidance is to assist EPA reviewers of NEPA documents in providing accurate, realistic, and consistent comments on the assessment of cumulative impacts. The guidance focuses on specific issues that are critical in EPA's review of NEPA documents under Section 309 of the Clean Air Act. While there is no "cookbook" method of assessing cumulative impacts, the guidance offers information on what issues to look for in the analysis, what practical considerations should be kept in mind when reviewing the analysis, and what should be said in EPA comments concerning the adequacy of the analysis.

The assessment of cumulative impacts in NEPA documents is required by Council on Environmental Quality (CEQ) regulations (CEQ, 1987). Cumulative impacts, however, are not often fully addressed in NEPA documents due to the difficulty in understanding the complexities of these impacts, a lack of available information on their consequences, and the desire to limit the scope of environmental analysis. To improve how cumulative impacts are assessed in environmental impact analysis, CEQ developed a handbook entitled "Considering Cumulative Effects under the National Environmental Policy Act" (CEQ 1997). CEQ's handbook offers the most comprehensive and useful information to date on practical methods for addressing cumulative effects in NEPA documents. Consequently, the concepts presented in the handbook serve as the foundation for this guidance. Reviewers are urged to use this guidance and the CEQ handbook simultaneously.

The guidance has four sections including this introduction. Section 2 *What are Cumulative Impacts* briefly summarizes the definition and basic concepts used in this guidance. Section 3 *EPA's Review of Cumulative Impacts* addresses several fundamental questions concerning EPA's review of cumulative effects in a NEPA analysis. Section 4 *Major Review Areas* discusses several of the key areas that should be considered to adequately analyze cumulative impacts and offers practical suggestions on how to prepare comments to address cumulative impacts in NEPA documents. References are cited in a bibliography.

2. WHAT ARE CUMULATIVE IMPACTS?

Cumulative impacts result when the effects of an action are added to or interact with other effects in a particular place and within a particular time. It is the combination of these effects, and any resulting environmental degradation, that should be the focus of cumulative impact analysis. While impacts can be differentiated by direct, indirect, and cumulative, the concept of cumulative impacts takes into account all disturbances since cumulative impacts result in the compounding of the effects of all actions over time. Thus the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource no matter what entity (federal, non-federal, or private) is taking the actions . Consistent with the CEQ regulations (CEQ, 1987), effects and impacts are used synonymously in the guidance.

CEQ's regulations (CEQ, 1987) explicitly state that cumulative impacts must be evaluated along with the direct effects and indirect effects of each alternative. By mandating the consideration of cumulative impacts, the regulations ensure that the range of actions that is considered in NEPA documents includes not only the project proposal but also all actions that could contribute to cumulative impacts. Federal agencies prepare cumulative impact analysis using different terms and approaches. To avoid arguing over semantic differences, EPA reviewers should avoid conflicts over terminology and pursue a common sense approach. The concept of cumulative impacts as total impacts provided above is meant to facilitate discussion in this document, but it is not intended to replace other usages that meet the intent of good cumulative effects analysis.

3. EPA'S REVIEW OF CUMULATIVE IMPACTS

This section addresses fundamental questions concerning EPA's review of cumulative impact analysis in NEPA documents.

Q. How should EPA review cumulative impacts analyses in NEPA documents?

A. The assessment of cumulative impacts is not substantially different from the assessment of direct or indirect impacts. The same type of considerations are made to determine the environmental consequences of the alternatives for direct,

indirect, or cumulative impacts. One possible difference is that cumulative impact assessment entails a more extensive and broader review of possible effects. Reviewers should recognize that while no "cookbook" approach to cumulative impacts analysis exists, a general approach is described in the CEQ handbook. As with the review of direct or indirect impacts, EPA review of cumulative impacts analysis is most effective if done early in the process, especially in the scoping phase.

Federal agencies have the responsibility of determining how and the extent to which cumulative impacts are assessed in NEPA documents and documenting that effort. In reviewing the analysis, the EPA reviewer should determine if the information presented is commensurate with the impacts of the project, i.e., a greater degree of detail is needed for more potentially serious impacts. In addition, in making its rating determinations, EPA will consider cumulative impacts when determining the environmental impact of the action and the adequacy of the analysis. EPA comments should identify significant cumulative impacts that may affect resources of concern and suggest mitigation measures that will avoid or minimize adverse effects to the environment. While this guidance emphasizes the effects of projects on ecological resources, other resources and areas that should be considered include socioeconomic resources, human health, recreation, quality of life issues, and cultural and historical resources.

Q. Should EPA reviewers expect that cumulative impact analysis be done in all NEPA documents?

A. NEPA documents do not necessarily require cumulative impact assessments in every case. However, EPA expects that the action agency consider whether cumulative impacts is a significant issue that should be addressed every time a NEPA document is prepared. NEPA documents in this context includes both environmental assessments and environmental impact statements. As with most NEPA assessments, the analysis should be commensurate with the project's impacts and the resources affected. In all phases of the cumulative impact assessment, EPA should ensure that the level of analysis and scope are commensurate with the potential impacts, resources affected, project scale, and other factors. While projects that have long-lasting and widespread effects in environmentally sensitive areas should receive close scrutiny, some projects may not require in-depth consideration of cumulative impacts. For example, small scale projects that have minimal impacts that are of short-duration would not likely contribute significantly to cumulative impacts.

Q. Can cumulative impacts be the basis for adverse ratings?

A. Cumulative impacts that result in significant impacts can be the basis for adverse ratings. EPA will consider cumulative impacts when determining the rating for the environmental impacts of the proposed project. Ratings should be

based on the overall environmental impact of the proposed project or action, which includes cumulative impacts. When the NEPA document does not contain sufficient information, the determination of potential, total project impacts may be based on other documents, information, or on-site surveys. In these situations, the reviewer should identify the source of information that is the basis for EPA comments including those related to cumulative impact analysis.

Q. Should EPA comments suggest mitigation measures to address cumulative impacts?

A. The EPA's manual on reviewing and commenting on federal actions under NEPA and section 309 of the Clean Air Act (EPA, 1984) states that EPA's comments should include mitigation measures "...to avoid or minimize damage to the environment, or to protect, restore, and enhance the environment". It is appropriate for EPA comments to include recommendations for mitigation that address the cumulative impacts of the project. The comments should suggest a range of mitigation that addresses differing sources of the cumulative impacts. At a minimum, the mitigation should address the proposed project's contribution to the cumulative impacts. In addition, it is appropriate to suggest mitigation to address cumulative impacts that are caused by activities other than the proposed project. For example, mitigation could include forming partnerships among the different governmental agencies and private organizations to work on environmental restoration when those entities have contributed to cumulative impacts over a long period of time. It is important to note that EPA suggestions for mitigation are not necessarily constrained by whether the action agency has jurisdiction to implement the measures but the measures should be realistic and technically feasible.

Q. Do EPA reviewers have to prove that cumulative impacts are occurring if the issue of cumulative impacts is raised by a proposed project?

A. Ultimately, the action agency is responsible for determining whether cumulative impacts will occur. However, EPA reviewers should provide enough information in their comments to show the likelihood that cumulative impacts will occur. In order to make the case that the NEPA documents should include cumulative impact analysis, EPA comments need only to show the potential for cumulative impacts to occur, not absolute proof that such impacts will take place. EPA reviewers should use existing data to support an argument for considering cumulative impacts in the document.

4. MAJOR REVIEW AREAS

Several key areas of information should be considered by EPA reviewers in determining whether the cumulative impacts assessment in a NEPA document is adequate. These areas, as described below, expand on the approach presented in the CEQ handbook. Each subsection presents background information on one

of five areas and offers guidance on what EPA reviewers should look for in the assessment of cumulative impacts.

4.1 Resources and Ecosystem Components

EPA Review Approach

In reviewing cumulative impacts analysis, EPA reviewers should focus on the specific resources and ecological components that can be affected by the incremental effects of the proposed action and other actions in the same geographic area. EPA reviewers should determine whether the NEPA analysis has identified the resources and ecosystem components cumulatively impacted by the proposed action and other actions. The reviewer can determine which resources are cumulatively affected by considering:

(1) whether the resource is especially vulnerable to incremental effects;

(2) whether the proposed action is one of several similar actions in the same geographic area;

(3) whether other activities in the area have similar effects on the resource;

(4) whether these effects have been historically significant for this resource; and

(5) whether other analyses in the area have identified a cumulative effects concern.

Three documents that can provide useful information when considering important resource components include the 1993 EPA report, "Habitat Evaluation: Issues in Environmental Analysis Review", the 1993 CEQ report, "Incorporating Biodiversity Considerations Into Environmental Impact Analysis Under the National Environmental Policy Act", and the 1994 EPA report "Evaluation of Ecological Impacts from Highway Development".

Cumulative impacts can affect a broad array of resources and ecosystem components. In addition to considering the biological resources that are the staple of NEPA analysis, examples of other resources that should be considered include historic and archaeological sites, socioeconomic services and issues, and community structure and character. While a broad consideration of resources is necessary for the adequate assessment of cumulative impacts, the analysis should be expanded for only those resources that are significantly affected. In similar fashion, ecosystem components should be considered when they are significantly affected by cumulative impacts. The measure of cumulative effects is any change to the function of these ecosystem components.

Discussion

NEPA documents generally consider only a limited number of resources that may be potentially affected by cumulative impacts. In addition, assessments of impacts to biological resources generally have been limited to selected game species, federally or state listed threatened and endangered species, and wetlands habitats. These approaches are too limited and should be expanded to consider other valuable resources which could be affected, while also considering a broader array of potential effects.

As an example, federal assessment and mitigation for the loss of wetlands often focus primarily on the acreage affected rather than the function of the wetland within the broader ecosystem. In such a case, the impact to the wetland might not be deemed significant if the wetland had no immediate wildlife values or other notable characteristics. However, by expanding the assessment to consider the full array of wetland functions and their importance with a broader context, cumulative impacts could be more fully assessed. For example, important functions to focus on could include the wetlands' role as a nursery for recreationally and/or commercially valuable aquatic species; its ability to minimize downstream flooding; and its ability to improve water quality.

To ensure the inclusion of the resources that may be most susceptible, cumulative impacts can be anticipated by considering where cumulative effects are likely to occur and what actions would most likely produce cumulative effects. A framework for this consideration for forested areas is modified from Bedford and Preston (1988). Certain types of forests are more likely to be affected by cumulative effects as described by the following examples:

1) forests downwind from major sources of air pollution that contain plant organisms that are susceptible to ozone and other airborne pollutants;

2) forested areas lower in a watershed because they are often closer to development and pollutants follow the movement of water;

3) forests that are susceptible to fragmentation because, with increasing fragmentation, areas will have a large perimeter in relation to their area; and

4) areas experiencing development pressure.

Resources of concern may also be identified by considering actions that alter ecological processes and therefore can be expected to produce cumulative effects. Changing hydrologic patterns, for example, is likely to elicit cumulative effects. Bedford and Preston (1988) offered the following alterations that would likely initiate cumulative effects in wetlands or watersheds:

1) changes in sediment transport;

2) alteration of discharge and retention rates of water;

3) changes in velocity of water moving through the system;

4) disposal of organic pollutants where uptake is controlled by biological processes;

5) disposal of chemicals that easily separate from sediment and other materials to which they are attached; and

6) filling of wetlands that results in increased pollutant loadings.

The NEPA document should identify which resources or ecosystem components of concern might be affected by the proposed action or its alternatives within the project area. Once these resources have been identified, consideration should be given to the ecological requirements needed to sustain the resources. It is important that the NEPA document consider these broader ecological requirements when assessing how the project and other actions may cumulatively affect the resources of concern. Often these ecological requirements may extend beyond the boundaries of the project area, but reasonable limits should be made to the scope of the analysis.

NEPA Example: Several examples exist of agency NEPA documents that have included a thorough consideration of resources. The Supplemental Information Report for the Trail Creek Timber Sale, Wisdom Ranger District, Beaverhead National Forest, MT was prepared by the Forest Service (Forest Service, 1991) to consider two important resources (ecosystem components) that were not included in the FEIS for the project. The two resources were (1) the value of the Trail Creek area as a biological corridor between adjacent wilderness and roadless areas and (2) the biodiversity of the Trail Creek area and surrounding lands as it might be affected by habitat fragmentation. The report considered potential impacts in the context of the natural disturbance process, such as fire and insects, that have continually altered the distribution and abundance of mature forest and associated wildlife and plant species in the Trail Creek area since the retreat of the Pleistocene glaciers about 10,000 years ago.

Ecosystem processes at the landscape level have traditionally been overlooked, but are now considered among the resources most likely to be affected cumulatively by multiple activities. The Forest Service and other agencies are now applying an ecosystem approach to many NEPA analyses to better consider these resources. Other examples include the Draft Supplemental EIS on Management of Habitat for Late-Successional and Old-Growth Forest Related Species (Forest Service and BLM, 1993) and the current Draft EISs for the Interior Columbia Basin Management Project (Forest Service and BLM, 1997). The Federal Highway Administration (1996) is also beginning to apply an analogous system approach to the impact assessment of human communities.

4.2 Geographic Boundaries and Time Period

EPA Review Approach

Geographic boundaries and time periods used in cumulative impact analysis should be based on all resources of concern and all of the actions that may contribute, along with the project effects, to cumulative impacts. Generally, the scope of analysis will be broader than the scope of analysis used in assessing direct or indirect effects. To avoid extending data and analytical requirements beyond those relevant to decision making, a practical delineation of the spatial and temporal scales is needed. The selection of geographic boundaries and time period should be, whenever possible, based on the natural boundaries of resources of concern and the period of time that the proposed action's impacts will persist, even beyond the project life. EPA reviewers should determine whether the NEPA analysis has used geographic and time boundaries large enough to include all potentially significant effects on the resources of concern. The NEPA document should delineate appropriate geographic areas including natural ecological boundaries, whenever possible, and should evaluate the time period of the project's effects.

Discussion

Spatial and temporal boundaries should not be overly restricted in cumulative impact analysis. Agencies tend to limit the scope of their analyses to those areas over which they have direct authority or to the boundary of the relevant management area or project area. This is often inadequate because it may not cover the extent of the effects to the area or resources of concern. The most common temporal scope is the life of the project. This may not be appropriate if the effects last longer than the project's useful life.

The EPA reviewer can determine an appropriate spatial scope of the cumulative impact analysis by considering how the resources are being affected. This determination involves two basic steps:

(1) identifying a geographic area that includes resources potentially affected by the proposed project and

(2) extending that area, when necessary, to include the same and other resources affected by the combined impacts of the project and other actions.

In practice, the areas for several target species or components of the ecosystem can often be captured by a single ecoregion or watershed. For example, an impact assessment for a forest plan modification may have to be expanded beyond its administrative forest management unit. Instead, the scope of the assessment might consider the entire watershed for the area covering portions of wilderness areas, national or state parks, other federal lands, and private holdings. Boundaries would be based on the resources of concern and the characteristics of the specific area to be assessed. Examples include stream

sections important for salmonid feeding or spawning that are within or downstream of the administrative unit; maintenance of disturbance patterns to ensure structural and functional integrity of regional forests; and biological corridors and wildlife habitat that connect public and private lands. For practical purposes, ecological boundaries may need to be combined with political boundaries to adequately delineate the assessment area.

NEPA Example: The Final Supplemental EIS on Management of Habitat for Late-Successional and Old-Growth Forest Related Species (Forest Service and BLM, 1994) is an important example of study boundaries combining administrative units with natural regions. The planning area for the EIS included all lands administered by the Forest Service and the Bureau of Land Management within the range of the northern spotted owl. This species range matched well with the ecosystem consisting of late-successional and old-growth forest in the region.

EPA reviewers should recommend that the proper spatial scope of the analysis include geographic areas that sustain the resources of concern. Importantly, the geographical boundaries should not be extended to the point that the analysis becomes unwieldy and useless for decision-making. In many cases, the analysis should use an ecological region boundary that focuses on the natural units that constitute the resources of concern. Three examples of classifications of ecological regions that may be useful for large geographic areas include Omernik's EPA ecoregions (Omernik, 1989), Bailey's Forest Service ecoregions (Bailey, 1978), and the USGS hydrologic units or watersheds. The Natural Resources Conservation Service uses delineated areas termed Major Land Resources Areas that are based on soil types, climate, geology, topography, and hydrology. For non-ecological resources, other geographic areas, such as historic districts (for cultural resources) or metropolitan areas (for economics), should be used.

NEPA Example: The Draft EIS on the Special Area Management Plan (SAMP) for the Hackensack Meadowlands District, NJ (EPA and Army Corps of Engineers, 1995) is another example of creating a study area that considers both political boundaries and natural boundaries for both management utility and resource relevance. The plan covers an area with 14 municipalities in two counties that are experiencing continual pressure for development. Prepared by the U.S. EPA, U.S. Army Corps of Engineers, and Hackensack Meadowlands Development Commission, the draft EIS assesses the cumulative impacts of development scenarios within an area that includes 8,500 acres of wetlands that, because of their position in the landscape, "perform a number of significant ecological functions and support a diverse community of associated wildlife."

Determining the temporal scope requires estimating the length of time the effects of the proposed action will last. More specifically, this length of time extends as long as the effects may singly, or in combination with other anticipated effects, be significant on the resources of concern. At the point where the contribution of

effects of the action, or combination of all actions, to the cumulative impact is not significant the analysis should stop. Because the important factor in determining cumulative impact is the condition of the resource (i.e., to what extent it is degraded), analysis should extend until the resource has recovered from the impact of the proposed action.

For example, an impact assessment of ground water withdrawals to cool power plant turbines should go beyond determining whether the capacity of the aquifer is adequate to provide water for the life of the power plant. The analysis should also consider the long-term effects of lowering the aquifer level. Should municipal drinking water and agricultural irrigation withdrawals increase in the future, the cumulative effect of the power plant withdrawals may lower aquifer levels to the point where, at predictable intervals in the future, droughts will eliminate all supply. The NEPA document may, therefore, have to consider time periods beyond the life of the power plant.

NEPA Example: The Final Supplemental EIS on Management of Habitat for Late-Successional and Old-Growth Forest Related Species (Forest Service and BLM, 1994) looked sufficiently forward in time to address the probability of restoring or maintaining sustainable ecosystem conditions. The forest draft EIS determined that previous alterations to the regional ecosystem prevented a return to pre-settlement landscape condition or recovery of aquatic resources within the next 100 years, but that the selected alternative would reverse a 50-year trend toward degradation.

There are no set or required formulas for determining the appropriate scope of the cumulative impact analysis. Both geographic boundaries and time periods need to be defined on a case-by-case basis. Determining the boundaries and periods depends on the characteristics of the resources affected, the magnitude and scale of the project's impacts, and the environmental setting. In practice, a combination of natural and institutional boundaries may be required to adequately consider both potential impacts and possible mitigation measures. Ultimately, the scope of the analysis will depend on an understanding of how the effects are occurring in the assessment area.

4.3 Past, Present, and Reasonably Foreseeable Future Actions

EPA Review Approach

The adequacy of cumulative impact analysis depends on how well the analysis considers impacts that are due to past, present, and reasonably foreseeable actions. EPA reviewers should determine whether the cumulative analysis adequately considered the following:

1) whether the environment has been degraded, and if so, to what extent:

2) whether ongoing activities in the area are causing impacts; and

3) the trends for activities and impacts in the area.

Considering the past, present, and reasonable foreseeable future actions provides a needed context for assessing cumulative impacts. The inclusion of other actions occurring in proximity to the proposed action is a necessary part of evaluating cumulative effects. Agencies should identify activities occurring outside of their jurisdiction that are affecting the same resources being affected by their actions. Consultation with other agencies potentially affecting the resources of concern is not usually done and a consideration of private activities seldom occurs. In addition, agencies may not always include other actions taken by their agency. EPA reviewers should determine whether the NEPA document considered all past, present, and future actions that contribute to significant cumulative effects on the resources of concern. The analysis should include the use of trends information and interagency analyses on a regional basis to determine the combined effects of past, present, and future actions. NEPA documents should only consider those past, present, and future actions that incrementally contribute to the cumulative effects on resources affected by the proposed action. Actions affecting other resources, or with cumulatively insignificant effects on the target resources, do not add to the value of the analysis.

Discussion

To successfully assess cumulative impacts, NEPA documents should consider a broad range of activities and patterns of environmental degradation that are occurring in the vicinity of the project . The following considerations (as modified from Klein and Kingsley, 1994) can assist in identifying actions that may relate to the project under review:

1) the proximity of the projects to each other either geographically or temporally;

2) the probability of actions affecting the same environmental system, especially systems that are susceptible to development pressures;

3) the likelihood that the project will lead to a wide range of effects or lead to a number of associated projects; and

4) whether the effects of other projects are similar to those of the project under review.

5) the likelihood that the project will occur -- final approval is the best indicator but long range planning of government agencies and private organizations and trends information should also be used;

6) temporal aspects, such as the project being imminent;

As an example, the cumulative effect of transportation projects and other development in an urban setting often results in alteration of topography, habitat fragmentation, changes in water flows and water quality, increased sediment and contaminant runoff, and direct mortality from road kills. To address these issues, the actions included should start with the proposed project but also include other present, past, and future actions. Other current development should include related construction such as shopping malls within proximity of the new road construction or upgrades undertaken on connecting roads within the area of study. Past actions that should be considered include, for example, any housing and commercial development, alteration of hydrologic flows to control flooding, filling of wetlands, construction of other highways, and upstream development. The analysis should also extend further back in time to include previous changes to the area and region such as resource extraction or agricultural activities. Future actions should include any planned communities or commercial areas, induced growth and accompanying infrastructure, projected increase in population and traffic, and road expansion.

The identification of the effects of past actions is critical to understanding the environmental condition of the area. Knowing whether the resource is healthy, declining, near collapse, or completely devastated is necessary for determining the significance of any added impacts due to the proposed project. The NEPA document should consider how past activities have historically affected and will continue to detrimentally affect the resources of concern. How far back in time to consider depends on how long the resources of concern have been affected. Trends analysis, or how the resource condition has changed over time, is the most useful tool for looking at the accumulated effect of past actions. For example, if 50% of the wetland functions in a basin have been lost due to both agriculture and urban development, any present or future impacts should be taken into account in determining impacts to flood storage capacity and other important wetland functions.

Other present actions that may be detrimentally affecting the resources of concern need to be considered at the same time impacts of the proposed action are considered. NEPA documents should consider information on all other relevant activities in the study area including other actions of the proposing agency, actions of other federal agencies, actions of state and local governments, and private actions. While EPA already monitors federal activities on a regional basis, state and county resources should be used to monitor local and private activities.

The identification of future actions is also important. According to the response for question 18 of the "Forty Most Asked Questions concerning CEQ's NEPA Regulations" (CEQ, 1981), the NEPA document "must identify all the indirect effects that are known, and make a good faith effort to explain the effects that are

not known but are 'reasonably foreseeable'." The critical question is "What future actions are reasonably foreseeable?". Court decisions on this topic have generally concluded that reasonably foreseeable future actions need to be considered even if they are not specific proposals. The criterion for excluding future actions is whether they are "speculative." The NEPA document should include discussion of future actions to be taken by the action agency. The analysis should also incorporate information based on the planning documents of other federal agencies, and state and local governments. For example, projects included in a 5-year budget cycle might be considered likely to occur while those only occurring in 10-25 year strategic planning would be less likely and perhaps even speculative. For private actions, the analysis should use regional and local planning documents. In the absence of these plans (and to refine expectations where activities have diverged from the plans), the analysis should refer to projected development trends. In all of these cases, the best information should be used to develop scenarios that predict which future actions might reasonably be expected as a result of the proposal.

NEPA Example: The Commencement Bay Natural Resource Damage Assessment: Restoration Plan and Final Programmatic EIS (FWS and NOAA, 1997) addressed the problem of including the many and various past actions by quantifying the previous loss of 98% of mudflat and marsh habitat through a combination of historical records and photographic evidence. The Final EIS for the Castle Mountain Project, San Bernardino County, CA (BLM 1990) considered 26 other existing and proposed activities that might cumulatively affect 12 resources of concern. The potential impact of activities in the categories of utilities/services, commercial and residential, recreation, mining, and grazing were evaluated based on their location and which resources they might affect. The Draft EIS for the Disposal and Reuse of Naval Base, Philadelphia, PA (Department of the Navy, 1995) addressed "connected, cumulative, and similar existing and potential actions," including general growth trends in South Philadelphia, other land use development initiatives, related actions by other DoD services, realignment of the Naval Base, proposed leasing of shipyard facilities to private shipbuilders, and significant, proposed off-base transportation improvements.

4.4 Describing the Condition of the Environment

EPA Review Approach

The NEPA analysis should establish the magnitude and significance of cumulative impacts by comparing the environment in its naturally occurring state with the expected impacts of the proposed action when combined with the impacts of other actions. Use of a "benchmark" or "baseline" for purposes of comparing conditions is an essential part of any environmental analysis. "The concept of a baseline against which to compare predictions of the effects of the proposed action and reasonable alternatives is critical to the NEPA process."

(CEQ, 1997) To determine how the project will affect the resource's ability to sustain itself, the NEPA document should include a description of the baseline condition that considers "...how conditions have changed over time and how they are likely to change in the future without the proposed action". (CEQ, 1997) If it is not possible to establish the "naturally occurring" condition, a description of a modified but ecologically sustainable condition can be used in the analysis. In this context, ecologically sustainable means the system supports biological processes, maintains its level of biological productivity, functions with minimal external management, and repairs itself when stressed.

While a description of past environmental conditions is usually included in NEPA documents, it is seldom used to fully assess how the system has changed from previous conditions. The comparison of the environmental condition and expected environmental impacts can be incorporated into the environmental consequences or affected environment sections of NEPA documents. EPA reviewers should determine whether the NEPA analysis accurately depicts the condition of the environment used to assess cumulative impacts. In addition, reviewers should determine whether NEPA documents incorporate the cumulative effects of all relevant past activities into the affected environment section. For the evaluation of the environmental consequences to be useful, it is important that the analysis also incorporate the degree that the existing ecosystem will change over time under each alternative.

Discussion

Often the current condition is used as the benchmark for comparing the environmental effects of the alternatives. However, the current condition typically may not adequately represent how actions have impacted resources in the past and present or how resources might respond to future impacts. Designating existing environmental conditions as a benchmark may focus the environmental impact assessment too narrowly, overlooking cumulative impacts of past and present actions or limiting assessment to the proposed action and future actions (McCold and Saulsbury 1996). For example, if the current environmental condition were to serve as the condition for assessing the impacts of relicensing a dam, the analysis would only identify the marginal environmental changes between the continued operation of the dam and the existing degraded state of the environment. In this hypothetical case, the affected environment has been seriously degraded for more than 50 years with accompanying declines in flows, reductions in fish stocks, habitat loss, and disruption of hydrologic functions. If the assessment took into account the full extent of continued impacts, the significance of the continued operation would more accurately express the state of the environment and thereby better predict the consequences of relicensing the dam.

For the purposes of section 309 reviews, different methods of depicting the environmental condition are acceptable. The condition of the environment should, however, address one or more of the following:

1) how the affected environment functions naturally and whether it has been significantly degraded;

2) the specific characteristics of the affected environment and the extent of change, if any, that has occurred in that environment; and

3) a description of the natural condition of the environment or, if that is not available, some modified, but ecologically sustainable, condition to serve as a benchmark.

Two practical methods for depicting the environmental condition include use of the no-action alternative and an environmental reference point. Historically, the no-action alternative (as reflecting existing conditions) has usually been used as a benchmark for comparing the proposed action and alternatives to existing conditions. The no-action alternative can be an effective benchmark if it incorporates the cumulative effects of past activities and accurately depicts the condition of the environment.

Another approach for describing the environmental condition is to use an environmental reference point that would be incorporated into the environmental consequences and affected environment sections of the document. The natural condition of the ecosystem, or some modified but sustainable ecosystem condition, can be described as the environmental reference point. In analyzing environmental impacts, this environmental reference point would not necessarily be an alternative. Instead, it would serve as a benchmark in assessing the environmental impacts associated with each of the alternatives. Specifically, the analysis would evaluate the degree of degradation from the environmental reference point (i.e., natural ecosystem condition) that has resulted from past actions. Then the relative difference among alternatives would be determined for not only changes compared to the existing condition but also changes critical to maintaining or restoring the desired, sustainable condition.

Determining what environmental condition to use in the assessment may not be immediately clear. Choosing and describing a condition should be based on the specific characteristics of the area. In addition, the choice of condition can be constrained by limited resources and information. For these reasons, the environmental condition described by the environmental reference point or no-action alternative should be constructed on a case-by-case basis so that it represents an ecosystem able to sustain itself in the larger context of activities in the region. In this respect, there is no predetermined point in time that automatically should represent the environmental condition. In addition, it may not be practical to use a pristine condition in situations of intensive development.

For example, it may not be very useful to use a pre-development condition to assess the extent of degradation in a heavily urbanized setting. It may be more useful in this situation to consider the condition of several important resources of concern (i.e., water quality, air quality, or quality of life) in comparison with expected environmental consequences of the action. Since most ecosystems can be delineated and have distinct characteristics, determination of the environmental condition does not need to be a subjective process leading to speculation about the condition of the environment before it was degraded.

Depending on whether the information is reasonably obtainable, the environmental condition chosen may be a pristine environment, or at the very least, a minimally functioning ecosystem that will not further degrade. The use of the environmental condition to compare alternatives is not an academic exercise, but one that can most effectively modify alternatives and help decision making. Examples of conditions might include before project, before "substantial" development, or a reference ecosystem that is comparable to the project area. Selecting the best environmental condition for comparative purposes can be based on the following:

1) consider what the environment would look like or how it would behave without serious human alteration;

2) factor in the dynamic nature of the environment;

3) define the distinct characteristics and attributes of the environment that best represent that particular type of environment (focus on characteristics and attributes that have to do with function); and

4) use available or reasonably obtainable information.

For example, in a hypothetical case of harbor dredging and disposal, the existing condition of the aquatic ecosystem is highly modified from natural conditions. Human settlement along major waterways spans hundreds of years and commercial development has become very intense in many areas. Following practices used in some NEPA analyses, the degraded condition of the benthic communities and shoreline vegetation would be considered the condition for assessing the impacts of sediment dredging and disposal. By using this environmental condition, the analysis would not recognize the full extent of the degradation and would possibly underestimate the actual impacts of the proposed action. The environmental condition for this case could be set at pre-development (or at least at early development) or, if historical data are not available, use a reference point constructed from an understanding of how a similar ecosystem would behave in a natural state. The affected environment section should include a discussion of the extent of degradation that the current condition has experienced when compared to the characteristics of an

undisturbed harbor environment. And finally, the extent of change and future trends should be considered in each alternative.

NEPA Example: The Forest Service's Snowmass Ski Area Final Environmental Impact Statement (Forest Service, 1994) and the Army Corps of Engineers Elk Creek Lake Final Evironmental Impact Statement (Army Corps of Engineers, 1991) both define baseline conditions for comparison of alternatives. In assessing the potential environmental impacts of the Snowmass Ski Area expansion, the Forest Service established a "pre-development" reference point from which all past, present, and reasonably foreseeable future environmental impacts were examined. Consequently, the EIS presented a comprehensive discussion of the cumulative impacts upon various resources. The Elk Creek Lake Final EIS also identified a "pre-development" reference point, defined by the Corps as "base conditions", for specific resources along the Rogue River and Elk Creek. The assessment then explored the alteration of resource conditions with respect to other actions, including the proposed project.

Issue 4.5 Using Thresholds to Assess Resource Degradation

EPA Review Approach

Qualitative and quantitative thresholds can be used to indicate whether a resource(s) of concern has been degraded and whether the combination of the action's impacts with other impacts will result in a serious deterioration of environmental functions. In the context of EPA reviews, thresholds can be used to determine if the cumulative impacts of an action will be significant and if the resource will be degraded to unacceptable levels. EPA reviewers should determine whether the analysis included specific thresholds required under law or by agency regulations or otherwise used by the agency. In the absence of specific thresholds, the analysis should include a description of whether or not the resource is significantly affected and how that determination was made.

Discussion

If adequate data and analytical procedures are available, specific thresholds that indicate degradation of the resources of concern should be included in the NEPA analysis . The thresholds should be practical, scientifically defensible, and fit the scale of the analysis. Thresholds may be set as specific numerical standards (e.g., dissolved oxygen content to assess water quality), qualitative standards that consider biological components of an ecosystem (e.g., riparian condition and presence of particular biophysical attributes), and/or desired management goals (e.g., open space or unaltered habitat). Thresholds should be represented by a measurement that will report the change in resource condition in meaningful units. This change is then evaluated in terms of both the total threshold beyond which the resource degrades to unacceptable levels and the incremental contribution of the proposed action to reaching that threshold. The measurement

should be scientifically based. For example, thresholds for determining adverse change in the functioning of a wetland could include the percentage of historic wetland loss in the region, occurrence of species at risk, ambient water quality data that exceed standards, and estuarine pollution susceptibility index.

Since cumulative impacts often occur at the landscape or regional level, thresholds should be developed at similar scales whenever possible. Indicators at a landscape level can be used to develop thresholds as well as assess the condition of the environment. By using the following landscape indicators as modified from O'Neil et al. (1997) and Jones et al. (1996), thresholds can be crafted by determining the levels, percentages, or amount of each that indicate a significant impact for a particular area. Examples of thresholds include:

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- The total change in land cover is a simple indicator of biotic integrity; thresholds for areas with high alterations would generally be lower than areas that are not as degraded; if open space or pristine areas are a management goal then the threshold would be a small percentage change in land cover.
- Patch size distribution and distances between patches are important indicators of species change and level of disturbance. Thresholds would be set to determine the characteristics of an area needed to support a given plant or animal species.

- Estimates of fragmentation and connectivity can reveal the magnitude of disturbance, ability of species to survive in an area, and ecological integrity. Thresholds would indicate a decrease in cover pattern, loss of connectivity, or amount of fragmentation that would significantly degrade an area.

- Indicators of water quality and watershed integrity can be used to set thresholds. Specific concentrations and levels of nitrogen, phosphorous, turbidity, dissolved oxygen, and temperature can be used.
- Thresholds for a decline in water quality can take the form of size and amount of riparian buffer zones. Condition of riparian zones and changes in percent of buffer areas can indicate a decline in water quality due to soil erosion, sediment loading, and contaminant runoff.

In a hypothetical project to develop a skiing resort to be constructed on federal lands, thresholds would be developed for several resources of concern. The impacts of road construction and use, ski runs, housing development, and water use would have wide ranging effects on resources such as riparian condition, water quality, wildlife habitat, and vegetation. Thresholds for cover and loss of connectivity could be developed to determine the significance of impacts to wildlife and vegetative cover. For example, thresholds could be developed from known information on the amount of habitat necessary for successful ungulate

breeding. Numerical standards for dissolved oxygen and water temperature could be used to determine significance of impacts to coldwater fisheries. Narrative standards of stream condition would be used to determine thresholds for successful fish spawning.

NEPA Example: NEPA analyses have examined actions where the cumulative effects exceed a threshold which is tied to a national air quality or water quality standard. In the Final EIS for Hydroelectric Development in the Upper Ohio River Basin (FERC, 1988), the Federal Energy Regulatory Commission determined the point at which dissolved oxygen fell below the standard by modeling the reduced spillage and aeration caused by adding turbines to additional dams in succession. Setting thresholds to represent the carrying capacity of an ecosystem is more difficult. In the Draft EIS on Cumulative Impacts of Recreational Boating on the Fox River and Chain O'Lakes Area in Lake and McHenry Counties, IL, the U.S. Army Corps of Engineers assessed the impacts of boat traffic on the carrying capacity of aquatic life by setting a threshold of water clarity needed for vegetation growth. At the same time, they set a social carrying capacity threshold of the number of boats that made people feel crowded. While the concept of translating exceedences of thresholds to significant impacts on carrying capacities of both ecological and human resources is being applied more extensively, analysts still often face situations where there are limits to scientifically exact thresholds, and have to use other methods to develop thresholds. For example, in the Draft Supplemental EIS on Management of Habitat for Late-Successional and Old-Growth Forest Related Species (Forest Service and BLM, 1993), it was necessary to rely on expert opinion from panels to assess the "probability of ensuring the viability of species."

Determining a threshold beyond which cumulative effects significantly degrade a resource, ecosystem, or human community is sometimes very difficult because of a lack of data. Without a definitive threshold, the NEPA practitioner should compare the cumulative effects of multiple actions with appropriate national, regional, state, or community goals to determine whether the total effect is significant. These desired conditions can best be defined by the cooperative efforts of agency officials, project proponents, environmental analysts, non-governmental organizations, and the public through the NEPA process. The integrity of historical districts is an example of a threshold that is goal related. These districts, especially residential and commercial historic districts in urban areas, are particularly vulnerable to clearance programs carried out by local governments, usually with use of federal funds. Though individual structures of particular architectural distinction are often present, such districts are important because they are a collection of structures that relate to one another visually and spatially; the primary importance of each building is the contribution that it makes to a greater whole. Often in conjunction with code enforcement programs to remove blighting influences and /or hazards to public safety, local governments condemn and demolish properties. Viewed in isolation as an individual action, such demolition of an individual structure does not significantly diminish the

historic and architectural character of the district and indeed may be beneficial to the overall stability of the district. But the cumulative effect of a whole series of such demolitions can significantly erode the district. Continued loss of historic structures, often with resultant vacant lots and incompatible new construction, can reach a point where the visual integrity of the district is lost. Once this threshold is passed, subsequent demolitions become increasingly difficult to resist and ultimately the qualities of the historic district are lost.

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